Estd. 1962
"A++" Accredited by NAAC(2021)
With CGPA 3.52

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शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४,महाराष्ट्र
दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी विभाग २३१–२६०९०९३/९४

SU/BOS/Science/ № 0 0 2 1 4 **Date:** 1 3 SEP 2022

To,
The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject :- Regarding syllabi of M.Sc., & B. Sc. (NEP-2020) adegree programme under the Faculty of Science and Technology as per National Education Policy, 2020 .

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M.Sc., & B. Sc. (NEP-2020) System** under the Faculty of Science and Technology **as per National Education Policy, 2020 .**

Sr. No.	Faculty of Science and Technology	Programme/ Course
1	**Botany**	**M. Sc. Part- I BotanyRevised Syllabus**
		B. Sc. Part- I Botany

This syllabi and nature of question paper shall be implemented from the Academic Year 2022-2023 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

SHIVAJI UNIVERSITY, KOLHAPUR.

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(2021)

Revised Syllabus For

B. Sc. I Botany

(Faculty of Science & Technology)

Paper –I, II - (Semester- I)

and

Paper -III, IV - (Semester-II)

(NEP-2020) Syllabus to be implemented from August 2022 onwards.

A] **Ordinance and Regulations: (As applicable to Degree Course)**

B] **Shivaji University, Kolhapur**

Revised Syllabus For

Bachelor of Science

1. **TITLE : Subject- Botany**

   Optional under the Faculty of Science and Technology

2. **YEAR OF IMPLEMENTATION**:- Revised Syllabi implemented from August 2022 onwards.

3. PREAMBLE:-

[Note :-The Board of Studies should briefly mention foundation, core and applied components of the course / paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.**]**

4. GENERAL OBJECTIVES OF THE COURSE:
(as applicable to the Degree concerned)

Objectives:-

1) To impart knowledge of Science.

2) To develop scientific attitude, open Minded, critical, curious.

3) To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute the science.

4) To understand scientific terms, concepts, facts, phenomenon and their relationships.

5) To make the students aware of natural resources and environment.

6) To provide practical experience to the students as a part of the course

7) To develop scientific ability to work in the field of research and other fields of their own interest and to make them fit for society.

8) To acquire knowledge of plant and related subjects so as to understand natural phenomenon, manipulation of nature and environment in the benefit of humanbeings.

9) To develop ability for the application of the acquired knowledge to improve agriculture and other related fields to make the country selfreliant and sufficient.

10) To create the interest of the society in the subject and scientific hobbies, exhibitions and other similar activities.

5. DURATION

The course shall be a full time course.

6. PATTERN:-

Pattern of Examination will be Semester.

7. FEE STRUCTURE :-

As per Government /University rules.

1. Refer brochure and prospectus of concern affiliated college/institute to Shivaji University, Kolhapur.
2. Other fee will be applicable as per rules and norms of Shivaji University, Kolhapur.

8. ELIGIBILITY FOR ADMISSION:

As per guidelines obtained from Shivaji University, Kolhapur by following rules and regarding reservations by Govt. of Maharashtra**.**

9. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

10. STRUCTURE OF COURSE- B. Sc. I Botany

FIRST YEAR (SEMESTER I and II) (Total Number of papers - IV)

Sr. No.	Subjects/Papers	Theory	Internal	Total Marks
1.	Paper-I	**50**	-	50
2.	Paper-II	**50**	-	50
3.	Paper-III	**50**	-	50
4.	Paper-IV	**50**	-	50
	Practical			50
	Total			**250**

11. SCHEME OF TEACHING AND EXAMINATION:-

[The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

FIRST YEAR - SEMESTER – I/ II : Botany (Optional)

Scheme of Teaching and Examination

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/Week)				ExaminationScheme (Marks)		
		L	T	P	Total	Theory	Term Work	Total
	Semester-I							
1	Paper-I	2.5	-	-	2.5	50		50
2	Paper-II	2.5	-	-	2.5	50		50
	Semester-II							
3	Paper-III	2.5	-	-	2.5	50		50
4	Paper-IV	2.5	-	-	2.5	50		50
	Practical- I (annual)	-	-	4	04	50	-	50
	Total	**05**	**-**	**04**	**09**	**-**	**-**	**250**

- Practical Examination will be conducted annually for 50 Marks.
- Except English, there shall be combined passing for two theory courses of 50 marks each. i.e. Minimum 35 marks are required for passing out of 100.
- There shall be separate passing for theory and practical courses.
- CGPA Ability Enhancement Compulsory Course(AECC) for (A and B) is English
- SEC- Skill Enhancement Course (Vocational Studies –I):

  Field Projects/ Internship/ Apprenticeships/ Community Engagement and Services, any one Selected From Pool of Courses .

