



P. D. E. A's
Prof. Ramkrishna More Arts, Commerce
and Science
College Akurdi Pune-411044
(Autonomous)



Affiliated to

Savitribai Phule Pune University [SPPU]

B. Sc. With Major Botany

(Three years B. Sc. in Botany / Four Years Honors in Botany)

2024 Pattern

Choice Based Credit System-2024 Pattern

Under

Autonomy and NEP-2020

From Academic Year
2025-2026

Syllabus

S. Y. B. Sc. With Major Botany

Board of Studies in Botany

Department of Botany

Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044

Rules and Regulations

1. National Credit Framework (NCrF): For creditisation and integration of all higher education qualifications leading to a certificate/ diploma/ degree with multiple entry and exit options, college will refer to National Credit Framework (NCrF) which encompasses the qualification frameworks for higher education, vocational and skill education and school education, namely National Higher Education Qualification Framework (NHEQF), National Skills Qualification Framework (NSQF) and National School Education Qualification Framework (NSEQF) respectively.

2. Structure of Four years multidisciplinary UG Programme and Five Years Integrated Multidisciplinary Master's Degree Programmes with Multiple Entry and Exit Options at Different Levels:

- (i) Students will have the flexibility to enter four years multidisciplinary Under Graduate Programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.
- (ii) Students will get a Certificate after a One year programme (minimum 40 Credits), a Diploma after two years (minimum 80 Credits), a Bachelor's degree after three years (minimum 120 Credits), and a Bachelor's degree with Research or Honours after Four years (minimum 160 Credits).

3. Qualification Type and Credit Requirements of Four Years Multidisciplinary Degree Programme with Multiple Entry and Exit Options

- (i) Details of qualifications, minimum credit requirements, exit credit courses, year and semester are as under:

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 Years Bachelor's degree	120	132	6	3
6.0	Bachelor's degree Honour's with Major	160	176	8	4
	Bachelor's degree Honour's with Major	160	176	8	4
7.0	Master's Degree	200	220	10	5
8.0	Ph. D.	----	-----	-----	----

- (ii) An exit 6-credit bridge course(s) lasting two months, including at least 6-credit job specific internship/apprenticeship that will help the graduates acquire job-ready competencies required to enter the workforce will be an additional requirement for the award of the undergraduate Certificate/ Diploma/ three year Bachelor's Degree.
- (iii) On exit, the students will have the option to re-enter the programme in the college, or in a different higher education institution. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.
- (iv) Eligibility for admission to the fourth year of four-year **Honours with Research Degree Programmes** as per UGC guidelines: Minimum CGPA of 7.5 or minimum 75% at three-year degree.
- (v) PG curriculum, as illustrated below, have flexibility a) One-year Post-Graduate Diploma (PGD), b) Two year Post-graduate Programme and c) 5 Years Master's degree programmes with multiple Entry and Exit options at different levels.
- (a) Post-Graduate Diploma (PGD):** Programme duration- One year (2 semesters) after any bachelor's degree, min. 40 credits
- (i) UGC: 1-Year (2 semesters) Post-Graduate Diploma (PGD) after 3-years Bachelor's degree: Level 6.0

(ii) UGC: 1-Year (2 semesters) PGD after 4 years Bachelor's degree (Honors/ Research): Level 6.5

(b) Master's Degree:

(i) UGC: 2-Years (four semesters) Master's Degree after obtaining a 3-years Bachelor's degree, Minimum 40 credits/year, second year devoted entirely to research, PG – 2nd year: Level 6.5

OR

(i) 1-Year (two semesters) Master's Degree after obtaining a 4-year Bachelor's degree (Honours/Research): Minimum 40 credits: Level 6.5

(c) Level 8 represents Ph. D. Research Degree.

(d) A 5-year Integrated Bachelor's and Master's programme shall have a minimum of 220 credits.

(e) Master's and doctoral programmes, while providing rigorous research-based specialization, should also provide opportunities for multidisciplinary work, in academia, government, research institutions, and industry.

4. Lateral Entry/ Re-entry at higher Levels after exit from lower levels of four years multidisciplinary UG degree programme:

(i) The credit points earned and accumulated shall be used to determine the eligibility for taking admission to various programs at multiple levels, subject to fulfilment of the broad principles laid down under NCrF. Students who leave with a Certification, Diploma, or a Basic Bachelor's Degree will be eligible to re-enter the programme at the exit level to complete or progress to the next level through lateral entry mode. Depending upon the academic and physical facilities available, the State Universities/ Autonomous Colleges (Higher Education Institutions or HEI) may earmark specific seats/ intake for lateral entry into the second year/ third year/ fourth year of a four years multidisciplinary UG degree programme as approved by Professional Standard Setting Bodies (PSSB/Govt. of Maharashtra/ statutory council of affiliating University plus any consequential vacancies caused by exits to an ongoing programme (four-year Degree Programme and Integrated Master's or second year Master's). Lateral entry or Re-entry is open to those students if he/she has either –

(a) successfully completed the first year/second year/third year of the particular four years multidisciplinary degree programme in any ABC registered HEI with valid credits in ABC and re-entering into the second year/third year/fourth year, respectively of the same four years degree programme of any ABC registered HEI, within stipulated/ permissible period of years as decided by Statutory Councils of that HEI

OR

(b) Already successfully completed a multidisciplinary four-year first-degree programme and is desirous of and academically capable of pursuing another multidisciplinary four years first-degree programme in an allied subject.

(ii) A student will be allowed to enter/re-enter only at the odd semester. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records. However, in terms of the admission eligibility requirements, the student shall belong to the same faculty/ discipline in terms of Major Subject i.e., the Major subject of his earlier Programme and the Major subject of the new Programme for which he is seeking admission must be from the same faculty/discipline. Reservation for lateral entry will be executed as per the Government of Maharashtra norms.

5. Distribution of Credits across Multidisciplinary Four Years Degree Programme:

(i) Four-year multidisciplinary degree programme with Honours/ Specialization Degree will have Internship and Core /Major Courses with a minimum of 22 credits per sem. in the Fourth Year.

(ii) Four-year multidisciplinary degree programme with Research will have Research Projects, Seminars, Dissertations and Internships with a minimum of 22 credits per Sem. in the Fourth Year.

(iii) Students shall select a 'Major or Core Subject/ Discipline' and a '**Minor Subject/Discipline**' from **the lists of various Subject Combinations and Options provided the Colleges**. In general, for the four years multidisciplinary bachelor's degree programme, the distribution of credits will be as follows:

(a) Disciplinary/interdisciplinary Major/ Core Subject (minimum of 68 credits)- Mandatory and Elective Courses

(b) Disciplinary/interdisciplinary Minor Subject (maximum of 22 credits)

- (c) Skill based/Vocational studies corresponding to the Major/ Core Subject (8 credits)
- (d) Field projects/internship/apprenticeship/community engagement and service corresponding to the Major/ Core Subject (14-22 credits) with a maximum of six credits per Semester
- (e) Generic/ Open Electives through Baskets of Elective Courses (12 credits),
- (f) Ability Enhancement Courses including Languages, Literature and Environmental Studies (12 credits),
- (g) In-built modules on the Indian Knowledge System (IKS) in Major/ Core Subject at Level 4.5 – 2 credits
- (h) Value-based Education, Life Skills and Professional Ethics: Co-curricular Courses such as Sports and Culture, NSS/NCC and Fine/ Applied/Visual Arts (8 credits).

Student can earn some credits (SEC/VSC/GE/OE) in the form of online from-

- (i) The National Skills Qualifications Framework (NSQF) organizes qualifications for Vocational and Skill Courses in a series of 8 levels based on professional knowledge, professional skills, core skills and responsibilities, in the increasing order of complexity and competency.
- (ii) University Grants Commission (Credit Framework For Online Learning Courses through Study Webs of Active-Learning for Young Aspiring Minds) Regulations, 2021, **permits up to 40 per cent of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) platform.**

6. Examination and Assessment Process:

- (i) The basic principle of the credit framework is that credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- (ii) Exit options are provided with certification, diploma and basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a four years multidisciplinary degree programme. Students will receive a Bachelor's degree with Honours/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.
- (iii) For the smooth success of four-year multidisciplinary degree programme with multiple entry and exit systems, the examination mode will be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes. This is in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019)'.

(iv) Evaluation of each students in each course will be done as follows

- a. Each theory or practical course will be of 2 credits = 50 marks
- b. Internal evaluation 30% weightage (15 marks)
- c. External evaluation 70% weightage (35 marks)
- d. Students should secure 40% marks in each type of evaluation for successful completion of a course (student should secure at least 6 marks in internal and 14 marks in external evaluation).

(v) Evaluation Pattern.

a. Internal evaluation - Two written test, each of 20 marks will be conducted i. e. two tests on two modules. 1st assignment after completing 6 weeks of teaching and 2nd on completion of 13th week of teaching. 5 marks out of 15 will be assigned from these written tests. Remaining 10 marks will be assigned from other types of evaluation such as seminars, orals, poster presentation, open book challenging tests, surprise test, objective test etc. Examination (Internal and external) will conducted so that CO, PO, PSO can be evaluated.

b. External Evaluation - External evaluation will be done at the end of each semester.

- i. For theory, 35 marks written examination will be conducted and time of examination will be 2-hours.
- ii. For practical, 35 marks practical examination will be conducted and time of examination will be 4-hours.
- iii. For project / field project, 35 marks evaluation will done on the basis of viva-voce and examination of thesis by the examiners.
- iv. For OJT 35 marks evaluation will be done on the basis of report of industrial mentor /

supervisor / industry and viva-voce. However, student has to produce and submit OJT certificate from competent authority of industry.

7. Attendance: The student must have at least 70% attendance, to appear any type of examination.

8. Declaration of Results:

- (i) Declaration of result is based on the Semester Grade Point Average (SGPA) earned towards the end of each semester or the Cumulative Grade Point Average (CGPA) earned at the completion of all eight semesters of the programme and the corresponding overall alpha-sign or letter grades as given in Table 2. If some candidates exit at the completion of the first, second or third year of the four years Undergraduate Programmes, with Certificate, Diploma or Basic Degree, respectively, then the results of successful candidates at the end of the second, fourth or sixth semesters shall also be classified on the basis of the CGPA obtained in the two, four, six or eight semesters, respectively. Successful candidates at the end of the tenth semester of the integrated Master's Degree Programmes shall also be classified on the basis of CGPA obtained in the ten semesters of the Programmes. Likewise, the successful candidates of one year or two semesters Master's Degree Programme are also classified on the basis of the CGPA of two semesters of the Master's Degree Programme.

Table-2: Grades on degree certificate/mark sheet will be assigned to the students as per the following table

Semester GPA/ Program CGPA Semester/Program	% of Marks	Alpha-Sign / Letter Grade Result
9.00-10.00	90-100	O (outstanding)
8.00 - <9.00	80.00 – <90.00	A+ (Excellent)
7.00 - <8.00	70.00-<80.00	A (Very Good)
6.00 - <7.00	60.00-<70.00	B+ (Good)
5.50 - <6.00	55.00-<60.00	B (Above Average)
5.00 - <5.50	50.00-<55.00	C (Average)
4.00 - <5.00	40.00-<50.00	P (Pass)
Below 4.00	< 40	F (Fail)
Ab	-----	Absent

- (ii) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. For non-credit courses 'Satisfactory' or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9. Award of Major and Minor Degree:

- (i) A student pursuing four-year multidisciplinary UG programme will be awarded an appropriate Honours/ Research degree in Major/ Core Subject on completion of VIII Semester with the minimum of 176 credits if he secures in that Subject at least 50% of the total credits for that programme. He shall thus study the specific number of Mandatory Core Courses, Core Electives, Vocational and Skill Courses and Field projects/ Internships connected to Core Subjects in eight semesters so as to cover at least 50% of the total credits.
- (ii) In case of Research Degree, a student shall pursue research project and write dissertation in that Major in the VII and VIII semesters.

On the basis of above rules and regulations under NEP-2020 following course frame work is adopted by the Prof. Ramkrishna More Arts, Commerce and Science College, Akurdi, Pune-411044 for the completing of four years honours degree in Major and Minor subjects.

10. Distribution of Credits across Four Years Degree Programmes:

In general, for the four years' bachelor's degree programme, the distribution of credits will be as follows:

(a) Major (Core) Subject comprising Mandatory and Elective Courses:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses offered in all Four years;
- 2 credit course on Major Specific IKS shall be included under Major;

- iii. Elective courses of Major will be offered in the third and/or final year.
- iv. Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects connected to Major first to fourth year.

(b) Minor Subject: 18-20 Credits

- i. The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.
- ii. The credits of Minor subjects shall be completed in the first three years of UG Programme.

(c) Generic/ Open Elective Courses (OE): 10-12 credits

- i. It is to be offered in I and/or II year
- ii. Faculty-wise baskets of OE shall be prepared by University/ Autonomous Colleges.
- iii. OE is to be chosen compulsorily from faculty other than that of the Major.

(d) Vocational and Skill Enhancement Courses (VSEC): 14-16 credits

Vocational Skill Courses (VSC): 8-10 credits, including Hands on Training corresponding to the Major and/or Minor Subject:

- i. To be offered in first to three years;
- ii. Wherever applicable vocational courses will include skills based on advanced laboratory practicals of Major

Skill Enhancement Courses (SEC): 06 credits

- i. To be offered in I and II year;
- ii. To be selected from the basket of Skill Courses approved by University/ Autonomous Colleges

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): 14 Credits

- **AEC: 08 credits**

- i. To be offered in I and II year
 - ii. English: 04 Credits
 - iii. Modern Indian Language: 04 credits
 - iv. To be offered from the Basket approved by the College;
- The focus for both languages should be on linguistic and communication skills.

- o **IKS: 2 Credits**

- i. To be offered in I Year
- ii. Courses on IKS to be selected from the basket of IKS courses approved by the Colleges

- o **VEC: 04 Credits**

- i. To be offered in I year
- ii. Value Education Courses (VEC) Environmental Science Education (Compulsory), Understanding India, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- o **Internship/Apprenticeship corresponding to the Major (Core) Subject: 8 Credits**

- o **Field Projects/Community Engagement and Service corresponding to the Major (Core) Subject: minimum 4-6 credits**

To be offered in II, and III years of UG Degree Programmes.