  Total Marks for B.Sc.-I Botany (Excluding English) : 250
- Theory and practical lectures : 48 minutes each

  Exit at Level 5:

Those who are interested to exit after Level 5 shall have to complete the SEC-I and SEC-II courses with allotted credits of Shivaji University Guidelines

U.G. structure for Science

SEM	DSC	DSE/OEC/ GEC/IDS	AECC Languages	Skill Enhancement courses(SEC) Multidisciplinary	Total
I	4 x (4+2)=24		4	SEC-1(1)	30
				VBC (1)	
II	4 x (4+2)=24		4	SEC II (2)	30
III	3 x 8=24		4(EVS)	SEC III (2)	30
IV	3 x 8=24			SEC IV (2)	26
V		DSE[4x(2+2)= 16]	4	SEC V (2)	22
VI		DSE[4x(2+2)= 16]	4	SEC VI (2)	22
	Total credits				160

Programme Structure for Bachelor of Science with Botany as a Major subject
With Multiple Entry Multiple Exit Options

SEM	Discipline Specific Core Courses (DSC) (L+P) (Credits)	Discipline Specific Elective Courses (DSE) (L+P) (Credits)	Ability Enhancement Compulsory Courses (AECC) (L+P) (Credits)	Skill Enhancement Courses (SEC)		Total Credits
				Vocational Courses (L+P) (Credits) (Non	Value Based Courses (P)	
I	Botany- (Theory 4 + practical 2 = 6 credits). And any other three courses along with botany Physics / Chemistry / Zoology / Microbiology / Geology / Comp. Sc. / Biotech ./Electronics / Geography / Industrial Microbiology / Maths / statistics (courses- 3 x credits- 6=18 credits) **Total credits 24**	--	AECC-1; (4) credits)- English for communication.	SEC-1: (1 –credit) Multidisciplinary (select From the Pool of Courses)	VBC (1 credit)	30
II	Botany- Theory credits 4 practical credits 2 Total credits for each subject= 6 credits). And any other three courses along with botany Physics / Chemistry / Zoology / Microbiology / Geology / Comp. Sc. / Biotech ./Electronics / Geography / Industrial Microbiology / Maths / statistics (courses- 3 x credits- 6=18 credits) **Total credits 24**	--	AECC- 2: (4 credits) Eng for communication	SEC-2: (2- credit) Multidisciplinary (select From the Pool of Courses)		30
Level 5 : Exit with Certificate Course in Science with the completion minimum credits as per the Shivaji						

University Guidelines.						
III	**Botany (Theory 4 + practical 4) = 8 credits** Along with botany select any two courses form Physics / Chemistry / Zoology / Microbiology / Geology / Comp. Sc./ Pollution / Biotech ./Electronics / Geography / Industrial Microbiology / Maths / Statistics / Astrophysics/ Plant Protection. (2 courses x 8 credits = 16 credits) **Total credits 24**	--		SEC-3 (2 credits) Multidisciplinary (select From the Pool of Courses)		26
IV	**Botany (Theory 4 + practical 4) = 8 credits** Along with botany select any two courses form Physics / Chemistry / Zoology / Microbiology / Geology / Comp. Sc. / Pollution / Biotech ./Electronics / Geography / Industrial Microbiology / Maths / statistics / Astrophysics/ Plant Protection. (2 courses x 8 credits = 16 credits) **Total credits 24**	--	AECC-3 : (4 credits) Environmental Studies (Project)	SEC- 4 (2 credits) Multidisciplinary (select From the Pool of Courses)		30
Level 6 : Exit with Diploma in Science (with the completion of with the completion minimum credits as per the Shivaji University Guidelines.						

V	--	Four DSE courses of Botany (Theory credits = 2 + practical credits = 2 Total credits for each course = 4 (4 courses x 4 credits each =16 credits) Total credits= 16	AECC-4 (4 credits) Professional Communication (Eng)	SEC- 5 (2 credits) Multidisciplinary (select From the Pool of Courses)		22
VI	--	Four DSE courses of Botany (2+2) = 4 credits each (4 x 4 =16 credits) Total credits= 16	AECC-6 (4 credits) Professional Communication (Eng)	SEC- 6 Multidisciplinary (select From the Pool of Courses)		22
	Total credits					160

Level 7 : Exit with three years Bachelor of Science (with the completion minimum credits as per the Shivaji University Guidelines.
) or continue studies for Bachelor with (Honours/Research) four year Degree Programme

Note: 1. For first year Sem-I, students have to select any four DSC courses available at their respective colleges. Same four courses they have to continue for Sem-II.

2. For second year Sem-III, students have to select any three out of four DSC courses of first year. Same three courses they have to continue For Sem-IV.

3. For third year Sem –V, students have to select any one DSC course out of three DSC courses of second year. Same course they have to continue for Sem-VI.

4. For semesters V & VI there shall be four DSE courses (papers) for each semester

5. The DSC courses from C1 to C14 have two papers of 50 marks each with combined passing i.e. minimum 35 marks are required to pass out of 100 marks.

6. Students can exit after Level 5 with Certificate Course in Science (with the completion of courses equal to minimum allotted credits as per shivaji university guidelines)
7. Students can exit after Level 6 with Diploma in Science (with the completion of courses equal to minimum credits allotted by the Shivaji University, Kolhapur
8. Students can exit after Level 7 with Bachelor of Science (with the completion of courses equal to minimum credits allotted by the Shivaji University, Kolhapur
9. SBC: Skill Based Courses (2 credits). Students have to select one for each semester from the pool of courses available at their respective colleges or the pool of courses from Shivaji university .
10. VBC: Value Based Courses , Students have to select one for each semester from the pool of courses available at their respective colleges

13. STANDARD OF PASSING:-

As Prescribed under rules & regulation for each degree.

14. NATURE OF QUESTION PAPER AND SCHEME OF MARKING:

(MODULE wise weightage of marks should also be mentioned)

Q. 1. Multiple choices questions (10-Questions) --- 10 Marks

Q.2. Attempt **any two** of the following.

(Essay type/Broad answer questions) ---- 20 Marks

Q.3. Write short notes (**any four**) --- 20 Marks

15. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)

(Introduced from August 2022 onwards)

Old Syllabus (Semester pattern)			**Revised Syllabus (Semester pattern)**	
Paper No.	**Title of Old Paper**	**Semester No**	**Paper No.**	**Title of New Paper**
I	Biodiversity of Microbes, Algae and Fungi	**I**	**I**	Microbes, Algae and Bio fertilizers
II	Biodiversity of Archegoniate	**I**	**II**	Cell biology and Analytical Techniques
III	Plant Ecology	**II**	**III**	Mycology, Phyto pathology and Mushroom Cultivation
IV	Plant Taxonomy	**II**	**IV**	Archegoniate (Bryophytes, Pteridophytes and Gymnosperms)

16. SPECIAL INSTRUCTIONS, IF ANY. --- Nil

Semester- I

Botany Paper I: DSC-13 A: Microbes, Algae and Biofertilizers

CREDIT: 2. LECTURE PERIODS: 2.5 PER WEEK- LECTURE HOURS; 2 PER WEEK
MARKS: 50

MODULE	SUB-MODULE	TOPICS	LECTURE PERIOD
1	**Microbes**		
	1.1 Viruses	i) Discovery, General characteristics, ii) Structure of viruses iii) Types of viruses- DNA viruses (T- Phage), RNA viruses (TMV) iv) Economic importance	06
	1.2 Bacteria	i) Discovery, General characteristics ii) Cell structure iii) Forms of bacteria iv) Nutrition, v) Reproduction- vegetative, asexual and sexual (Conjugation) vi) Economic importance	06
2	**Algae and Biofertilizers**		
	2.1 Algae	i) General outline of plant kingdom (Cryptogams and Phanerogams), ii) General characteristics of algae Classification (as per G. M. Smith, 1955) up to classes iii) Economic importance iv) Life cycle (excluding developmental stages of sex organs) of the following types- **a) Cyanophyceae**: *Nostoc* **b) Chlorophyceae**: *Spirogyra*	09
	2.2 Biofertilizers	i) Introduction, Microbes used as Biofertilizers, ii) Study of following Biofertilizers with respect to characters, association and uses of **a)Bacteria:***Rhizobium* **b) Blue-green algae:** *Nostoc* **c) Fungi:** *Trichoderma* **c) Pteridophytes:** *Azolla* iii) Procedure for preparation of Biofertilizers- Bacteria and Blue green algae	09
Total Lectures			**30**