- o **Co-curricular Courses (CC) such as Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts: 8 credits.** To be offered in I and/or II year

- o **Research Projects: 12 credits**

To be offered in the final year for 4-year Honours with Research UG Degree

The UGC Regulations, 2021 permit up to 40% of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the SWAYAM platform and/or other State Level Common Platforms which can be developed in due course with the participation of different Universities/ HEIs.

Abbreviations: Generic/ Open Electives: **GE/OE**; Vocational Skill and Skill Enhancement Courses: **VSEC**; Vocational Skill Courses: **VSC**; Skill Enhancement Courses: **SEC**; Ability Enhancement Courses: **AEC**; Indian Knowledge System: **IKS**; Value Education Courses: **VEC**; **OJT**: On Job Training; Internship/ Apprenticeship; Field projects: **FP**; Community engagement and service: **CEP**; Co-curricular Courses: **CC**; Research Methodology-**RM**; Research Project: **RP** Note: The Credit Distribution Table given above is illustrative only. The Universities/ Autonomous Colleges may suitably modify within the broader framework

of credit distribution across six verticals.

11. Definitions:

i. One semester = 15 weeks

ii. 1-credit theory = 15 hours i.e. for 1 credit, 1 hour per week teaching is to be performed.

15 hours of 1-credit are splinted as 12 hours actual teaching + 3 hours Tutorial (Numerical problem solving sessions, revision on difficult topics, dialog on student's difficulties, and internal evaluation)

iii. 1-credit practical = 30 hours. Thus, 1 credit practical = 2 contact hours in laboratory per week. 30 hours splinted as 24 hours actual table work and 6 hours for journal competition, oral on each practical and other internal evaluation.

iv. Each theory course of any type (major, minor, VSC, VEC, OE/GE, VEC, SEC, CC, etc.) **is of 2 credits.**

v. Theory per semester: Each theory course is of 2 credits. Thus, for each theory course contact hours = 24 teaching + 6 tutorials

vi. Each practical course is of 2 credits = 60 hours per semester

a. Minimum 12 laboratory sessions will be conducted in one semester.

b. Each laboratory sessions will be of 4 hour.

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Revised Credit Framework / Structure for NEP-2020(II); CBCS Pattern-2024 with two Major at FY

To be Implemented from Academic Year 2024-25

Level / Difficulty	Sem	Subject-1				Subject-2	GE/OE	SEC	IKS	AEC	VEC	CC	Total
Certificate													
4.5 / 100	I	4T + 2P/T				4T + 2P/T	2T	2T/P	2T (General)	2T	2T	0	22
	II	4T + 2P/T				4T + 2P/T	2T/P	2T/P	0	2T	2T	2	22
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 Continue option: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and another as minor and third subject will be dropped.													
Diploma													
Level / Difficulty	Sem	Credits Related to Major				Subject-2	GE/OE	SEC	IKS	AEC	VEC	CC	Total
		Major Core	Major Elective	VSC	FP / CEP OJT /								
5.0 / 200	III	4T + 2P/T	0	2T/P	2 FP	2T+ 2T/P	2T	0	2T (Major Specific)	2T	0	2	22
	IV	4T + 2P/T	0	2T/P	2 CEP	2T + 2P/T	2T/P	2T/P	0	2T	0	2	22
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 and Minor													
Three years Graduation Degree													
5.5 /300	V	8T + 4P/T	4T + 2P/T	2T/P	2 FP/RP	0	0	0	0	0	0	0	22
	VI	8T + 4P/T	2T + 2P/T	2T/P	4 OJT	0	0	0	0	0	0	0	22
	Total Credits	48	10	8	10	20	8	6	4	8	4	6	132
Four Years Graduate Degree with Honours (Major and Minor subjects)													
6.0 /400		10T + 4P/T	2T + 2P/T	0	0	4T RM	0	0	0	0	0	0	22
		10T + 4P/T	2T + 2P/T	0	4 OJT	0	0	0	0	0	0	0	22
	Total Credits	76	18	8	14	24	8	6	4	8	4	6	176
Four Years Graduate Degree with Honours (Research)													
6.0 /400		6T + 4P/T	2T + 2P/T	0	4 RP	4T RM	0	0	0	0	0	0	22
		6T + 4P/T	2T + 2P/T	0	8 RP	0	0	0	0	0	0	0	22
	Total Credits	68	18	8	22	24	8	6	4	8	4	6	176

Abbreviations:

VSC - Vocational Skill Course;

FP – Field Project

AEC – Ability Enhancement Courses

GE/OE – Generic or Open elective courses

T – Theory **P** – Practical

SEC – Skill Enhancement Course;

CEP – Community Engagement Project

VEC – Value Education Course

RP – Research Project

IKS – Indian Knowledge System

OJT – On Job Training

CC – Curricular Courses

RM – Research Methodology

1. A student can select three subject from the same faculty in first year. **At second year From Subject-1 and -2 student will select any one subject as major and one subject as minor.** Student cannot select Major and Minor subjects other than these two subjects taken at first year.
2. **VSC, IKS-2, OJT, FP, CEP, RP, RM should be related to Major subject**
3. OE/GE – Must be selected from basket approved by college and **selected from the faculty other than faculty of Major subject.**
4. **SEC should be selected from the basket of same faculty approved by the college.**
5. Each theory course may be of 2 or 4 credit; each practical course should be of 2 credit only.
6. For those subject's practical cannot be conducted, they have to convert practical credits into theory credits. The decision should be taken BOS of respective subject.
7. This credit framework is applicable to all faculties in the college. The courses which are under AICET, they must take approval to this framework from AICET or respective body.

NEP Coordinator

IQAC Coordinator

Deans

Vice Principal

Principal

1. **Arts Faculty** : _____

2. **Commerce Faculty:** _____

3. **Science Faculty:** _____

4. **Inter- disciplinary courses:** _____

Year	Sem	Major Courses	Major Elective Courses	Subject 2 (Minor Course)	VSC	IKS	GE /OE	SEC
FY	I	2 Theory + 1 Practical BOMAT-111 Basic Plant Science BOMAT-112 Applied Plant Science BOMAP-113 Practical Botany I	0	0	0	1 Theory GEIKT-111 Generic IKS	1 Theory BOGET-111 Agrotourism and Ecotourism	1 Practical BOSEP-111 Practical on Biofertilizers and Biopesticides
	II	2 Theory + 1 Practical BOMAT-121 Basics of Plant Ecology BOMAT-122 Cell Biology BOMAP-123 Practical Botany II	0	0	0	0	1 Practical BOGEP-121 Practical on Agrotourism and Ecotourism	1 Theory BOSET-121 Biofertilizers and Biopesticides
SY	III	2 Theory + 1 Practical BOMAT -231 Lower Cryptogams BOMAT -232 Plant Physiology BOMAP -233 Practical Botany III	0	1 Theory + 1 Practical BOMIT-231 Nursery and Gardening Management BOMIP-232 Practical on Nursery and gardening management	1 Theory BOVST-231 Herbal Technology	1 Theory BOIKT-231 Indian Agriculture	1 Theory BOGET-231 Agriculture for Competitive Exams	0
	IV	2 Theory + 1 Practical BOMAT -241 Higher Cryptogams and Gymnosperms BOMAT -242 Phytochemistry BOMAP -243 Practical botany IV	0	1 Theory + 1 Practical BOMIT-241 Applied Botany and Entrepreneurship BOMIP-242 Practical on Applied Botany & Entrepreneurship	1 Practical BOVSP-241 Practical on Herbal Technology	0	1 Practical/ 1 Theory BOGEP-241 Practical on Ayurvedic Botany OR BOGET-241 Ayurvedic Botany	1 Practical BOSEP-241 Practical on Plant Identification and Herbarium
TY	V	4 Theory + 2 Practical BOMAT – 351 Angiosperms and Plant Evolution BOMAT -352 Plant Molecular Biology BOMAT-353 Plant Pathology BOMAT-354 Research Methodology and Scientific writing BOMAP -355 Practical botany V BOMAP -356 Practical botany VI	2Theory + 1Practical BOMET-351 A Industrial Botany BOMET-351 B Gardening and Landscape designing BOMET-351 C Medicinal botany	0	1 Theory BOVST-351 Plant Tissue Culture	0	0	0

			BOME-352 Elective practical botany AB/BC/CA					
	VI	4 Theory + 2 Practical BOMAT-361 Genetics and Plant Breeding BOMAT-362 Plant Biotechnology BOMAT-363 Seed Technology and Post-Harvest technology BOMAT-364 Plant based Food and Nutrition BOMAP-365 Practical botany VII BOMAP-366 Practical botany VIII	1 Theory + 1 Practical BOMET-361A Computational Botany BOMET-361B Environmental Botany BOME-362 A Practical on Computational Botany BOME-362 B Practical on Environmental Botany	0	1 Practical BOVST-361 Practical on Plant Tissue Culture	0	0	0
VII and VIII Sem honors degree with major								
Year	Sem	Major Courses	Major Elective Courses	Minor Courses	VSC	IKS	GE /OE	SEC
TY Honors Major	VII	5 Theory + 2 Practical BOMAT-471 Plant Systematics - I (Algae & Fungi) BOMAT-472 Advanced Cell Biology BOMAT-473 Genetics & Plant Breeding BOMAT-474 Plant organism Interaction BOMAT-475 Floriculture and Pomoculture BOMAP -476 Practical botany IX BOMAP -477 Practical botany X	1 Theory + 1 Practical BOMET -471A Crop Physiology BOME-472A Practical on Crop Physiology BOMET-471B Pharmacognosy BOME-472B Practical on Pharmacognosy	RM 4 credits	0	0	0	0
	VIII	5 Theory + 2 Practical BOMAT-481 Plant Systematics - II (Bryophytes and Pteridophytes) BOMAT-482 Advanced Molecular Biology BOMAT-483 Biostatistics BOMAT-484 Tools and Techniques in Plant Science BOMAT-485 Plant Evolution BOMAP – 486 Practical botany XI	1 Theory + 1 Practical BOMET-481A Applied Biotechnology and Nanotechnology BOME-482A Practical on Applied	0	0	0	0	0

		BOMAP- 487 Practical botany XII	Biotechnology and Nanotechnology BOMET-481B Biodiversity BOMEF- 482B Practical on Biodiversity					
VII and VIII Sem Honors degree with research								
TY Honors Research	VII	4 Theory + 1 Practical BOMAT-471 Plant Systematics - I (Algae & Fungi) BOMAT-472 Advanced Cell Biology BOMAT-473 Genetics & Plant Breeding BOMAT-474 Plant organism Interaction BOMAP-475 Practical botany XI	1 Theory + 1 Practical BOMET -471A Crop Physiology BOMEF -472A Practical on Crop Physiology BOMET-471B Pharmacognosy BOMEF- 472B Practical on Pharmacognosy	RM 4 credits	0	0	0	0
	VIII	4 Theory + 1 Practical BOMAT-481 Plant Systematics - II (Bryophytes and Pteridophytes) BOMAT-482 Advanced Molecular Biology BOMAT-483 Biostatistics BOMAT-484 Tools and Techniques in Plant Science BOMAT-485 Plant Evolution BOMAP-476 Practical botany XII	1 Theory + 1 Practical BOMET-481A Applied Biotechnology and Nanotechnology BOMEF-482A Practical on Applied Biotechnology and Nanotechnology BOMET-481B Biodiversity BOMEF- 482B Practical on Biodiversity	0	0	0	0	0

Program: B.Sc. [Botany], 2024-25

Program Outcomes (POs) for B.Sc. Botany:

1. **Core Botanical Knowledge:** Demonstrate a thorough understanding of core concepts in plant science including morphology, physiology, ecology, cell biology, taxonomy, and evolution.
2. **Applied Botanical Skills:** Apply botanical knowledge to practical areas such as biofertilizers, Biopesticides, nursery management, herbal technology, and Phytochemistry.
3. **Ecological & Environmental Awareness:** Develop ecological sensitivity and environmental consciousness through courses like plant ecology, environmental awareness.
4. **Scientific Research & Methodology:** Acquire skills in scientific research design, experimental techniques, data analysis, and scientific writing.
5. **Practical Laboratory Competence:** Perform standard laboratory Practicals in plant identification, microscopy, Phytochemistry, molecular biology, plant pathology, and biotechnology.
6. **Vocational skills:** Gain hands-on vocational skills in nursery techniques, herbal product development, plant tissue culture, and plant-based nutrition.
7. **Communication Skills:** Enhance scientific and creative communication skills in both regional languages (Marathi and Hindi) and scientific English through integrated language and writing courses.
8. **Computational & Analytical Skills:** Apply computational tools and quantitative reasoning in plant sciences, especially in genetics, bioinformatics, and data-driven ecological assessments.
9. **Interdisciplinary Approach:** Integrate concepts from biotechnology, nanotechnology, ethnobotany, and traditional knowledge systems to solve real-world botanical problems.
10. **Sustainable Development Goals Orientation:** Align botanical knowledge with sustainable agriculture, biodiversity conservation, and community welfare, especially in field projects and community engagement.
11. **Ethical and Social Responsibility:** Exhibit ethical practices and understand the socio-cultural implications of botanical research and biotechnological applications.
12. **Entrepreneurship and Employability:** Prepare for employment or entrepreneurship in the fields of agriculture, horticulture, herbal medicine, seed technology, and environmental consultancy.
13. **Global and Local Relevance:** Understand the global importance of plants in climate change, food security, and health, while valuing indigenous and local knowledge systems like Ayurveda and IKS.

Program Specific Outcomes(PSo):

PSO1: Understanding Plant Diversity and Evolution

Demonstrate in-depth knowledge of plant biodiversity from lower cryptogams (algae, fungi, lichens) to higher cryptogams and gymnosperms, as well as the classification, morphology, and evolution of angiosperms.

PSO2: Mastery of Plant Function and Structure

Apply core concepts in plant physiology, cell biology, molecular biology, and phytochemistry to understand plant function, structure, and metabolism at the cellular and organismal levels.

PSO3: Application of Botany in Agriculture and Industry

Utilize botanical knowledge in agriculture, seed technology, herbal medicine, nursery and gardening, biofertilizers production, and food and nutrition sciences, with practical exposure to field and lab-based practices.

PSO4: Proficiency in Research and Scientific Inquiry

Design and conduct botanical experiments, analyze data using appropriate methods, and communicate findings through research methodology, scientific writing, and participation in field/research projects.

PSO5: Environmental and Ethical Awareness with Community Relevance

Evaluate ecological issues and biodiversity conservation strategies, apply traditional knowledge systems (e.g., Ayurveda, IKS), and engage in community-based initiatives for sustainable development and environmental education.

Department of Botany

S.Y. B. Sc Botany

Third and Fourth Semester

Sr. No.	Subject Code	Subject Name	Allotted Credit	No. of Lecture /Practical
Major Course				
1	BOMAT 231	Lower Cryptogams	2	30L
2	BOMAT 232	Plant Physiology	2	30L
3	BOMAP 233	Practical Botany III (Practical Based on BOMAT 231 & 232)	2	12P
1	BOMAT 241	Higher Cryptogams and Gymnosperms	2	30L
2	BOMAT 242	Phytochemistry	2	30L
3	BOMAP 243	Practical Botany IV (Practical Based on BOMAT 241 & 242)	2	12P
Minor Course (For Other than Botany Major Students)				
1	BOMIT 231	Nursery and Gardening Management	2	30L
2	BOMIP 232	Practical on Nursery and Gardening Management	2	12P
1	BOMIT 241	Applied Botany for Entrepreneurship	2	30L
2	BOMIP 242	Practical on Applied Botany for Entrepreneurship	2	12P
Vocational Skill Course				
1	BOVST 231	Herbal Technology	2	30L
1	BOVSP 241	Practical on Herbal Technology	2	12P
Indian Knowledge System				
1	BOIKT 231	Indian Agriculture	2	30L
Skill Enhancement Course				
1	BOSEP 241	Practical on Plant Identification and Herbaria	2	12P
Generic Elective/Optional Elective				
1	BOGET 231	Agriculture for Competitive Exam	2	30L
2	BOGET 241	Ayurvedic Botany OR	2	12P
3	BOGEP 241	Practical on Ayurvedic Botany	2	12P
Field Project in Botany				
1	BOFPP 231	Field Project in Botany	2	120 Hr
Community Engagement Project (CEP), SEM-IV				
1	BOCEP-241	Community Engagement Project in Botany	2	120Hr

Ability Enhancement Courses Sem-III				
1	ENAET-231	English Communication and Soft Skill-I	2	30L
2	ENAET-241	English Communication and Soft Skill-II	2	30L
Co-Curricular Courses-III				
1	CCHRT-231	Human Rights: An Introduction	2	30L
2	CCCST-241	Cyber Security	2	30L
GE/OE from College basket for Science Faculty				
COMMERCE FACULTY				
1.	COGET-231	Fundamental insurance marketing	2	30L
2.	COGET-241	Advanced insurance marketing	2	30L
3.	BCGET-231	Digital marketing	2	30L
4.	BCGET-241	Basics of Data Science	2	30L
5.	BBGET-231	Production Management	2	30L
6.	BBGET-241	Management for Innovation & Sustainability	2	30L
ARTS FACULTY				
7.	PSGET-231	Psychology of Health and Well-being	2	30L
8.	PSGET-241	Psychology of Physical and Mental Health	2	30L
9	POGET-231	An Introduction to Political Science-I	2	30L
10.	POGEP-241	An Introduction to Political Science-II	2	30L
11.	ECGET- 231	Digital banking-I	2	30L
12.	ECGET- 241	Digital banking-II	2	30L
13.	GGGET-231	Introduction to Disaster Management	2	30L
14.	GGGEP -241	Practicals in Disaster Management	2	12P
Skill Enhancement Course (SEC) College basket for science faculty				
1.	CHSET-241	Chemo-Informatics and Organic Synthesis	2	30L
2.	ZOSET-241	Public Health and Hygiene	2	30L
3.	BOSEP 241	Practical on Plant Identification and Herbaria	2	12P
4.	MTSET-242	Computational Geometry	2	30L
5.	STSEP-241	Statistical Computing using R	2	30L
6.	STSET-241	Applied Statistics	2	30L
Minor course College basket for science faculty				
1.	CHMIT-231	Fundamentals of Analytical Chemistry	2	30L
2.	CHMIP-232	Analytical Chemistry Practical	2	12P
3.	CHMIT-241	Material Science-I	2	30L
4.	CHMIP-242	Practical on Material Science	2	12P
5.	BOMIT 231	Nursery and Gardening Management	2	30L

6.	BOMIP 232	Practical on Nursery and Gardening Management	2	12P
7.	BOMIT 241	Applied Botany for Entrepreneurship	2	30L
8.	BOMIP 242	Practical on Applied Botany for Entrepreneurship	2	12P
9.	ZOMIT-231	General Zoology-I	2	30L
10.	ZOMIP-232	Practical in General Zoology-I	2	12P
11.	ZOMIT-241	General Zoology-II	2	30L
12.	ZOMIP-242	Practical in General Zoology-II	2	12P
13.	MTMIT-231	Applied Linear Algebra	2	30L
14.	MTMIP-232	Applied Linear Algebra using Python	2	12P
15.	MTMIT-241	Discrete Mathematics	2	30L
16.	MTMIP-242	Discrete Mathematics using Python	2	12P
17.	STMIT-231	Standard Continuous Probability Distributions	2	30L
18.	STMIP-232	Statistics Practical-III	2	12P
19.	STMIT-241	Testing of Hypothesis	2	30L
20.	STMIP-242	Statistics Practical-IV	2	12P
21.	PHMIT-231	Semiconductor Devices	2	30L
22.	PHMIP-232	Physics Lab III	2	12P
23.	PHMIT-241	Waves and Optics	2	30L
24.	PHMIP-242	Physics Lab IV	2	12P

P. D. E. A's
Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044
(Autonomous)



Affiliated to

Savitribai Phule Pune University [SPPU]



B. Sc. With Major Botany

(Three years B. Sc. in Botany / Four Years Honors in Botany)

2024 Pattern

Choice Based Credit System-2024 Pattern

Under

Autonomy and NEP-2020

From Academic Year
2025-2026

Syllabus

S. Y. B. Sc. Botany

THIRD SEMESTER

Board of Studies in Botany

Department of Botany

Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044

Course	: Major	Total Credit	: 2
Code	: BOMAT 231	Course Type	: Theory
Subject	: Lower Cryptogams	Total Lecture	: 30L

Module - I Introduction and Algae 15L

Chapter 1 Introduction to Lower Cryptogams 8L

- 1.1 Introduction
- 1.2 Types and diagnostic features- Lower Cryptogams
- 1.3 Phylogenetic Evolution of lower Cryptogams

Chapter 2 Algae 7L

- 2.1 General characteristics
- 2.2 Habit, Habitat, Distribution, Morphological Peculiarities of thallus organization, Reproduction
- 2.3 System of Classifications
- 2.4 Outline classification as per G.M.Smith (1955) up to classes
- 2.5 Study of algae with reference to taxonomic position, Occurrence, Thallus structure, Reproduction and Life cycle of – *Nostoc*, *Chara*, *Sargassum*.
- 2.6 Ecological and Economic importance

Module - II Fungi and Lichens 15L

Chapter 3 Fungi 10L

- 3.1 General characteristics
- 3.2 Habit, Habitat, Distribution, Morphological study of thallus organization, Cell wall composition, nutrition, reproduction
- 3.3 System of Classifications
- 3.4 Outline classification as per Alexopoulos and Mims (1979) up to classes
- 3.5 Study of fungi with reference to taxonomic position, thallus structure, Reproduction and Life cycle of-*Aspergillus* (Ascomycota) *Puccinia* (Basidiomycotina), *Fusarium* (Deuteromycotina)
- 3.6 Ecological and Economic importance.

Chapter 4 Lichens and Micorrhiza 5L

- 4.1 Introduction
- 4.2 Types
- 4.3 Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance
- 4.4 Ecological & Economic importance

Suggested Readings:

1. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi, India.
2. Ganguli, H. C. and Kar, A. K. (2001). College Botany Vol. I. Books and Allied Press Ltd. Kolkata, India
3. Kumar H. D. (1988). Introductory Phycology. Affiliated East West Press Ltd. New Delhi

4. Kumar H. D. and H. N. Singh (1976). A Text Book of Algae. Affiliated East West Press Ltd. New Delhi, India
5. Pandey, B. P. (1994). A Text Book of Botany - Algae. S. Chand & Co. Ltd. New Delhi, India.
6. Pandey, S. N., Trivedi, P. S. and S. P. Misra (1995). A Text Book of Algae. Vikas Pub. House Pvt. Ltd. New Delhi, India.
7. Sharma, O. P. (1990). Text Book of Algae. Tata McGraw Hill Pub. Co. Ltd. New Delhi, India.

Course Outcome:

After successful completion of this course, students will be able to...

1. Identify and describe lower cryptogams of plant kingdom.
2. Explain economic and ecological significance of different lower Cryptogamic groups
3. Compare lower Cryptogamic plant forms and distinguish them to their respective groups.
4. Explain life cycle patterns of the cryptogams.

Course : Major
Code : BOMAT 232
Subject : Plant Physiology

Total Credit : 2
Course Type : Theory
Total Lecture : 30L

Module - I Physiological Principles and Processes

15L

- Chapter 1 Introduction to Plant Physiology** 01L
1.1 Introduction
1.2 Scope and applications of plant physiology
- Chapter 2 Plant water relations:** 04L
2.1 Importance of water to plant life, physical properties of water;
2.2 Tissue involved in water uptake: Xylem structure, types and function
2.3 Diffusion, Bulk flow, Osmosis- definition, types of solutions (hypotonic, isotonic, hypertonic), endosmosis, exosmosis, osmotic pressure, turgor pressure, wall pressure, importance of osmosis in plants.
2.4 Plasmolysis – definition, mechanism and significance
- Chapter 3 Ascent of sap and Transpiration** 05L
3.1 Introduction and definition,
3.2 Pathways of Ascent of sap- Symplastic, Apoplastic and Transmembrane
3.3 Factors affecting ascent of sap (External and Internal).
Transpiration-Definition, Types
(Cuticular, lenticular, stomatal Transpiration)
3.5 Transpiration pull or cohesion-tension theory, evidences and objections
3.6 Structure of stomata, mechanism of opening and closing of stomata,
3.7 Factors affecting the rate of transpiration, significance of transpiration
3.8 Guttation, Exudation
- Chapter 4 Translocation** 03L
4.1 Introduction, Definition
4.2 Photo-assimilates, Source, sink, source and sink relation
4.3 Tissue involved in food conduction: Phloem- structure, types and function
4.4 Phloem loading and unloading
- Chapter 5 Mineral nutrition** 02L
5.1 Essential elements- macro and micronutrients,
5.2 Role and deficiency symptoms,
5.3 Chelating agents- Definition and role in mineral nutrition

Module - II Physiology of Growth and Development

15L

- Chapter 6 Photosynthesis** 06L
6.1 Structure of a chloroplast, photosynthetic pigments and their role, Photosystems
6.2 Light reaction, Electron transport chain, Cyclic and Noncyclic photophosphorylation,

- 6.3 Carbon fixation in photosynthesis - Calvin cycle, HSK pathway: Salient features of C4 plants, metabolic pathway, CAM pathway,
- 6.4 Photo-respiration,
- 6.5 Significance of photosynthesis.

Chapter 7 Respiration **05L**

- 7.1 Structure of a mitochondrion, Definition and Types of respiration, Respiratory substrates,
- 7.2 Mechanism of aerobic respiration – Glycolysis, TCA cycle.
- 7.3 Electron transport system, Chemo-osmotic hypothesis of ATP synthesis, Balance sheet of ATP generation in respiration and Significance of respiration.

Chapter 8 Growth and Development **04L**

- 8.1 Introduction and definition
- 8.2 Differentiation and morphogenesis
- 8.3 Plant Growth Regulators and Inhibitors: Definition, types and function

Suggested Readings:

1. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). Plant physiology and Development.
2. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy (2015). Plant Physiology and Development (Sixth Edition) Sinauer Associates, Inc Publishers Sunderland, Massachusetts U.S.A. Conservation. Anamaya Publications, New Delhi, India.
3. Epstein, E., and Bloom, A. J. (2005) Mineral Nutrition of Plants: Principles and Perspectives, 2nd ed. Sinauer Associates, Sunderland, MA.
4. Salisbury F.B and Ross C.W (1992). Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA.
5. V. K. Jain (2017) Fundamentals of Plant Physiology S. Chand Publications.

Course Outcome:

After successfully completing this course, students will have the ability to...

5. Define and discuss various physiological processes in plants.
6. To study plant metabolism, energy production, storage, and its use.
7. Discuss how plants manage water uptake, transport, and loss.
8. Explain how plant functions in response to its environmental conditions.

Course : Major
 Code : BOMAP 233
 Subject : Practical Botany III
 (Practical Based on BOMAT 231 & 232)

Total Credit : 2
 Course Type : Practical
 Total Practical : 12

Sr. No	Practical Botany III (Practical Based on BOMAT 231 and 232)	12P
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Based on BOMAT 231 Lower Cryptogams (Algae, Fungi & Lichens)

- | | | |
|----|---|----|
| 1. | Study of Algae with respect to systematic position, thallus structure & reproduction of <i>Nostoc</i> | 1P |
| 2. | Study of Algae with respect to systematic position, thallus structure & reproduction of <i>Sargassum</i> | 1P |
| 3. | Study of Algae with respect to systematic position, thallus structure and reproduction of: <i>Chara</i> | 1P |
| 4. | Study of Fungi with respect to systematic position, thallus structure and reproduction of: <i>Puccinia</i> | 1P |
| 5. | Study of Fungi with respect to systematic position, thallus structure and reproduction of: <i>Aspergillus</i> | 1P |
| 6. | Study of Fungi with respect to systematic position, thallus structure and reproduction of: <i>Fusarium</i> | 1P |
| 7. | Study of Lichens: Crustose, Foliose, Fruticose (Demonstration) | 1P |
| 8. | Field Visit to rich Biodiversity regions

Students are expected to submit two forms or photographs of Bryophytes Pteridophytes and Gymnosperm along with tour report. | 1P |

Based on BOMAT 232 Plant Physiology

- | | | |
|-----|---|----|
| 9. | To Study permeability of plasma membrane using different concentrations of organic solvents | 1P |
| 10. | Determination of Diffusion Pressure Deficit (DPD) | 1P |
| 11. | Isolation of Leaf Protein Concentration (LPC) from suitable plant material | 1P |
| 12. | To Study the effect of two environmental factors (light and wind) on transpiration by excised twig | 2P |
| 13. | Study of Plasmolysis | 1P |
| 14. | Study of any two mineral deficiency Symptoms in plants | 1P |
| 15. | Demonstration Practical: Nitrogen Fixing bacteria, Imbibition in seeds, Ringing Experiment, Arc Auxanometer | 1P |

Suggested Readings

1. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi, India. ISBN-10:817319310X
2. Sundara S. Rajan. (2003). Practical Manual of Plant Ecology and Plant Physiology. Anmol Publication Pvt Ltd, Delhi, India: ISBN-10:9788126109630
3. Kochhar S.L, Sukhbir Kaur Gujral. (2011). Comprehensive Practical Plant Physiology. Laxmi Publications, New Delhi, India. ISBN-10 :0230324460.