SEMESTER –I

Botany Paper II: DSC-14 A: Cell biology and Analytical techniques

CREDIT: 2. LECTURE PERIODS: 2.5 PER WEEK- LECTURE HOURS; 2 PER WEEK
MARKS: 50

MODULE	SUB-MODULE	TOPICS	LECTURE PERIOD
1.	**Cell biology**		
	1.1 Cell as a structural and functional unit of life	i) Introduction, Definition ii) Cell as biochemical entity iii)Structure and difference between Prokaryotic and Eukaryotic cell iv) Plant cell wall- structure and functions	**04**
	1.2 Cell organelles and cell membrane	**i)** Ultrastructure and functions of a) Chloroplasts b) Mitochondria c) Ribosomes d) Endoplasmic reticulum e) Lysosomes f) Peroxisomes **ii) Cell membrane**- Structure, Fluid Mosaic model, role of cell membrane	**09**
	1.3 Cell division	i) Cell cycle and its importants. ii) **Mitosis**- Introduction, definition, stages and Significance iii) **Meiosis**- Introduction, definition, stages and Significance	**07**
2.	**Analytical techniques**		
	2.1 Microscopy	i) Principles of microscopy ii) Light microscopy iii) Fluorescence microscopy iv) Electron microscopy (SEM)	**05**
	2.2 Chromatography	i) Principles and applications of chromatography ii) Paper Chromatography- Ascending iii) Thin Layer Chromatography.(TLC)	**05**
Total Lectures			**30**

SEMESTER –II

Botany Paper III: DSC-13B: Mycology, Phytopathology and Mushroom cultivation

CREDIT: 2. LECTURE PERIODS: 2.5 PER WEEK- LECTURE HOURS; 2 PER WEEK
MARKS: 50

MODULE	SUB-MODULE	TOPICS	LECTURE PERIOD
1.	**Mycology**		
	1.1 Fungi – A)	i) General characters of fungi ii) Classification as per Ainsworth (1973) - upto class iii) Economic importance	**06**
	B)	Life cycle (excluding developmental stages of sex organs) of the following types- **a) Zygomycotina: *Mucor*** **b) Ascomycotina: *Penicillium***	**07**
	1.2 Lichens	i) Occurrence and General characters ii) Nature of association iii) Types of lichens iv) Economic importance	**04**
2	**Phytopathology and Mushroom cultivation**		
	2.1 Phytopathology	i) Introduction and General symptoms. ii) Study of following plant diseases with respect to symptoms and control measures- **a) Viral** – Yellow vein mosaic of Bhendi **b) Bacterial** – Blight of Pomegranate **c) Fungal** – White rust of crucifers **d) Mycoplasma (MLO)-** Grassy shoot of sugarcane	**06**
	2.2 Mushroom cultivation	i) Introduction and History ii) Steps in cultivation of *Pleurotus sajor-kaju* iii) Commercial importance.	**07**
Total Lectures			**30**

SEMESTER –II

Botany Paper IV: DSC-14B: Archegoniate (Bryophytes, Pteridophytes and Gymnosperms)

CREDIT: 2. LECTURE PERIODS: 2.5 PER WEEK- LECTURE HOURS; 2 PER WEEK
MARKS: 50

MODULE	SUB-MODULE	TOPICS	LECTURE PERIOD
1.	**Archegoniate and Bryophytes**		
	1.1 Archegoniate	i) Introduction, ii) Diagnostic features of archegoniate iii) Transition to land habit iv) Alternation of generation	**04**
	1.2 Bryophytes	i) General characters ii) Classification as per G.M. Smith (1955) upto classes iii) Ecological & Economic importance. iv) Morphology, Anatomyand life cycle (excluding developmental stages of sex organs) of **Anthocerotopsida**- *Anthoceros*	**08**
2	**Pteridophytes and Gymnosperms**		
	2.1 Pteridophytes	i) General characters ii) Classification as per G.M. Smith (1955) upto classes iii) Ecological and Economic importance iv) Morphology, anatomy (leaf and stem) and life cycle (excluding developmental stages of sex organs of a) **Lycophyta** – *Selaginella* b) Heterospory& Seed habitat	**08**
	2.2 Gymnosperms	i) General characters ii) Classification as per Sporne (1965) upto classes iii) Ecological and Economic importance. iv) Morphology, Anatomy(leaf and stem) and life cycle (excluding developmental stages of sex organs) of **Gnetopsida** – *Gnetum* v) Connecting link between Pteridophytes and Angiosperms	**10**
Total Lectures			**30**

Practical's of B. Sc. Part – I Botany (CBCS)

(With effect from August- 2022)

Botanical Excursion:

One teacher along with a batch not more than 20 students be taken for Botanical. Excursion to places of Botanical interest, one in each semester. If there are female students in a batch of twenty students, one additional lady teacher is permissible for excursion. T.A. and D.A. for teacher and non-teaching staff participating in excursions should be paid by the concern colleges as per University rules. Tour report duly certified by teacher concerned and Head of the Department should be submitted at the time of practical examination.

Practical Course:

B. Sc. Part – I Botany practical course is to be covered in twenty five practicals. These practicals are to be performed by the students. Each practical is to be supplemented by permanent slides, preserved / fresh specimens, materials, charts, herbarium sheets where ever necessary.