Course Outcome

After successful completion of this course, students will be able to....

1. Describe distinguishing characters and Classify Lower Cryptogams.
2. Explain the Life cycle of Lower Cryptogams.
3. To analyse osmotic behaviour and cell permeability
4. Understand plant water relations through DPP and Plasmolysis experiments.
5. To discuss several essential insights and skills in plant physiology, experimental techniques, and data interpretation.

Course : Minor
Code : BOMIT 231
Subject : Nursery and Gardening Management

Total Credit : 2
Course Type : Theory
Total Lecture : 30L

Module -I Basics of Nursery Management

15L

Chapter 1 Introduction to Nursery

03L

- 1.1 Introduction and Definition of Nursery
- 1.2 Objectives, scope and importance
- 1.3 Factors influencing site selection
- 1.4 Building up of infrastructure for nursery

Chapter 2 Seed

06L

- 2.1 Seed: Definition, Structure and types
- 2.2 Seed dormancy, Causes and methods of breaking dormancy
- 2.3 Factors affecting Seed viability
- 2.4 Seed Production, Seed banks
- 2.5 Production and maintenance of Seedlings: Seed Handling, Storage, Germination Beds, Sowing Methods, Germination Process, Factors affecting seedling growth and maintenance
- 2.6 Transplanting of Seedlings: Bed for Transplants, Process of Transplanting and its maintenance, Tending the Seedlings, Weed Control

Chapter 3 Vegetative Propagation Technique

03L

- 3.1 Cutting, Budding, Grafting, Layering: Introduction, Types and Procedure
- 3.2 Hardening of plants – greenhouse, Shade house and glass house, mist chamber

Chapter 4 Management Practices

03L

- 4.1 Water and Nutrient management
- 4.2 Temperature and Light management
- 4.3 Pest and Disease Management

Module - II: Basics of Gardening Management

15L

Chapter 5 Introduction to Gardening

04L

- 5.1 Definition, Objectives and Scope on Gardening Management
- 5.2 History and Salient Features of Landscape gardening in India - Aryans period, Buddhist period, Mughal period, British period

Chapter 6 Landscape Gardening

05L

- 6.1 Definition, scope and importance of Landscape designing
- 6.2 Design Principles, Site selection and Analysis
- 6.3 Styles of Landscape Gardening
- 6.4 Vertical and Terrace Gardening
- 6.5 Plant selection criteria for Ecological, Aesthetic and Functional Garden

Chapter 7 Garden Management Practices

03L

7.1 Water and Nutrient management

7.2 Pest and Disease Management

7.3 Development maintenance and sustainable Practices

Chapter 8 Gardens in India and Globe

03L

Features of famous botanical and aesthetic gardens of India and Globe:

- i. Acharya Jagadish Chandra Bose Indian Botanic Garden (Calcutta),
- ii. National Botanical Research Institute (NBRI) (Lucknow)
- iii. Royal Botanical Garden, Kew, UK
- iv. Kyoto Botanical Garden, Japan
- v. Botanical Garden in SPPU
- vi. Botanical and Medicinal Plant gardens in Maharashtra

Suggested Readings:

1. Dr. B. A. Patil, Dr. S. T. Moharekar, Dr. S. J. Chavan and Dr. Asha B. Kadam. Savitribai Phule Pune University (CBCS Pattern June 2021) BO 3510: Medicinal Botany. Pub. Prashant Publication, Maharashtra, India.
2. Dr. B. A. Patil, Dr. S. T. Moharekar, Dr. S. J. Chavan and Dr. Asha B. Kadam. Savitribai Phule Pune University (CBCS Pattern June 2021) BO 3610: Nursery and Gardening Management. Pub. Prashant Publication, Maharashtra, India.
3. Bose T.K. & Mukherjee, D., Gardening in India, Oxford & IBH Publishing Co., New Delhi. 1972
4. Agrawal, P.K. (1993). Hand Book of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
5. Sandhu, M.K., Plant Propagation, Wile Eastern Ltd., Bangalore, Madras. 1989

Course Outcome

After successful completion of this course, students will be able to,

1. Understand the basics of nursery structure, tools and management practices.
2. Demonstrate propagation techniques like cutting, grafting and Layering.
3. Apply principles of garden Layout and maintenance.
4. Develop skills for raising healthy nursery plants and managing small scale gardens.

Course : Minor	Total Credit : 2
Code : BOMIP 232	Course Type : Practical
Subject : Practical on Nursery & Gardening Management	Total Practical : 12

Sr. No	Practical on Nursery & Gardening Management	12P
1.	Identification and use of garden tools and its implements	1P
2.	Soil testing by different parameters (Soil Electrical Conductivity (EC), Soil Bulk Density, Soil Texture (Particle Size Distribution) , Soil Lime Requirement, Soil Respiration (Microbial Activity)	1P
3.	Preparation of Bed for nursery	1P
4.	Study of Grafting and budding method	1P
5.	Study of Air Layering and cutting method	1P
6.	Performance of Seed Viability test	1P
7.	Preparation of potting mixture: Potting and repotting	1P
8.	Study the fertilizers requirements of garden plants	1P
9.	Demonstration on Laying out drip irrigation, sprinklers	1P
10.	Preparation of nursery bed and polybag filling	1P
11.	To study sowing method of seeds and other material	1P
12.	Study and Control measures of plant pests and diseases	1P
13.	Establishment and management of vegetable garden	1P
14.	Field visit/ Industrial visit (Compulsory)	1P

Suggested Readings:

1. Dr. K. N. Dhumal, Dr. Sayyad Iliyas, Dr. V. B. Kadam, Ms. Shazzen Khan, Dr. Gauri Abhyankar, Dr. V. D. Ranade, Dr. A. D. Kshirsagar, Dr. N. A. Ghayal, Dr. S. S. Jagtap, Dr. N. B. Admuthe, Dr. A. M. Bhosale. Hand Book of Botany Practicals Botany (BO-367, BO-368 & BO-369). Pub. Nirali prakashan, Mumbai, Maharashtra, India.
2. Dr. B. A. Patil, Dr. S. T. Moharekar, Dr. S. J. Chavan and Dr. Asha B. Kadam. Savitribai Phule Pune University (CBCS Pattern June 2021) BO 3510: Medicinal Botany. Pub. Prashant Publication, Maharashtra, India.
3. Dr. B. A. Patil, Dr. S. T. Moharekar, Dr. S. J. Chavan and Dr. Asha B. Kadam. Savitribai Phule Pune University (CBCS Pattern June 2021) BO 3610: Nursery and Gardening Management. Pub. Prashant Publication, Maharashtra, India. Bose T.K. & Mukherjee, D., Gardening in India, Oxford & IBH Publishing Co., New Delhi. 1972.
4. Handbook of Agriculture- Indian Council of Agricultural Research, New Delhi.
5. Plant Breeding: Principles and Methods- Phundan Singh, 2009. Kalyani Publishers, New Delhi.

Course Outcome

After successful completion of this course, students will be able to,

1. Describe plant propagation techniques.
2. Design the model and maintain different types of gardens.
3. Recognize common pests and diseases in nurseries and apply basic control measures.
4. Develop entrepreneurship skills for small scale nursery and gardening ventures.

Course : Vocational Skill Course
Code : BOVST 231
Subject : Herbal Technology

Total Credit : 2
Course Type : Theory
Total Lecture : 30

Module - Introduction to Herbal Technology

15L

Chapter 1 Introduction and scope of Herbal Technology

06L

- 1.1 Definition and scope of herbal technology
- 1.2 Herbal Technology: Bridging Ancient Wisdom and Modern Science
- 1.3 Definition of herb, Herbal medicine, Herbal medicinal products
- 1.4 From Plant to Product: Identification, Authentication, and Processing of Herbal Drugs
- 1.5 Herbal drugs industry: Present scope and prospects. A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India

Chapter 2 Uses of medicinal plants and conservations of medicinal plants.

09L

- 2.1 Systematic Study of Common Medicinal Herbs: Morphology, medicinal uses, and Biological Sources
- 2.2 Herbal Nutraceuticals: Culinary Uses and Health Benefits of Medicinal Herbs
- 2.3 Conservation and sustainable use of medicinal plants; In-situ and Ex-situ conservation methods. Centers for conservation of medicinal plants

Module - II Analytical Pharmacognosy and Herbal Cosmetics

15L

Chapter 3 Photochemistry and Analytical Pharmacognosy

08L

- 3.1 Analytical Techniques in Pharmacognosy: Ensuring Purity and Efficacy in Herbal Products
- 3.2 Histochemical tests for screening of phytoconstituents in natural drugs alkaloids, flavonoids, steroids, terpenoids, tannins, glycosides, and volatile oils
- 3.3 Advanced Extraction Techniques for Herbal Medicines: From Decoctions to Supercritical Fluids
- 3.4 Adulteration in Herbal Drugs: Types, Detection, and Quality Control Strategies

Chapter 4 Herbal Cosmetics

07L

- 4.1 Herbal Cosmetics: A Natural Approach to Skincare, Haircare, and Oral Care
- 4.2 Aromatherapy Oils: Applications in Wellness and Therapeutics
- 4.3 The Science of Herbal Formulations: Advantages Over Synthetics in Cosmetics
- 4.4 Sustainable Approaches to Herbal Cosmetics: Combining Nature with Innovation

Suggested Readings:

1. Textbook of Pharmacognosy and Phytochemistry by Biren Shah and Avinash Seth.
2. Herbal Drug Technology by M. S. Ashok Kumar and P. Rajendra Kumar.
3. Herbal Medicine: Biomolecular and Clinical Aspects edited by Iris F. F. Benzie and Sissi Wachtel-Galor.
4. Essentials of Botanical Extraction: Principles and Applications by Subhash Mandal, Vivekananda Mandal, and Tapan Kumar Mandal.
5. Quality Control Methods for Medicinal Plant Materials by World Health Organization

Course Outcome:

After Completion of this course, students are able to,

1. To summarise the knowledge of herbal medicine.
2. To study different extraction techniques in Ayurvedic sciences.
3. Describe the quality control and safety measures of Ayurvedic medicines.
4. Discuss the analytical techniques in Pharmacognosy.

Course : Indian Knowledge System
Code : BOIKT 231
Subject : Indian Agriculture

Total Credit : 2
Course Type : Theory
Total Lecture : 30

Module - I Ancient Indian Agriculture

15L

Chapter 1 History of Indian Agriculture

10L

- 1.1 Introduction, Significance of Agriculture in India
- 1.2 History of Indian agriculture: The importance of agriculture since ancient times, irrigations emphasized in the Ramayana, Mahabharata and other texts, Indian agriculture by Greek historians and later travellers

Chapter 2 Irrigation Methods in Ancient India

05L

- 2.1 Agriculture and irrigation in the era of different Kings of Indian tradition
- 2.2 Major water reservoirs of ancient times. The Ery system of south India

Module – II Agriculture in India

15L

Chapter 3 Technologies in Indian Agriculture

07L

- 3.1 Excellence of Indian agricultural technologies for sustainable development
- 3.2 Productivity of Indian agriculture in medieval Thanjavur and eighteenth-century Allahabad, Chengalpattu, etc.

Chapter 4 Agriculture in India

06L

- 4.1 Indian knowledge of agriculture in ancient times
- 4.2 Indian knowledge of agriculture in medieval times
- 4.3 Indian knowledge of agriculture in modern times

Chapter 5 Indian Agriculture: Ancient and Modern

02L

- 5.1 Introduction
- 5.2 Applications of ancient Indian Agriculture in Modern Agricultural practices
- 5.3 Role of ancient Indian Agriculture in sustainable farming

Suggested Readings:

1. Lokopakara (For the Benefit of People) - An Ancient Text on Indian Agriculture Ayangarya, V. S. Asian Agri-History Foundation, India. (2006).
2. The Ery Systems of South India. Mukundan, T. M. Akash Ganga Trust, Chennai. (2005).
3. Traditional Water Management Systems of India. Chakravarty, K. K., Badam, G. L., Paranjpye, V. Aryan Books International, New Delhi. (2006).
4. Water Harvesting, Conservation and Irrigation in Mewar (AD 800-1700). Bhadani, B. L. Manohar Publishers & Distributors, New Delhi. (2012).
5. Indian Agriculture: Four Decades of Development" by V.M. Dandekar and Nilakanth Rath
6. History of Indian Agriculture: A Comprehensive Study" by Lallanji Gopal

7. Agricultural and Economic History of India" by Shri Ram Sharma
8. History of Indian Agriculture: A Collection of Essays" edited by A. M. Michael
9. Water Architecture in South Asia: A Study of Types, Development and Meanings" by Rutgerd Boelens and Dik Roth
10. Irrigation and Hydraulic Engineering in the Indus Valley Civilization" by Gregory L. Possehl

Course Outcomes:

After the completion of this course, Students are able to,

1. Understand ancient Indian agriculture and the current scenario.
2. Elaborate the irrigation techniques in India and demonstrate the various irrigation techniques followed in India.
3. To study the effectiveness of different agriculture technologies implemented in India.
4. Discuss Indian knowledge of agriculture during the past in India.

Course : GE/OE
 Code : BOGET 231
 Subject : Agriculture for Competitive Exam

Total Credit : 2C
 Course Type : Theory
 Total Lecture : 30L

Module - I Basics of Agriculture	15L
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Chapter 1	Agriculture and Cropping System	02L
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- 1.1 Definition, meaning and branches of Agriculture
- 1.2 Factors affecting crop production
- 1.3 Cropping Systems: Definition and types of cropping systems
- 1.4 Meteorology: weather parameters

Chapter 2	Water and Soil for Agriculture	03L
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- 2.1 Sources of water
- 2.2 Absorption and movement of water in soil
- 2.3 Soil moisture constant
- 2.4 Forms of soil water
- 2.5 Factors affecting available soil moisture
- 2.6 Absorption of soil moisture by plant

Chapter 3	Irrigation in Agriculture	03L
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- 3.1 Water requirement
- 3.2 Irrigation requirement of crops
- 3.3 Factors affecting water requirement
- 3.4 Measurement of irrigation
- 3.5 Water use efficiency
- 3.6 Importance of drainage and their types
- 3.7 Effect of drainage on soil and crop growth

Chapter 4	Food Production and Agriculture	05L
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- 4.1 Food production and consumption trends in India
- 4.2 Food security and growing population
- 4.3 NFSM and other food security related Government Initiatives
- 4.4 Availability of food grains, per capita expenditure on food
- 4.5 Food based dietary approaches to eliminate hunger
- 4.6 Protein Energy Malnutrition or Protein Calorie Malnutrition (PEM or PCM)
- 4.7 HRD in context of work capacity of women and children

Chapter 5	Geoinformatics in Agriculture	02L
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- 5.1 Geo-informatics
- 5.2 Crop discrimination and Yield monitoring
- 5.3 Remote sensing concepts and application in agriculture
- 5.4 Global positioning system (GPS)

Module - II Act and Laws related to Agriculture	15L
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Chapter 6	Maharashtra land revenue code:	04L
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- 6.1 Classification of land occupancies
- 6.2 Responsibilities and duties of revenue officer
- 6.3 Use of lands for agriculture and non- agriculture
- 6.4 Encroachment of land, Revenue surveys
- 6.5 Assessment and settlement of land revenue

Chapter 7	Tenancy and agricultural lands act:	03L
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- 7.1 Concept of tenancy
- 7.2 Right of tenancy

	7.3 Condition of purchase of agriculture land in Maharashtra	
	7.4 Sale of tenanted land	
	7.5 Confiscation of powers of revenue officers	
Chapter 8	Land acquisition acts:	02L
	8.1 Essential commodities act in relation to cotton, sugarcane, food grains	
	8.2 Right to Fair compensation and Transparency in Land Acquisition	
	8.3 Rehabilitation and Resettlement Act, 2013.	
Chapter 9	Scopes, benefits coverage and limitations of the amendments:	06L
	1. Agriculture Pest and Disease Act (1950)	
	2. Prevention of Food Adulteration Act (1954)	
	3. Food production order Act (1956)	
	4. Asian Development Bank Act (1966)	
	5. Indian Seeds Act (1966)	
	6. Vegetable Oil Product Act (1967)	
	7. Insecticides Act (1968)	
	8. Agriculture Produce Market Act (1972)	
	9. Meat Food Products Order (1973)	
	10. Vegetable Oil Product (standard of quality) Order (1975)	
	11. Regional Rural Banks Act (1976)	
	12. Indian Veterinary Council Act (1984)	
	13. Consumer Protection Act (2019)	
	14. Indian Fisheries Act (1897)	
	15. Central Agricultural Universities Act (1992)	
	16. Destructive insects and Pests (Amendment and Validation) Act (1992)	
	17. The Protection of Plant Varieties and Farmers' Rights Act (2001)	
	18. Biodiversity Act (2002)	

Suggested Readings:

1. Textbook of Field Crops Production-Foodgrain Crops (Vol-I), ICAR Publication, New Delhi.
2. Textbook of Field Crops Production-Commercial Crops (Vol-II), ICAR Publication, New Delhi.
3. Handbook of Agriculture, ICAR Publication, New Delhi.
4. Rana, K.S., Choudhary, A.K., Sepat, S. and Bana, R.S. 2014. Advances in Field Crop Production. IARI, New Delhi. pp 475.
5. Choudhary, A.K., Rana, D.S., Bana, R.S., Pooniya, V., Dass, A., Kaur, R., Rana, K.S. 2015. Agronomy of Oilseed and Pulse Crops, IARI, New Delhi & ICAR, DARE, New Delhi, India. pp 206.
6. Bal, J.S. (2007). Fruit growing. Kalyani Publishers, Ludhiana, India.
7. Bose, T.K. and Som, M.G. (1995) Vegetables crops of India. Naya Prokash Publications, Kolkatta, India.
8. Chadha, K.L. (1993). Handbook of horticulture, ICAR, India.
9. Chadha, T.R. (2000). Textbook of temperate fruits. ICAR, New Delhi.
10. Chattopadhyay, T.K. A textbook on Pomology, Vol. 2,3,4, Kalyani publishers, Ludhiana, India.,
11. Mukhopadhyay, A and Randhawa, G.S. (1992). Floriculture in India, Allied Publishers, New Delhi.
12. Panda, H. (2010). Handbook on Spices and Condiments (Cultivation, Processing and Extraction). Asia Pacific Business Press Inc., New Delhi

Course Outcome:

After Completion of this course, students are able to,

1. To study Agriculture and Cropping Systems.
2. To explain Irrigation and food production in agriculture.
3. Describe laws and amendments related to farming and lands.
4. Understand and apply the knowledge for competitive exams

Course : GE/OE
Code : BOGET 231
Subject : स्पर्धा परीक्षेसाठी कृषिविद्या

Total Credit : 2
Course Type : Theory
Total Lecture : 30

अध्याय I शेतीची मूलभूत माहिती

15L

अध्यायभाग व्याख्या, शेतीच्या विविध शाखा:

02L

- 1
- 1.1 पीक उत्पादनावर परिणाम करणारे घटक
 - 1.2 पीक प्रणाली: पीक पद्धतीची व्याख्या आणि प्रकार
 - 1.3 हवामानशास्त्र: हवामान मापदंड

अध्यायभाग पाण्याचे स्रोत:

03L

- 2
- 2.1 जमिनीत पाण्याचे शोषण आणि हालचाल
 - 2.2 जमिनीतील ओलावा स्थिरता
 - 2.3 मातीच्या पाण्याचे प्रकार
 - 2.4 जमिनीतील ओलावा प्रभावित करणारे घटक
 - 2.5 वनस्पतीद्वारे मातीची आर्द्रता शोषण्याची प्रक्रिया

अध्यायभाग पाण्याची गरज:

03L

- 3
- 3.1 पिकांना सिंचनाची गरज
 - 3.2 पाण्याच्या गरजेवर परिणाम करणारे घटक
 - 3.3 सिंचनाचे मोजमाप
 - 3.4 पाणी वापराची कार्यक्षमता
 - 3.5 निचराचे महत्त्व आणि त्यांचे प्रकार
 - 3.6 माती आणि पिकाच्या वाढीवर निचरा होण्याचा परिणाम

अध्यायभाग भारतातील अन्न उत्पादन आणि उपभोग:

05L

- 4
- 4.1 अन्न सुरक्षा आणि वाढती लोकसंख्या
 - 4.2 NFSM आणि इतर अन्न सुरक्षा संबंधित सरकारी उपक्रम
 - 4.3 अन्नधान्याची उपलब्धता, अन्नावरील दरडोई खर्च
 - 4.4 भूक दूर करण्यासाठी अन्न आधारित आहार पद्धती
 - 4.5 प्रथिने ऊर्जा कुपोषण किंवा प्रथिने कॅलरी कुपोषण
 - 4.6 महिला आणि मुलांच्या कामाच्या क्षमतेच्या संदर्भात मानव संसाधन विकासाची भूमिका

अध्यायभाग भू-माहितीशास्त्र:

02L

- 5
- 5.1 पीक सापन्नभाव आणि उत्पन्नाचे निरीक्षण
 - 5.2 रिमोट सेन्सिंग आणि त्यांचा कृषी क्षेत्रात उपयोग
 - 5.3 ग्लोबल पोजिशनिंग सिस्टम

अध्याय II शेती संबंधित कायदा

15L

अध्यायभाग महाराष्ट्र जमीन महसूल कोड:

04L

- 6
- 6.1 जमिनीच्या वहिवाटीचे वर्गीकरण

- 6.2 महसूल अधिकाऱ्याच्या जबाबदाऱ्या आणि कर्तव्ये
- 6.3 शेती आणि बिगर शेतीसाठी जमिनीचा वापर
- 6.4 जमिनीचे अतिक्रमण, महसूल सर्वेक्षण
- 6.5 जमीन महसुलाचे मुल्यांकन आणि व्यवस्था

अध्यायभाग 7	भाडेकरू आणि शेतजमीन कायदा:	03L
	7.1 भाडेकरूची संकल्पना	
	7.2 भाडेकराराचा हक्क	
	7.3 महाराष्ट्रातील शेतजमीन खरेदीची अट	
	7.4 भाडेकरू जमिनीची विक्री	
	7.5 जप्तीसाठी महसूल अधिकाऱ्यांचे अधिकार	
अध्यायभाग 8	भूसंपादन कायदा:	02L
	8.1 जीवनावश्यक वस्तू कायदा: कापूस, ऊस, अन्नधान्य यांच्या संबंधात	
	8.2 भरपाईचा अधिकार आणि भूसंपादनात पारदर्शकता	
	8.3 Rehabilitation and Resettlement Act, 2013.	
अध्यायभाग 9	सुधारणांची व्याप्ती, फायदे आणि मर्यादा	06L
	9.1 Agriculture Pest and Disease Act (1950)	
	9.2 Prevention of Food Adulteration Act (1954)	
	9.3 Food production order Act (1956)	
	9.4 Asian Development Bank Act (1966)	
	9.5 Indian Seeds Act (1966)	
	9.6 Vegetable Oil Product Act (1967)	
	9.7 Insecticides Act (1968)	
	9.8 Agriculture Produce Market Act (1972)	
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	9.11 Regional Rural Banks Act (1976)	
	9.12 Indian Veterinary Council Act (1984)	
	9.13 Consumer Protection Act (2019)	
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1. Textbook of Field Crops Production-Foodgrain Crops (Vol-I), ICAR Publication, New Delhi.
2. Textbook of Field Crops Production-Commercial Crops (Vol-II), ICAR Publication, New Delhi.
3. Handbook of Agriculture, ICAR Publication, New Delhi.
4. Rana, K.S., Choudhary, A.K., Sepat, S. and Bana, R.S. 2014. Advances in Field Crop Production. IARI, New Delhi. pp 475.
5. Choudhary, A.K., Rana, D.S., Bana, R.S., Pooniya, V., Dass, A., Kaur, R., Rana, K.S. 2015. Agronomy of Oilseed and Pulse Crops, IARI, New Delhi & ICAR, DARE, New Delhi, India. pp 206.
6. Bal, J.S. (2007). Fruit growing. Kalyani Publishers, Ludhiana, India.
7. Bose, T.K. and Som, M.G. (1995) Vegetables crops of India. Naya Prokash Publications, Kolkatta, India.

8. Chadha, K.L. (1993). Handbook of horticulture, ICAR, India.
9. Chadha, T.R. (2000). Textbook of temperate fruits. ICAR, New Delhi.
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11. Mukhopadhyay, A and Randhawa, G.S. (1992). Floriculture in India, Allied Publishers, New Delhi.
12. Panda, H. (2010). Handbook on Spices and Condiments (Cultivation, Processing and Extraction). Asia Pacific Business Press Inc., New Delhi

Course Outcome:

After Completion of this course, students are able to,

1. To study Agriculture and Cropping Systems.
2. To explain Irrigation and food production in agriculture.
3. Describe laws and amendments related to farming and lands.
4. Understand and apply the knowledge for competitive exams

P.D.E. A's

Prof. Ramkrishna More Art's Commerce and Science College, Akurdi

IQAC

NEP and Autonomy Implementation

Date: 27/06/2024

Field Project Guidelines

Part-I: Government of Maharashtra Guidelines

Ref: <https://dhepune.gov.in/wp-content/uploads/2017/01/RPT-20221020-Dr-R-D-Kulkarni-Committee-Report-1.pdf> (Kulkarni Committee report 04-11-2022)

FPP-231: Field Project

College Guidelines

- **Practical Based:** Field projects involve going out into the real world (on the field), collecting data and samples on specified problem, tabulating and analysing data and conducting experiments on field or in laboratory on collected samples, obtaining conclusions, compiling project.
OR
- **Survey Based:** Field projects involve going out into the real world (on the field), collecting data, tabulating and analysing data, obtain conclusions from data, compiling project.
OR
- **Analysing and solving problem type:** Understand the problem, solving problem and implementing solutions to actual problems faced by communities or organizations.

GUIDELINE TO CARRY OUT FIELD PROJECT WORK

1. **Duration of Project work:** - One semester, minimum 60 hours' field and laboratory work. At least 1 sessions of 4 hours should be allotted to each students.
2. *Department should allot project guide (mentor) to each student. Each student should be allotted separate project or may be given in small team. In case of project in team, each student should work on different aspect of the problem, data should be collected independently, then put together collected data and analyse it. Draw the conclusions. Project should be presented by team and each student should represent different aspect of project. As project is performed in team, there should sufficiently large data collected by the team.*
3. **Choice of Research Problem and Workout:** Student should select appropriate problem to the field project work with the help of his mentor. Project problem should be related to the major subject or it may be inter-dispersary. Outline should be prepared by student with the help of mentor to perform and complete field project within stipulated time.
4. **Internal Evaluation and Schedule for Submission of Project Work:**
 - a. Field work and related laboratory work must be completed by a student within 12 weeks from the commencement of the IIIrd semester.
 - b. Internal evaluation will be performed by mentor and one internal examiner when project is near to completion (10th week of semester).

- c. Hard copy of the project work (two copies) should be submitted to department at the end of semester (15th week after commencement of IIIrd semester).

Format for submission of project report-

The hard copy of project should contain about 25-30 pages (*A, size paper, 1-inch margin from all sides, font - Times New Roman, Font size – 12 pt, line spacing 1.5*). Should be divided into the following parts:

- a. Title page
- b. Certificate of completion of Project Work from mentor and HOD.
- c. Declaration by candidate regarding plagiarism
- d. Index
- e. Abstract of the project
- f. **Chapter-1:** Introduction to problem (introduction, signification of research problems selected, aims and objectives) **(5 to 6 pages)**
- g. **Chapter-2:** Review of Literature (Related Research Problem) **(5-6 pages)**
- h. **Chapter-3:** Material and Methods/Methodology/Experimental **(5-7 pages)**
- i. **Chapter-4:** Results and Discussion or Data and Interpretation of data **(8 – 10 pages)**
- k. **Chapter-5:** Conclusions **(1-2 pages)**
- l. Bibliography/References/webliography
- m. Acknowledgement

Few Examples field projects

Science:

1. Monitor local water quality and assess pollution sources.
2. Analyse plant diversity and its impact on soil health.
3. Conduct surveys to understand human-wildlife interactions.
4. Track climate change effects on specific ecosystems.
5. Develop sustainable waste management solutions for rural communities.