Details of Practical Examination:

A) Practical Examination for B. Sc. I. will be conducted at the end of second semester.

B) Every candidate must produce a certificate from Head of Department of his / her college, saying that he / she has completed practical course in satisfactory manner as per terms laid down by Academic council on the recommendations of Board of Studies in Botany. The student should record his / her observation and report of each experiment in the journal. The journal is to be signed periodically by teacher in charge and certified by the Head of Department at the end of year. Candidates have to produce their certified journal and tour report at the time of practical examination. Candidate is not allowed to appear for the practical

examination without a certified journal / a certificate from Head of Botany Department regarding the same.

C) Practical Examination should be of five hours duration and shall test a candidate in the following respect.

1. Practical study of external and internal structures of different plant types and their classification.
2. Making temporary stained preparations and identification.
3. Identification and setting of biochemical experiments.
4. Study of plant diseases as per syllabus.
5. Spotting of the specimens as per syllabus.

List of Practicals:

1. Study of microscope: Light and Electron microscope (SEM with Photograph)
2. Electron microphotographs/models of viruses – T-Phage and TMV
3. Forms of bacteria- (Temporary / permanent slides/ photographs).
4. Bacteria- Gram staining technique
5. Study of vegetative and reproductive structures of *Nostoc*
6. Study of vegetative and reproductive structures of *Spirogyra*
7. Study of different types of Biofertilizers as per theory syllabus
8. Study of vegetative and reproductive structures of *Mucor.*
9. Study of vegetative and reproductive structures of *Penicillium*.
10. Study of forms of lichen- Crustose, Foliose and Fruticose.
11. Study of Mushroom cultivation (Demonstration).
12.13. Study of plant diseases per theory.
14. Study of vegetative and reproductive structures of *Anthoceros*
15. Study of vegetative and reproductive structures of *Selaginella*
16. Study of vegetative and reproductive structures of *Gnetum*
17. Study of cell and its organelles with the help of electron microphotographs.
18. Study of cell structure in Onion peels (cataphyll), it's staining and mounting.
19. Study of effect of organic solvent concentrations on membrane permeability.
20 .Study of peroxisome (enzyme activity catalase)
21. Study of glyoxisome (enzyme activity-malate dehydrogenase)
22. Study of different stages of mitosis.
23. Study of different stages of meiosis.
24. Separation of photosynthetic pigments by ascending paper chromatography.
25. Separation of amino acids by thin layer chromatography.

Course Outcomes

CO1. Students will able to recognize the structure , types and multiplication of viruses.

CO2. Students will able to understand the bacterial types, structure and mode reproduction

CO3. Students will able to identify the different types of algae and their importance in day today life.

CO4. Students will able develop the skills for the production of different type of Bio fertilizers ,

CO5. Students will able to distinguish the prokaryotic and eukaryotic organisms and acquire the knowledge of different plant cell organelles and its role in the plant body.

CO6. Students will able to understand the different types of cell division and it's phases.

CO7. Students will able to handle all types of microscope.

CO8. Students will able to develop a skill in the chromatography techniques.

CO9. Students will able to identify and classify the different fungi and also realize the economic importance of fungi.

CO10. Students will able to identify the lichens on the basis of morphology and to know the medicinal value of the lichens.

CO11. Students will be able to recognize the different plant diseases and their management.

CO12. Students will able to develops the soft skill technique in the Mushroom Cultivation and realize the commercial status of the mushrooms.

CO13. Students will able to identify the bryophytes their importance.

CO14. Students will able to recognize the characters and ecological importance of pteridophytes.

CO15. Students will be able to identify, classify the gymnosperms and understand the Economic importance of gymnosperms.

(iii) Specific Objectives:----------

(iv) A brief note :- (On expected level of study from examination and assessment point of view):- -----

(v) Recommended Reading:
(In MLA/APA Style Sheet Format)

a) Basic Reading :-

b) Additional Reading :-

c) References :-

d) Books

List of Books Recommended for B. Sc. I Botany

Algae –

1.Introductory Phycology. Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York.
2. Algae - Kumar H. D. and H. N. Singh (1991)
3. Algae - Sharma O. P. (1986)
4. Algae - Pandey B. P. (1994)
5. A Text book of Algae - Chopra G. L. (1969)
6. A Text book of Algae - Kumar H. D., Singh H. N. (1977)
7. A Text book of Botany - V. Singh, P. C. Pandey, Jain D. K. (1999)
8. A Text book of Botany Vol. I – Pandey S. N., S. P. Misra, P. S. Trivedi (1.982)
9. A Treatise on Algae - K. N. Bhatia (1980)