Social Sciences:

6. Assess access to education and propose improvements in underprivileged areas.
7. Document cultural traditions and practices facing preservation challenges.
8. Analyse the impact of social media on mental health in specific communities.
9. Evaluate the effectiveness of government programs for poverty reduction.
10. Explore economic opportunities and challenges in developing regions.

Business & Technology:

11. Research consumer preferences and behaviours in emerging markets.
12. Analyse the impact of new technologies on specific industries or communities.
13. Develop digital solutions to improve healthcare access in underserved areas.
14. Assess the effectiveness of marketing campaigns for local businesses.
15. Evaluate the feasibility of renewable energy implementation in specific regions.

Arts & Humanities

16. Create public art installations that address social issues.
17. Conduct oral history interviews to document personal experiences.
18. Preserve and restore historical landmarks or cultural artifact's.
19. Develop educational programs using local arts and heritage.
20. Analyse the impact of globalization on cultural identity.

Ref: <https://statanalytica.com/blog/field-project-topics/>.

Course Outcome:

After successful completion of this course, students will be able to,

1. In-depth understanding of theoretical concepts
2. Development of critical thinking and problem-solving skills
3. Enhancement of communication and collaboration ability
4. Analytical skills development
5. Practical aptitude improvement
6. Increased awareness of societal and environmental issues

Question Paper Pattern Courses Related to Botany

Marks: 35		Time: 2 Hour	
Instructions to the Candidate:			
1. All questions are compulsory.			
2. Figures to right indicate full marks.			
3. Use of Log table and scientific calculator is allowed./ Draw well labelled diagram wherever necessary.			
Question-1	Solve Any five of the following (Short Answers) i. ii. iii. iv. v. vi. vii.	Three def. type, two tricky questions and two questions problem type (if applicable)	5 Marks
Question-2	A. Solve any two of the following i. ii. iii.	Note or Describe type questions	6 Marks
	B. Solve the following Single question of four marks i. ii.	Problem type or tricky reasoning type question	4 marks
Question-3	A. Solve any two of the following i. ii. iii.	Write Note / Differentiate type questions	6 Marks
	B. Solve the following Single question of four marks i. ii.	Problem type or Derive equation or Tricky discussion type question	4 marks
Question-4	Solve Any four of the following i. ii. iii. iv. v.	Application type, Justification type question	10

P. D. E. A's
Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044
(Autonomous)

Affiliated to



Savitribai Phule Pune University [SPPU]



B. Sc. With Major Botany

(Three years B. Sc. in Botany / Four Years Honors in Botany)

2024 Pattern

Choice Based Credit System-2024 Pattern

Under

Autonomy and NEP-2020

From Academic Year
2025-2026

Syllabus

S. Y. B. Sc. Botany

FOURTH SEMESTER

Board of Studies in Botany

Department of Botany

Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044

S. Y. BSc. BOTANY
Fourth Semester

Course	: Major	Total Credit	: 2
Code	: BOMAT 241	Course Type	: Theory
Subject	: Higher Cryptogams and Gymnosperms	Total Lecture	: 30

Module - I Higher Cryptogams	15L
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Chapter 1 Introduction	1L
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1.1 Higher Cryptogams

Chapter 2 Bryophytes:	7L
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2.1 General characters of Bryophytes

2.2 Classification Systems

2.3 Alternation of generation in Bryophytes, Economic importance

2.4 Life History of *Marchantia* with respect to: Systematic position, distribution in India, habit and habitat, External and internal morphology of gametophytes,

2.5 Reproduction: Vegetative and sexual, Structure of sex organs (Development is not expected) Fertilization, Structure of sporophyte

2.6 Life cycle

Chapter 3 Pteridophytes:	7L
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3.1 General characters of Pteridophytes

3.2 Classification Systems

3.3 Contribution of Indian Petrologist - S. S. Bir, Economic importance

3.4 Life History of *Psilotum* with respect to: Systematic position, distribution in India, habit and habitat, External and internal morphology of gametophytes

3.5 Reproduction: Vegetative and sexual, Position and structure of sex organs (Development is not expected), Structure of sporophyte

3.6 Life cycle

Module - II Gymnosperms	15L
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Chapter 4 Gymnosperms:	3L
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4.1 Introduction and distribution in India

4.2 Distinguishing features

4.3 Economic importance of Gymnosperms

4.4 Classification Systems

4.5 Alternation of generation

Chapter 5 <i>Pinus</i>	6L
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5.1 General Characters and distribution in India

5.2 Systematic position

5.3 External and Internal morphology: a) Primary structure of root, stem and leaf.

5.4 Life cycle of *Pinus*

5.5 Reproductive structure: a) Male cone b) Structure & development of Male gametophyte c) Female cone d) Structure & development of Female gametophyte

Chapter 6 <i>Gnetum</i>	6L
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6.1 General Characters and Distribution in India

6.2 Systematic position

6.3 External and Internal morphology: a) Primary structure of root, stem and leaf b) Anomalous Secondary growth in *Gnetum*.

6.4 Life cycle of *Gnetum*

6.5 Reproductive structure a) Male cone b) Structure and development of Male gametophyte c) Female cone d) Structure and development of Female Gametophyte

6.6 Resemblance with Angiosperms.

Suggested Readings:

1. Datta, S. C. (1966). Introduction to Gymnosperms. Asia Pub. House, New Delhi, India.
2. Datta, S. C. (1998). Systematic Botany, 4th Ed. New Age International Pvt. Ltd. New Delhi, India.
3. Vashishta, P. C. (1983). Botany for degree students: Gymnosperms. S. Chand & Co. New Delhi, India.
4. Sporne, K. R. (1967). Morphology of Gymnosperms. Hutchinson university library London, U. K.

Course Outcome:

After successful completion of this course, students will be able to,

7. Remember higher cryptogams of plant kingdom.
8. To study of life cycle patterns of the higher cryptogams.
9. Understand economic and ecological significance of different groups of the higher cryptogams.
10. Identify difference between higher cryptogams

Course : Major
Code : BOMAT-242
Subject : Phytochemistry

Total Credit : 2
Course Type : Theory
Total Lecture : 30

Module - I Introduction to Phytochemistry

15L

Chapter 1 Introduction to Phytochemistry:

08L

- 1.1 Definition, scope, and importance of phytochemistry
- 1.2 Classification of phytochemicals: Primary and secondary metabolites
- 1.3 Overview of metabolic pathways:
- 1.4 Primary metabolism (glycolysis, TCA cycle)
- 1.5 Secondary metabolism (shikimic acid, & mevalonate pathway)
- 1.6 Role of phytochemicals in plants and their ecological significance

Chapter 2 Primary Metabolites:

07L

- 2.1 Carbohydrates: Structure, types and functions in plants
- 2.2 Proteins and amino acids: Structure, types and significance in plants
- 2.3 Lipids: Classification, type and functions in plants
- 2.4 Nucleic acids: structure, types and role in plants

Module - II: Secondary metabolites and its applications

15L

Chapter 3 Secondary Metabolites:

07L

- 3.1 Alkaloids: Definition, classification, function and examples
- 3.2 Phenolic compounds: Definition, classification, function and examples
- 3.3 Terpenoids and steroids: Definition, classification, function and examples
- 3.4 Glycosides: Definition, classification, function and examples
- 3.5 Resins and volatile oils: Composition and applications

Chapter 4 Applications of Phytochemicals:

08L

- 4.1 Medicinal uses of phytochemicals with respect to traditional and modern medicine
- 4.2 Antioxidant, antimicrobial, and anticancer properties of phytochemicals
- 4.3 Industrial applications: Cosmetics, food additives, and dyes
- 4.4 Role of phytochemicals in biopesticides and sustainable agriculture

Suggested Readings:

1. Harborne, J.B. (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*.
2. Taiz, L., Zeiger, E., Møller, I.M., & Murphy, A. (2015). *Plant Physiology and Development*.
3. Stumpf, P.K., & Conn, E.E. (1981). *Biochemistry of Plants: A Comprehensive Treatise*.
4. Publications and journals on phytochemistry and plant metabolites.

Course Outcomes:

After successful completion of this course, students will be able to,

1. Understand classification and description of the major phytochemical compounds in plants.
2. Explain the biosynthetic pathways of primary and secondary metabolites.
3. Demonstrate knowledge of techniques for the extraction and analysis of phytochemicals.
4. Identify the applications of phytochemicals in various fields.
5. Discuss ethical and sustainable practices in phytochemical research.

Course : Major
 Code : BOMAP 243
 Subject : Practical Botany IV
 (Practical Based on BOMAT 241 & 242)

Total Credit : 2
 Course Type : Practical
 Total Practical : 12

Sr. No	Practical Botany IV (Practical Based on BOMAT 241 and 242)	12P
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Based on BOMAT 241 Higher Cryptogams and Gymnosperms

- | | | |
|----|---|----|
| 1. | Study of life cycle of <i>Marchantia</i> . | 1P |
| 2. | Study of life cycle of <i>Polytrichum</i> . | 1P |
| 3. | Study of life cycle of <i>Pinus</i> . | 1P |
| 4. | Study of life cycle of <i>Gnetum</i> . | 1P |
| 5. | Field Visit to rich Biodiversity regions | 2P |

Students are expected to submit two forms or photographs of Bryophytes Pteridophytes and Gymnosperm along with tour report.

Based on BOMAT 242 Phytochemistry

- | | | |
|-----|---|----|
| 6. | Qualitative tests to detect carbohydrates in plant samples. | 1P |
| 7. | Qualitative tests to detect proteins in plant samples. | 1P |
| 8. | Isolate DNA from plant tissues and verify its presence using spectrophotometric or qualitative methods. | 1P |
| 9. | Qualitative test to detect flavonoids in plant from suitable plant materials. | 2P |
| 10. | Dragendorff's and Mayer's tests to detect alkaloids in plant samples (eg. <i>Rauvolfia serpentina</i> or tea leaves). | 1P |
| 11. | Extract phenolic compounds from plant materials (e.g., tea leaves) and confirmation using ferric chloride and Shinoda tests. | 1P |
| 12. | Steam distillation to isolate volatile oils from plants (<i>Mentha</i> or <i>Citrus</i>) and study of their physical and chemical properties. | 1P |
| 13. | Evaluate the antioxidant properties (eg. <i>Ocimum sanctum</i>) using DPPH assays. | 1P |

Suggested Readings:

1. Nelson, N. (1944). *A photometric adaptation of the Somogyi method for the determination of glucose*. The Journal of Biological Chemistry, 153(2), 375-380.
2. Sadasivam, S., & Manickam, A. (1996). *Biochemical Methods*. New Age International.
3. Bradford, M. M. (1976). *A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding*. Analytical Biochemistry, 72(1), 248-254.

4. Lowry, O. H., et al. (1951). *Protein measurement with the Folin phenol reagent*. Journal of Biological Chemistry, 193(1), 265-275.
5. Practical handbook of Ashok kumar and bendre.

Course Outcomes

After successful completion of this course, students will be able to,

1. Identify and apply different micro preparations of the material of Pteridophytes and bryophytes.
2. Explain life cycles of gymnospermic plants.
3. Understanding the morphological diversity of Bryophytes, Pteridophytes and Gymnosperms.
4. Recognize the distribution pattern and phytochemicals in plant samples.
5. Use steam distillation to isolate volatile oils from plants and study their physical and chemical properties.
6. Evaluate the antioxidant properties of *Ocimum sanctum* using DPPH assays.

Course	: Minor	Total Credit	: 2
Code	: BOMIT 241	Course Type	: Theory
Subject	: Applied Botany for Entrepreneurship	Total Lecture	: 30L

Module – I Biofertilizer and Biopesticide

15L

Chapter 1 Biofertilizers:

08L

Introduction, concept, scope and importance of biofertilizers, classification of biofertilizers

- 1.1 Structure and characteristic features of bacterial Bio fertilizers- *Azotobacter*, *Rhizobium*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, and fungal bio fertilizers- AM mycorrhiza and ectomycorrhiza
- 1.2 Production technology: Strain selection, sterilization, growth and fermentation, equipment, mass production of carrier based and liquid bio fertilizers. FCO specifications and quality control of bio fertilizers.

Chapter 2 Biopesticides

07L

- 2.1 Pesticides, classification of pesticides (insecticides, herbicides, bactericides, fungicides and larvicides), mechanism of toxicity, use in agriculture and household practices.
- 2.2 Effects and benefits of pesticides and their accumulation in animal and plant tissue and their side effects.
- 2.3 Mixing, loading and application of pesticides in agriculture crops. Appropriate storage, care and precautions taken during handling of pesticides, safety and protective measures during applications. FCO specifications and quality control of bio pesticides.

Module – II Flower Preservative Techniques And Pomology

15L

Chapter 3 Dry Flower Technology:

05L

- 3.1 Introduction of Dry Flower technology
- 3.2 Techniques of flower drying: Air drying, press drying, embedded drying, microwave drying, hot air oven drying, freeze drying and glycerine drying
- 3.3 Packaging, handling and storage of dry flower

Chapter 4 Pomology:

10L

- 4.1 Introduction to Pomology
- 4.2 Soil and Climate Requirements for Fruit Crops
- 4.3 Propagation Techniques in Fruit Crops.
- 4.4 Fruit Crop Management Practices
- 4.5 Diseases and Pests of Fruit Crops.

Suggested Readings:

1. Food Processing: Principles and Applications, 2nd Edition Stephanie Clark, Stephanie Jung (Co-Editor), Buddhi Lamsal (Co-Editor) ISBN: 978-0-470-67114
2. Food Processing And Preservation Paperback – 1 January 2002 by Sivasankar Prentice Hall India Learning Private Limited, ISBN: 8120320867
3. Dry Flowers Technology : Dehydration of Flowers, Foliage and Floral Craft Hardcover – 1 January 2015 by Subodh Kumar Datta, Pointer Publishers, 807, Vyas Building, Chaura Rasta, JAIPUR - 302003, ISBN: 9788171328130.

4. Rakshit, A., Meena, V.S., Parihar, M., Singh, H.B. and Singh, A.K. eds., 2021. Biofertilizers: Volume 1: Advances in Bio-inoculants. Woodhead Publishing.
5. Larson, R.A. ed., 2012. Introduction to floriculture. Elsevier.
6. Dole, J.M. and Wilkins, H.F., 1999. Floriculture: Principles and species (pp. ix+-613).