Fungi –

1. A Hand book of Lichens - D. D. Awasthi (2000)
2. An Introduction to Fungi - Dube H. C. (1990)
3. Morphology of Plants and Fungi --Blod, H.C., Aloxopoulos, G. J. and Delevoryas, T. 1980. (4th Edition) Harper and Foul Co., New York.
4. An Introduction to Fungi.--Dube, H. C. 1990. Vikas Publishing House Pvt. Ltd.,Delhi.
5. Cryptogamic Botany Vol. I & II (2nd Edition), Gilbert, M. S. 1985. Tata McgrawHill Publishing Co., Ltd New Delhi.
6. Fungi- Vashishtha B. R. (1996)
7. Fungi- Pandey B. P. (1994)
8. Introduction to Fungi - Sundrarajan (2001)

9. Introductory Mycology - C. J. Alexopoulos, C. W. Mims, M. Blackwell
10. Cryptogamic Botany Vol. I - Algae and Fungi - G. M. Smith (1974)
11. Plant diseases –Singh R. S. (1963).
12. Manual of plant pathology –Padoley S. K. & Mistry P. B.
13. Hand book of field crop diseases- Ny. Vall (1979).
14. Experiments in Microbiology, Plant pathology and Tissue culture- Aneja K. R. (1993).
15. Plant pathology- R. S. Mehrotra, (1980) Dean, Faculty of science, Kurkshetra University, Kurukshetra.
16. Plant Diseases- F.T. Brooks, periodical Expert book Agency, D-42, VivekVihar, Delhi 1100032.
17. Plant diseases –RajaniShrma, Campus books international, 4831/24 Prahlad Street, An sari Road, Daryaganj, New Dehli-110002.
18. Diseases of crop plant in India –Dr. Rangaswami.
19. Plant diseases –R.S. Singh
20. Modern plant pathology – R. S. Bilgrami and H. C. Dube.

Bryophytes –

1. Bryophytes. Puri, P. 1985. Amarm& Sons, Delhi.
2. College Botany - S. Sundararajan (1999)
3. College Botany Vol. I - Gangulee H. C., Das K. S. and Datta C. T. (1991)
4. College Botany Vol. II - Gangulee H. C., Kar A. K. (1999)
5. College Botany Vol. III -- S. K. Mukharji (1990)
6. Cryptogamic Botany Vol. I- G. M. Smith (1955)
7. Cryptogamic Botany: Bryophytes and Pteridophytes - Smith G. C. (1955)

Pteridophytes—

1. An Introduction to Pteridophytes - Rashid A. (1978)
2. An Introduction to Pteridophyta (Diversity and Differentiation) -A. Rashid (1976)
3. A Text book of Pteridophyte – S. N. Pandey, P. S. Trivedi, S. P. Misra (1995)
4. An Introduction to Embryophyta - Parihar N. S. (1961)
5. Morphology and Evolution of Vascular Plants Gifford, E. M. and Foster, A. S. 1989. W.H. Freeman & Co., New York.
6. Morphology of vascular Plant (lower groups) -- A. J. Eames.
7. Illustrated Manual of Ferns of Assam -S. K. Borthakur, P. Deka, K. K. Nath (2000)
8. Pteridophyta – Vascular Cryptogams - P. C. Vashishta (1972)
9. Botany for Degree Students- Pteridophyta (Vascular Cryptogams) - P. C. Vashishta, A. K. Sinha, Anil Kumar – S Chad –Multicolour Illustrative Revised Edition- 2006.

Gymnosperms –

1.Botany for Degree Students- Gymnosperms (Vascular Cryptogams) - P. C. Vashishta, A. K. Sinha, Anil Kumar – S Chad –Multicolour Illustrative Revised Edition- 2006.
2. The Morophology of Gymmosperms. -- Sporne, K. R. 1991. B. I. PublicationsPvt., Bombay, Calcutta, Delhi.
3. Morphology of Gymnosperms -- J. M. Coulter and C. J. Chamberlain.
4. Gymnosperms – Structure & Evolution.--C. J. Chamberlain
5. Morphology of Gymnosperms.--K. R. Sporne.

6. Gymnosperms- Vashishta P. C. (1976)
7. Gymnosperms- C. J. Chamberlein (1966)
8. Indian Gymnosperms in Time and Space - Ramanujan C. G. K. (1979)
9. Origin and Evolution of Gymnosperms - Ed Charles B. Beck (2002)
10. Phylogeny and form in the plant Kingdom - H. C. Dittmer (1964)

Cytology, Microbiology and Analytical Techniques-

1. Plant Cell Biology –Structure and function-Gunning B.E.S and Steer M.W. (1996).
2. Plant Cell Biology-A practical approach.-Harris N. and Oparka K. J. (1994). (IRL-Press of oxford University UK.).
3. Cell Biology- De. Robert et.al. (1982), (Publ. Sundar and Company).
4. Cell Biology –C. B. Powar (1992), Himalaya Publ. House, Delhi.
5. Plant Biochemistry-Cell-Sumps P.K. and Connie's. (1981).
6. Molecular Cell Biology-Albert's B. Bray D. Lewis J. Faff M. Robert K. & Watson J.D. (1999). (Publ. Garlands publishing co-In, New York U.S.A.)
7. Text Book of cell and molecular biology –Gupta P.K. (1999), Rastogi publication, Meerat.
8. Molecular and Cellular Biology-Wolfe S.L. (1993), Wadsworth publishing Company, California, U.S.A.
9. Applied Microbiology- Vinita Kale and Kishore Bhusari (2007) Himalaya Publishing House, Mumbai.
10. Virology- Saravanan P. MJP, Publishers, Chennai. 600005.
11. Chromatographic Methods- Stock, R. and C. B. F. Rince (1978).
12. Biological Techniques- Srivastava, H. S. (1999).

C] OTHER FEATURES:

1. INTAKE CAPACITY / NUMBER OF STUDENTS:-

As per university rules.

2. TEACHERS QUALIFICATIONS:-

- As prescribed by norms.
- However required number of core faculty should be given for particular course along with paper wise and Specialization wise work load allocation.
- Work load details should be as per Apex body/UGC/State Govt./University norms.

3. **The Board of studies should clearly mention the required Books, Journals and specific Equipments necessary for the Course.**

(A) LIBRARY: Library be equipped with the required Reference and Text Books, Journals and Periodicals for higher and advanced studies as per stated in revised syllabus and approved by BOS.

(B) SPECIFIC EQUIPMENTS:

T.V., V.C.R. V.C.P., L.C.D., Overhead Projector, Computers and necessary software and operating systems etc. are necessary to run the course

(C) LABORATORY SAFETY EQUIPMENTS:

i)Fire extinguishers at least two sets in each laboratory of 600 sq.ft. Area.

ii) Leakage of gases be avoided.

iii) First aid kit be made available.

iv) Sugar / Glucose –500gm pack- a pinch of sugar and a cup of drinking water in hypoglycemic condition or in extreme weakness of student or a person concerned

B) GENERAL SAFETY RULES FOR LABORATORY WORK

1) List of equipments needed for Laboratory Safety:-

1. Fire extinguisher
2. First Aid Kit
3. Good ear thing and insulated wirings for electrical supply.
4. Emergency exit
5. Apron and goggles wherever necessary
6. Fuming Chambers
7. Masks flows and shoes while handling hazardous chemicals & gases (Good valves, manometers and regulators for gas supply)
8. Operational manuals for instruments (handling to be made as suggested.)
9. Rules of animals and blanks ethics.
10. Leakage of gases to be avoided.
11. Cylinders or flow pipes to handle Acids.
12. No weighing for NaOH and hygroscopic substances.
13. Stabilized supply in the laboratory.

2) There Is No Substitute for Safety

1. Any injury no matter how small, it must be reported to teacher immediately.
2. a) In case any chemical enters your eyes go immediately to eye- wash facility and flush your eyes and face with large amount of water.

   b) For acid or phenol split, do not use water instead put some bicarbonate.
3. In case of fire, immediately switch of all gas connections in the laboratory and pour sand on the source of fire or cover it with asbestos or cement sheet.
4. While leaving laboratory, make sure that gas, water taps and electricity are switched off.
5. Remove your lab coat. Gloves and clean your hands before leaving laboratory.

6. Make your workplace clean before leaving the laboratory.
7. Keep your hands away from your face, while working in laboratory.
8. Each laboratory must have a first aid box.
9. Know what to do in case of emergency - e.g.

   (a) Know the place of fire extinguisher and first aid box.
10. Don't use cell phones in the laboratory.