Course Outcome

After successful completion of this course, students will be able to,

1. Explain biofertilizers their types and importance; their constituents
2. Describe biopesticides- types, effects and benefits
3. Demonstrate the mixing, loading and solutions of biopesticides
4. Understand food processing and food preservation techniques
5. Discuss Techniques for Dry flower technology; Packaging, handling and its storage

Course : Minor	Total Credit : 2
Code : BOMIP 242	Course Type : Practical
Subject : Practical on Applied Botany for Entreprunership	Total Practical : 12

Sr. No	Practical on Applied Botany for Entreprunership	12P
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Practical on Biofertilizer and Biopesticide

- | | | |
|----|--|----|
| 1. | Preparation of composting/ vermicomposting bed | 1P |
| 2. | Mass multiplication of BGA and <i>Azolla</i> and its application in paddy field | 1P |
| 3. | Preparation and application of biofertilizers in different crops | 1P |
| 4. | Preparation of biofertilizer using <i>Rhizobium</i> | 1P |
| 5. | Process of Isolation of phosphate solubilizing bacteria from soil | 1P |
| 6. | Study of effect of chemical fertilizers and biofertilizers on plant growth and yield | 1P |
| 7. | Commercial proposal preparation for biofertilizers, Biopesticides production unit | 1P |
| 8. | Visits to Commercial Biofertilizers and biocontrol units | 1P |

Practicals on Flower Preservative Techniques and Pomology

- | | | |
|-----|---|----|
| 9. | Study of flower drying techniques. | 1P |
| 10. | Study of Packaging, handling and storage of dry flower | 1P |
| 11. | Preparation of Herbarium | 1P |
| 12. | Analysis of macronutrient and micronutrient content of the soil for Fruit Crop. | 1P |
| 13. | Grafting and Budding Techniques | 1P |
| 14. | Pruning and Training of Fruit Crops | 1P |
| 15. | Study of Fertilizers and Irrigation Techniques for Fruit Crops | 1P |

Suggested Readings:

1. Abbey, L., Abbey, J., Leke-Aladekoba, A., Iheshiulo, E.M.A. and Ijenyo, M., 2019. Biopesticides and biofertilizers: types, production, benefits, and utilization. Byproducts from agriculture and fisheries: adding value for food, feed, pharma, and fuels, pp.479-500.
2. Kaushik, B.D., Kumar, D. and Shamim, M. eds., 2019. Biofertilizers and biopesticides in sustainable agriculture. CRC Press.
3. Balasubramanian, P. and Karthickumar, P., 2017. Biofertilizers and biopesticides: a holistic approach for sustainable agriculture. In Sustainable utilization of natural resources (pp. 255-284). CRC Press.

4. Parewa, H.P., Joshi, N., Meena, V.S., Joshi, S., Choudhary, A., Ram, M., Meena, S.C. and Jain, L.K., 2021. Role of biofertilizers and biopesticides in organic farming. *Advances in Organic Farming*, pp.133-159.
5. Hogg, R., 1881. *The Florist and Pomologist: A Pictorial Monthly Magazine of Flowers, Fruits, and General Horticulture...* Published at the "Journal of Horticulture" Office.
6. Paszt, L.S. and Zurawicz, E., 2005. Studies of the rhizosphere of strawberry plants at the Research Institute of Pomology and Floriculture in Skierniewice, Poland. *International journal of fruit science*, 5(1), pp.115-126.

Course Outcome

After successful completion of this course, students will be able to,

1. Explain the isolation and role of various soil bacteria in bio-fertilizer production.
2. Describe the production steps and specific requirements for each bio-fertilizers.
3. Demonstrate the restoration of soil fertility by performing the sustainable agricultural practices.
4. Apply the Practical Skills in Flower Preservation.

Course : Vocational Skill Course
Code : BOVSP 241
Subject : Practical on Herbal Technology

Total Credit : 2
Course Type : Practical
Total Lecture : 12

Sr. No	Practical on Herbal Technology	12P
1.	Study medicinal plants and document their distinguishing features.	1P
2.	Microscopic analysis of powdered herbal samples for physical properties.	1P
3.	To prepare Decoction, infusion, and maceration of medicinal herbs.	2P
4.	Qualitative tests for alkaloids, flavonoids, tannins, and glycosides.	2P
5.	Thin layer chromatography of any medicinal herb for the secondary metabolites.	1P
6.	Steam distillation to extract essential oils from medicinal herb using Clevenger apparatus.	1P
7.	Determination of Extractive Values of Medicinal herbs.	1P
8.	Prepare different herbal tea/infusion by using different medicinal herbs.	1P
9.	Prepare herbal face cream Formulate herbal shampoo and test the pH of the products.	1P
10.	Visit any herbal medicinal plant garden/Nursery/herbal medicine producing labs/Pharmacognosy lab.	1P

Suggested Readings:

1. **Books:** Kokate, C.K., Purohit, A.P., & Gokhale, S.B. *Pharmacognosy*. Nirali Prakashan. Trease, G.E., & Evans, W.C. *Pharmacognosy*. Elsevier.

Khandelwal, K.R. *Practical Pharmacognosy*. Nirali Prakashan.

2. **Pharmacopeias:** Indian Pharmacopeia (IP)
British Pharmacopeia (BP)

3. **Research Articles:** Peer-reviewed journals on phytochemistry and herbal pharmacology.

4. **Web Resources:** National Medicinal Plants Board (NMPB) – www.nmpb.nic.in
WHO Monographs on Selected Medicinal Plants.

5. **Field Guides:** Manuals on botanical identification and dichotomous keys.

Course Outcome:

After Completion of this course, students are able to,

1. Analyse the distinguishing features of medicinal plants.
2. Recognize adulterants through microscopic and physical analysis as per pharmacopeia standards.
3. Perform phytochemical tests for active compounds.
4. Understand the culinary and medicinal uses of herbal tea /infusions.
5. Formulate herbal cosmetics and shampoos and assess product quality.

Course	: Skill Enhancement Course	Total Credit	: 2
Code	: BOSEP 241	Course Type	: Practical
Subject	: Practical on Plant Identification and Herbaria	Total Practical	: 12

Sr. No	Practical on Plant Identification and Herbaria	12P
1.	To study Lower and Higher cryptogams wrt diagnostic features	1P
2.	To study of Gymnosperms wrt diagnostic features	1P
3.	To study the sources of data for systematics (morphological, anatomical, cytological and embryological characters)	1P
4.	Introduction to Taxonomical Literature and online Resources (Study of Flora, Monograph, Taxonomic Journal, Online Taxonomy Databases and Bibliography Search)	1P
5.	Introduction to identification and classification of angiosperms	1P
6.	Preparation of dichotomous key for given specimen	1P
7.	Preservation and Preparation of herbarium specimens of algae	1P
8.	Preservation and Preparation of herbarium specimens of bryophytes (mosses, liverworts, and hornworts)	1P
9.	Preservation and Preparation of herbarium specimens pteridophytes (ferns, horsetails, clubmosses)	1P
10.	Preservation and Preparation of herbarium specimens of Gymnosperms	1P
11.	Preservation and Preparation of herbarium specimens of Angiosperms	1P
12.	Introduction to e-herbaria / digital herbaria	1P
13.	Field visit/ Collection	1P

Suggested Readings:

1. Bendre, A., 2008. *Practical botany*. Deep and Deep Publications.
2. Bendre, A.M., 2010. *A Text Book of Practical Botany-1* (Vol. 1). Rastogi Publications.
3. Singh, V., Pande, P.C. and Jain, D.K., 2003. *Taxonomy & Economic Botany*. Rastogi Publications.

4. Seshagirao, K., Harikrishnanaik, L., Venumadhav, K., Nanibabu, B., Jamir, K., Ratnamma, B.K., Jena, R. and Babarao, D.K., 2016. Preparation of herbarium specimen for plant identification and voucher number. *Roxburghia*, 6(1-4), pp.111-119.
5. Smith, B. and Chinnappa, C.C., 2015. Plant collection, identification, and herbarium procedures. *Plant microtechniques and protocols*, pp.541-572.

Course Outcomes:

After the completion of this course, Students are able to,

1. Study, classify and identify all plant groups
2. Understand Plant Identification Techniques
3. Evaluate Taxonomic Resources for Research
4. Create a Taxonomic Key

Course : GE/OE
 Code : BOGET 241
 Subject : Ayurvedic Botany

Total Credit : 2C
 Course Type : Theory
 Total Lecture : 30L

Module - I Introduction to Ayurveda and Phytochemical Analysis.		15L
Chapter 1	Medicinal Plant Parts and Their Therapeutic Roles - Overview of plant parts used in Ayurveda: roots, stems, leaves, bark, flowers, seeds - Medicinal and therapeutic properties of each plant part - Examples of commonly used medicinal plants (e.g., Neem, Ashwagandha, Tulsi)	6L
Chapter 2	Herbal Preparation Techniques and Phytochemicals - Introduction to herbal preparations: decoctions (Kashayam), infusions, oils - Basics of extraction methods and solvents - Important phytochemicals: alkaloids, flavonoids, tannins – their functions and significance in Ayurveda - Simple chemical identification tests (theory).	9L
Module - II Adulterations and Cultivations of Medicinal Drugs		15L
Chapter 3	Quality Control and Adulteration in Herbal Products - Types and causes of adulteration in herbal materials - Basic methods for detection of adulterants - Quality assurance techniques: Introduction to Thin Layer Chromatography (TLC) and High-Performance Liquid Chromatography (HPLC) - Importance of purity, safety, and efficacy in Ayurvedic medicine.	8L
Chapter 4	Cultivation, Propagation & Ethnobotany - Cultivation techniques: soil, climate, irrigation, and harvesting practices - Propagation methods: seeds, cuttings, layering, division – pros and cons - Introduction to ethnobotany and documentation of traditional knowledge - Role of local communities and conservation practices - Overview of herbal gardens and field visit importance	7L

Suggested Readings:

- 1) **Kirtikar, K.R. & Basu, B.D.** (1935). *Indian Medicinal Plants*. Lalit Mohan Basu Publications, Allahabad.
 – A classical reference for identification, uses, and properties of Indian medicinal plants.
- 2) **Sharma, P.V.** (2006). *Dravyaguna Vijnana* (Vol. I & II). Chaukhamba Bharati Academy, Varanasi.
 – Ayurvedic perspective on plant parts, therapeutic properties, and classifications.
- 3) **Nadkarni, K.M.** (2002). *Indian Materia Medica*. Popular Prakashan, Mumbai.
 – Describes traditional uses and pharmacological properties of medicinal plants.
- 4) **Trease, G.E. & Evans, W.C.** (2009). *Pharmacognosy* (16th Ed.). Saunders Elsevier.
 – Standard reference for phytochemical analysis, adulteration detection, and herbal preparations.

Course Outcome:

After Completion of this course, students are able to,

1. To apply the knowledge of Medicinal Plant Parts and Their Therapeutic Significance.
2. Understanding of Herbal Preparation Techniques and Phytochemical Analysis.
3. Detect Adulteration and Ensure Quality Control.
4. Describe the Medicinal Plant Cultivation techniques.

NEP 2020		B.Sc. Second Year			
Course	:	GE-OE	Total Credit	:	2
Code	:	General elective and Open Elective	Course Type	:	Theory
Subject	:	Ayurvedic Botany	Total Lecture	:	30

Module - I आयुर्वेद आणि फायटोकेमिकल विश्लेषणाचा परिचय.		15L
धडा १	औषधी वनस्पतींचे भाग आणि त्यांच्या उपचारात्मक भूमिका - आयुर्वेदात वापरल्या जाणाऱ्या वनस्पतींच्या भागांचा आढावा: मुळे, देठ, पाने, साल, फुले, बिया - प्रत्येक वनस्पतीच्या भागाचे औषधी आणि उपचारात्मक गुणधर्म - सामान्यतः वापरल्या जाणाऱ्या औषधी वनस्पतींची उदाहरणे (उदा., कडुलिंब, अश्वगंधा, तुळशी)	6L
धडा 2	हर्बल तयारी तंत्रे आणि फायटोकेमिकल्स - हर्बल तयारीचा परिचय: डेकोक्शन्स (कश्याम), इन्फ्युजन, तेल - निष्कर्षण पद्धती आणि सॉल्व्हेंट्सची मूलभूत माहिती - महत्वाचे फायटोकेमिकल्स: अल्कलॉइड्स, फ्लेव्होनॉइड्स, टॅनिन - आयुर्वेदात त्यांची कार्ये आणि महत्त्व - साध्या रासायनिक ओळख चाचण्या (सिद्धांत).	9L
Module - II Adulterations and Cultivations of Medicinal Drugs		15L
धडा 3	हर्बल उत्पादनांमध्ये गुणवत्ता नियंत्रण आणि भेसळ - हर्बल पदार्थांमध्ये भेसळीचे प्रकार आणि कारणे - भेसळ शोधण्यासाठी मूलभूत पद्धती - गुणवत्ता हमी तंत्रे: थिन लेयर क्रोमॅटोग्राफी (TLC) आणि हाय-परफॉर्मन्स लिक्विड क्रोमॅटोग्राफी (HPLC) चा परिचय - आयुर्वेदिक औषधांमध्ये शुद्धता, सुरक्षितता आणि परिणामकारकतेचे महत्त्व.	8L
धडा 4	लागवड, प्रसार आणि एथनोबॉटनी - लागवड तंत्रे: माती, हवामान, सिंचन आणि कापणी पद्धती - प्रसार पद्धती: बियाणे, कटिंग्ज, थर लावणे, विभागणी - फायदे आणि तोटे - एथनोबॉटनीचा परिचय आणि पारंपारिक ज्ञानाचे दस्तऐवजीकरण - स्थानिक समुदायांची भूमिका आणि संवर्धन पद्धती - औषधी वनस्पती बागांचा आढावा आणि क्षेत्रभेटीचे महत्त्व	7L

सुचित संदर्भः

- १) कीर्तिकर, के.आर. आणि बसू, बी.डी. (१९३५). भारतीय औषधी वनस्पती. ललित मोहन बसू प्रकाशन, अलाहाबाद. भारतीय औषधी वनस्पतींची ओळख, उपयोग आणि गुणधर्मांसाठी एक शास्त्रीय संदर्भ.
- २) शर्मा, पी.व्ही. (२००६). द्रव्यगुण विज्ञान (खंड १ आणि २). चौखंबा भारती अकादमी, वाराणसी. वनस्पतींचे भाग, उपचारात्मक गुणधर्म आणि वर्गीकरण यावर आयुर्वेदिक दृष्टीकोन.
- ३) नाडकर्णी, के.एम. (२००२). इंडियन मटेरिया मेडिका. पॉप्युलर प्रकाशन, मुंबई. औषधी वनस्पतींचे पारंपारिक उपयोग आणि औषधी गुणधर्मांचे वर्णन करते.
- ४) ट्रेस, जी.ई. आणि इव्हान्स, डब्ल्यू.सी. (२००९). फार्माकोग्नोसी (१६ वे संस्करण). सॉन्डर्स एल्सेव्हियर. फायटोकेमिकल विश्लेषण, भेसळ शोधणे आणि हर्बल तयारीसाठी मानक संदर्भ.

अभ्यासक्रमाचा निकालः

हा अभ्यासक्रम पूर्ण केल्यानंतर, विद्यार्थी हे करू शकतीलः

- १) औषधी वनस्पतींच्या भागांचे आणि त्यांच्या उपचारात्मक महत्त्वाचे ज्ञान.
- २) औषधी वनस्पती तयार करण्याच्या तंत्रांचे आणि फायटोकेमिकल विश्लेषणाचे आकलन.
- ३) भेसळ शोधण्याची आणि गुणवत्ता नियंत्रण सुनिश्चित करण्याची क्षमता.
- ४) औषधी वनस्पतींची लागवड, प्रसार आणि एथनोबॉटनीची आकलन.

Course : GE/OE
Code : BOGEP 241
Subject : Practical on Ayurvedic Botany

Total Credit : 2C
Course Type : Practical
Total Lecture : 12P

Sr. No	Practical on Ayurvedic Botany	12P
1.	Exploring Medicinal Properties of different Plant Organs: Leaves, Stems, Roots, Flowers and fruits with suitable examples	1P
2.	Preparation of Herbal Extracts: Decoctions, Infusions, and Oils from different plant parts and exploring its medicinal uses	1P
3.	Study of adulterations in medicinal plant products and detect various adulterations with proper suitable examples	1P
4.	Demonstration and Identification of specialized cells, tissues, and structures responsible for producing medicinal compounds	1P
5.	Understanding the significance of various plant compounds (alkaloids, flavonoids, and tannins) in medicinal plants	1P
6.	Exploring different Cultivation Techniques for Ayurvedic Medicinal Plants	1P
7.	To study different methods of propagating medicinal plants	1P
8.	Thin-layer chromatography (TLC) high-performance liquid chromatography (HPLC) for analyzing herbal medicinal products: Demonstrations	1P
9.	Study products/ cosmetics using medicinal plants	1P
10.	Preparation of different Ayurvedic Herbal Formulations (Kadha and Churnas)	1P
11.	Collection of medicinal plants (Any 5)	1P
12.	Visit botanical gardens, herbal farms, and natural habitats of medicinal plants	1P

Suggested Readings:

1. Medicinal Plants: Chemistry and Properties" by M. A. S. A. S. Bhatti
2. Herbal Medicine: Biomolecular and Clinical Aspects" by Iris F. F. Benzie and Sissi Wachtel-Galor
3. Adulteration of Medicinal Plants" by M. H. Rasool and R. P. Sharma
4. Plant Biotechnology and Genetics: Principles, Techniques, and Applications" by C. Neal Stewart Jr.
5. Ayurvedic Medicinal Plants: Cultivation, Processing, and Uses" by V. B. Pandya.

Course Outcomes:

By the end of this practical Course, students will be able to...

- 1) Understand the medicinal properties of different plant organs with suitable examples.
- 2) Perform various types of herbal extracts.
- 3) Recognize adulterations in medicinal plant products with examples.
- 4) Identify and demonstrate specialized cells, tissues, and structures responsible for the production of drug molecules.
- 5) Analyse the significance of plant compounds and their health benefits.

Course : GE/OE

Total Credit : 2C

Code : BOGEP 241

Course Type : Practical

Subject : आयुर्वेदिक वनस्पतिशास्त्रावर आधारित प्रात्यक्षिक Total Lecture : 12P

Sr. No	आयुर्वेदिक वनस्पतिशास्त्रावर आधारित प्रात्यक्षिक	12P
1.	वनस्पतींच्या विविध अवयवांचे औषधी गुणधर्म शोधणे: योग्य उदाहरणांसह पाने, देठ, मुळे, फुले आणि फळे.	1P
2.	हर्बल अर्क तयार करणे: वनस्पतींच्या वेगवेगळ्या भागांमधून डेकोक्शन, ओतणे, तेल आणि त्याचे औषधी उपयोग शोधणे.	1P
3.	औषधी वनस्पती उत्पादनांमधील भेसळीचा अभ्यास करा आणि योग्य योग्य उदाहरणांसह विविध भेसळ शोधून काढा.	1P
4.	औषधी संयुगे तयार करण्यासाठी जबाबदार असलेल्या विशेष पेशी, ऊती आणि संरचनांचे प्रात्यक्षिक आणि ओळख.	1P
5.	औषधी वनस्पतींमधील विविध वनस्पती संयुगे (अल्कलॉइड्स, फ्लेव्होनॉइड्स आणि टॅनिन) चे महत्त्व समजून घेणे.	1P
6.	आयुर्वेदिक औषधी वनस्पतींसाठी विविध लागवड तंत्रांचा शोध घेणे.	1P
7.	औषधी वनस्पतींच्या प्रसाराच्या विविध पद्धतींचा अभ्यास करणे.	1P
8.	हर्बल औषधी उत्पादनांचे विश्लेषण करण्यासाठी पातळ-स्तर क्रोमॅटोग्राफी (TLC) उच्च-कार्यक्षमता लिक्विड क्रोमॅटोग्राफी (HPLC) : प्रात्यक्षिके	1P
9.	औषधी वनस्पती वापरून उत्पादने/ सौंदर्य प्रसाधने अभ्यासा.	1P
10.	विविध आयुर्वेदिक हर्बल फॉर्म्युलेशन (कढा आणि चूर्ण) तयार करणे.	1P
11.	औषधी वनस्पतींचे संकलन (कोणत्याही ५).	1P
12.	वनस्पति उद्यान, हर्बल फार्म आणि औषधी वनस्पतींच्या नैसर्गिक निवासस्थानांना भेट द्या.	1P

सुचविलेले वाचन:

1. औषधी वनस्पती: रसायनशास्त्र आणि गुणधर्म" M. A. S. A. S. Bhatti द्वारे
2. हर्बल मेडिसिन: बायोमोलेक्युलर आणि क्लिनिकल एस्पेक्ट्स "आयरिस एफ. एफ. बेंझी आणि सिस्सी वाचटेल-गॅलर
- एम. एच. रसूल आणि आर. पी. शर्मा द्वारे 3. औषधी वनस्पतींची भेसळ
4. प्लांट बायोटेक्नॉलॉजी आणि जेनेटिक्स: प्रिन्सिपल्स, टेक्निक्स आणि ऑप्लिकेशन्स" सी. नील स्टीवर्ट जूनियर.
5. आयुर्वेदिक औषधी वनस्पती: लागवड, प्रक्रिया आणि उपयोग" व्ही. बी. पंड्या.

अभ्यासक्रमाचे परिणाम:

या प्रात्यक्षिक अभ्यासक्रमाच्या शेवटी, विद्यार्थी सक्षम होतील,

1. विविध वनस्पतींच्या अवयवांचे औषधी गुणधर्म योग्य उदाहरणांसह समजून घ्या.
2. विविध प्रकारचे हर्बल अर्क करा
3. औषधी वनस्पती उत्पादनांमधील भेसळ उदाहरणांसह शोधा.
4. औषध रेणूंच्या निर्मितीसाठी जबाबदार असलेल्या विशेष पेशी, ऊती आणि संरचना ओळखा आणि प्रदर्शित करा.
5. वनस्पती संयुगे आणि त्यांचे आरोग्य फायदे यांचे महत्त्व विश्लेषण करा.

IQAC

NEP and Autonomy Implementation

Community Engagement Project Guidelines

Date: 08/01/2025

Part-I: Government of Maharashtra Guidelines

Ref: <https://dhepune.gov.in/wp-content/uploads/2017/01/RPT-20221020-Dr-R-D-Kulkarni-Committee-Report-1.pdf> (Kulkarni Committee report 04-11-2022)

c) Study Tours:

The NEP 2020 (Section 22.12.) recognizes that the knowledge of the rich diversity of India should be imbibed first hand by learners. This would mean including simple activities, like touring by students to different parts of the country, which will not only give a boost to tourism but will also lead to an understanding and appreciation of diversity, culture, traditions and knowledge of different parts of India. HEIs can plan study tours under 'Ek Bharat Shrestha Bharat' concept and send students to visit various important destinations and study their history, scientific contributions, traditions, indigenous literature and knowledge, etc., as a part of augmenting their knowledge about our country.

BOCEP-241: Community Engagement Project

Community Engagement is...the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people. It is a powerful vehicle for bringing about environmental and behavioural changes that will improve the health of the community and its members. It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs, and practices.

At its most basic level, community engagement is striving towards improving the quality of life in a community through both political and non-political means. Community engagement is also commonly referred to as civic engagement or public participation, and all terms reference a desire to make a positive difference in one's community that manifests itself through action, combining knowledge, skills, values, and motivation.

The answer to "what is community engagement?" includes activism, volunteer work, such as community gardening, tutoring, , environment protection, socio-economic survey, . There are virtually limitless forms of community engagement. Some of the different forms of community engagement include:

- Maintaining a community garden
- Survey of peoples on their views on donating blood, promoting them for blood donation, etc.
- Helping to local farmers a) to set vermiculture b) organic farming c) water management
- Survey on waste generated in housing society and advocating to society for waste management.
- Psychological health survey of a) Primary school students b) School students c) House women's d) working women's, etc. and its analysis.

- Studying cultural, economic, regional diversity in housing society and its impact on social behaviour in society.
- Food quality survey in particular category of peoples (slum area, economically backward peoples, etc) its analysis and feedback.
- Nutritional Survey in society and its analysis.
- Water quality survey in a village and its analysis.
- Electricity utilization survey, its analysis and majors to minimize its utilization.
- Mobile screen time survey and analysis and majors to minimize mobile screen time.
- Survey on mobile addiction in school, college students and majors to minimize it.
- Survey on secure use of money transfer apps, e-purchase, e-banking, analysing problems of peoples and solution on it.
- Survey on health of girls in school and colleges, its analysis and feedback Survey on gender sensitization, gender equality, its analysis and feedback.
- Survey on helpless peoples for their health, shelter, food, etc. problems, its analysis and feedback.
- Survey on awareness of college students of backward classes on awareness of government scheme for them, its analysis and feedback.

GUIDELINE TO CARRY OUT COMMUNITY ENGAGEMENT PROJECT WORK

1. **Duration of Project work:** - One semester, minimum 60 hours field and laboratory work. At least 1 sessions of 4 hours per week should be allotted a students for 15 weeks.
 2. Department should allot project guide (mentor) to each student. CEP can be assigned to individual student or in a group to 2 to 4 students.
 3. **Choice of Research Problem and Workout:** Student/s should select appropriate problem for the community engagement project with the help of his/their mentor. Project problem should be related to the major subject or it may be inter-dispersary. Outline should be prepared by student with the help of mentor to perform and complete community engagement project within stipulated time.
 4. **Type of work expected:** a) Selection of topic b) Preparation of background for project work, c) preparation of questionnaire for survey d) selection of area / category of people / places / for survey e) Collection of feedback of peoples through questionnaire d) Analysis feedback of peoples e) Identification of problems and its severe ness f) Your solution on problem and feed to peoples. g) Compiling project
4. Internal Evaluation and Schedule for Submission of Project Work:
- a. Field work and related laboratory work must be completed by a student within 12 weeks from the commencement of the IIIrd semester.
 - b. Internal evaluation will be performed by mentor and one internal examiner when project is near to completion (10th week of semester).
 - c. Hard copy of the project work (two copies) should be submitted to department at the end of semester (15th week after commencement of IIIrd semester).

Format for submission of project report-

The hard copy of project should contain about 25-30 pages (*A4 size paper, 1 inch margin from all sides, font - Times New Roman, Font size – 12 pt, line spacing 1.5*). Should be divided into the following parts:

- a. Title page
- b. Certificate of completion of Project Work from mentor and HOD.
- c. Declaration by candidate regarding plagiarism

- d. Index
- e. Abstract of the project
- f. **Chapter-1:** Introduction to problem (introduction, signification of problems selected, aims and objectives) **(5 to 6 pages)**
- g. **Chapter-2:** Review of Literature (Related Research Problem) **(5-6 pages)**
- h. **Chapter-3:** Material and Methods/Methodology/Experimental **(5-7 pages)**
- i. **Chapter-4:** Data analysis and Interpretation of data **(8 – 10 pages)**
- k. **Chapter-5:** Feed back given to peoples / society /government agency / NGO, etc and Conclusions **(1-2 pages).**
- i. Bibliography / References / webliography

Evaluation of Project

- 1. Certified Project Report 10 marks
- 2. Presentation 15 Marks
- 3. Viva Voce on Project 10 Marks

NEP Coordinator

Deans

Course Outcome:

After Completion of this course, students are able to,

1. Hands-on Experience
2. Community Awareness
3. Social Responsibility
4. Interdisciplinary Learning
5. Community Partnerships

Question Paper Pattern Courses Related to Botany

Marks: 35		Time: 2 Hour	
Instructions to the Candidate: 1. All questions are compulsory. 2. Figures to right indicate full marks. 3. Use of Log table and scientific calculator is allowed./ Draw well labelled diagram wherever necessary.			
Question-1	Solve Any five of the following (Short Answers) i. ii. iii. iv. v. vi. vii.	Three def. type, two tricky questions and two questions problem type (if applicable)	5 Marks
Question-2	A. Solve any two of the following i. ii. iii.	Note or Describe type questions	6 Marks
	B. Solve the following Single question of four marks i. ii.	Problem type or tricky reasoning type question	4 marks
Question-3	A. Solve any two of the following i. ii. iii.	Write Note / Differentiate type questions	6 Marks
	B. Solve the following Single question of four marks i. ii.	Problem type or Derive equation or Tricky discussion type question	4 marks
Question-4	Solve Any four of the following i. ii. iii. iv. v.	Application type, Justification type question	10