    (a) Remember important phone numbers

3) DO's

1. Always wear lab coat, shoes in the laboratory. Every student must have their weight box, a napkin etc.
2. Maintain separate record book for each subject.
3. Keep your belongings at the place allotted for the same.
4. Maintain silence, order, cleanliness and discipline in the laboratory.
5. Work at the place allotted to you or specially used for certain operations.
6. Keep the working table clean.
7. Handle the laboratory equipments, glassware and chemical with great care.
8. Use only required quantities of material and apparatus of essential size.
9. Perform the test in their proper order.
10. Know the location of eye wash fountain and water shower.
11. Minimize your exposure to organic solvents.
12. The Metal like sodium should be kept under kerosene or liquid paraffin layer in a vessel with a cork stopper.
13. Sodium metal should be cut on dry filter paper. The cut off pieces of sodium should be immediately collected in a vessel containing kerosene or liquid paraffin.
14. Always pour acid into water when diluting and stir slightly.
15. All operations involving poisonous flammable gases and vapours should be carried out in the flame chamber (with exhaust facility)
16. Ladies should avoid wearing saree. If it is there, apron is essential.

4) DON'T

1. Don't work alone in the laboratory
2. Don't leave the glass wares unwashed.
3. Don't take apparatus, chemicals out of lab.

4. Don’t leave any substance in a vessel or bottle without label.
5. Don’t weigh the reagent directly on the balance pan.
6. Don’t throw the cut off pieces of sodium metal in sink or water. Transfer it immediately in its container.
7. Don’t take sodium metal with hands. Use forceps.
8. Don’t panic and run in case of fire. Use the fire extinguishers or sand buckets.
9. Don’t breathe the vapours of organic solvents.
10. Don’t pour any unused reagent back in its stock bottle.
11. Don’t eat or drink any food in laboratory.
12. Don’t use inflammable solvents like benzene, ether, chloroform, acetone and alcohol around flame.
13. Don’t distill to dryness.
14. Don’t exchange stoppers of flasks and bottles containing different reagents.
15. Don’t leave reagent bottle lying on the table.
16. Don’t disturb the order of reagent bottles in which they are placed.
17. Don’t bring reagent on your working table from the general shelf.
18. Don’t throw burning matchstick into dustbin.
19. Don’t leave the laboratory without permission.

5) LABORATORY / FIELD WORK CARE AND SAFTY FOR BOTANY STUDENTS

1. Unnecessary wastage of plant material during practicals should be avoided.
2. During study tour / personal collection, more emphasis be given on study of plants in nature and collection of wild plants should not be carried out.
3. If at all the collection of the plant material in needed, it should be carried out under supervision of concerned teacher. Collection of poisonous plants / poisonous mushrooms should be avoided.
4. Oral intake of unknown plant material, out of curiosity, during practical or collection tour is strictly prohibited.
5. If there is any allergic reaction while handling the plants / plant parts / pollen grains / fungal specimens it should be immediately brought to the notice of the concerned teacher and reported to the registered medical purloiner.
6. Wearing of hand gloves (and mask) is essential while handling poisonous plants / herbarium sheets / toxic and hazardous chemicals / reagents / strong acids / strong alkalis

during the experiment should be made with vacuum pipette / auto pipette / burette under the supervision of concerned teacher / lab assistant.

7. Highly inflammable organic solvents (alcohol, acetone etc.) should not be kept in vicinity of spirit lamp.
8. The laboratory safety measures adopted for handling of hazardous chemicals in chemistry practicals should be followed for conducting practicals in plant biochemistry / microbiology.
9. Operational manuals for equipments such or centrifuge, autoclave, spectrophotometer should be followed.
10. In case of minor injuries, preliminary treatment should be undertaken with the help of first aid kit available in the laboratory. In case of serious injury, concerned teacher should be immediately contacted for consultation to the physician.
11. The instruction report for breeding, experimentation will be submitted in a week period. (Which are laid down by Ministry of Social Justice & Empowerment and Ministry of Environment and Forests, Govt. of India).

PROGRAM SPECIFIC OUTCOMES (PSO) OF BOTANY:

In life science plant science is one of the most important basic and applied subject. Plants synthesized their own food material and provides the food and oxygen to all living organism. Most of the basic requirements fulfilled by the plants. This course has been designed to give the fruitful knowledge and to develop the commercial soft skills in the various aspects of plant science.

PSO 1: Understanding the classification of all higher and lower plants. Plant diseases and their management.

PSO 2: Understand the structure and function of different cell organelles and the role of cell membrane, plant anatomy, taxonomy and ecology.

PSO 3: Understand the skills for the production of Bio fertilizers and mushroom culture techniques.

List of Skill Enhancement courses.

- Soil and Water Analysis
- Handicrafts: Bamboo products
- Nature and wildlife photography.
- Bioprospecting of medicinal plants
- Aurvedic preparations
- Gardening and it's management.

Link for the pool of SEC courses from

National Skills Qualification Framework (NSQF)

(You may add or delete any courses as per available facilities)

https://drive.google.com/file/d/176Vwvx4SC2ONrt69XADruzI2qnfBPI_o/view?usp=sharing