



સૌરાષ્ટ્ર યુનિવર્સિટી

એકેડેમિક વિભાગ

યુનિવર્સિટી કેમ્પસ, યુનિવર્સિટી રોડ, રાજકોટ-૩૬૦૦૦૫

ફોન નં.(૦૨૮૧)૨૫૭૮૫૦૧ એક્સટે. નં.૨૦૨, ૩૦૪ ફેક્સ નં.(૦૨૮૧)૨૫૭૬૩૪૭ ઈ-મેઈલ : academic@sauuni.ac.in

નં.એકે/વિજ્ઞાન/ 109994/2024

તા. ૨૪/૦૩/૨૦૨૪

બોટની

પરિપત્ર:-

સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળની સ્નાતક કક્ષાના B.Sc.(બોટની)ના અભ્યાસક્રમ યલાવતી સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓને આથી જાણ કરવામાં આવે છે કે, વિષય નિષ્ણાંત દ્વારા બોટની સેમેસ્ટર ૧ અને ૨ નો નવો સુધારેલો અભ્યાસક્રમ બોટની વિષયની અભ્યાસ સમિતિ, વિજ્ઞાન વિદ્યાશાખા, એકેડેમિક કાઉન્સિલ તથા બોર્ડ ઓફ મેનેજમેન્ટની બહાલીની અપેક્ષાએ મંજૂરી આપવાં માન કુલપતિ.સાહેબને ભલામણ કરેલ છે. જે માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેથી સંબંધિત તમામે તે મુજબ તેની ચુસ્તપણે અમલવારી કરવી.

(મુસદ્દો કુલસચિવશ્રીએ મંજૂર કરેલ છે.)

સહી/-

(ડૉ.આર.જી.પરમાર)

કુલસચિવ

બિડાણ:- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

રવાના કર્યું

પ્રતિ,

(૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની બોટની વિષય યલાવતી સ્નાતક કક્ષાની સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓ તરફ

(૨) વિજ્ઞાન વિદ્યાશાખા હેઠળની બોટની વિષયની અભ્યાસ સમિતિના સર્વે સભ્યશ્રીઓ

નકલ જાણ અર્થે રવાના:-

૧. માન.કુલપતિશ્રી/કુલસચિવશ્રીના અંગત સચિવ

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે):-

૧. પરીક્ષા વિભાગ

૨. પી.જી.ટી.આર.વિભાગ

૩. જોડાણ વિભાગ



SAURASHTRA UNIVERSITY



FACULTY OF SCIENCE

Course Structure and Botany sem.-I & II Syllabus for Science FYUGP

B.Sc. Honours/ Honours with Research in Botany

Based on

UGC's guidelines NEP-2020 "Curriculum and Credit Framework for Undergraduate Programmes- CCFUP" and

Education Department, Government of Gujarat's Uniform Credit Structure for all HEIs of Gujarat State and Implementation of the Common Curriculum and Credit Framework under the National Education Policy-2020

(No: KCG/admin/2023-24/0607/kh.1 Sachivalaya, Gandhinagar dated 11/07/2023) and

Standard Operating Procedure for Implementation of NEP-2020 for the State of Gujarat- HEIs of Gujarat (No: KCG/admin/2023-24/865/ dated 26/07/2023) and

Additional content to be added to SOP published by KCG (No: KCG/NEP-2020/2023-24/893/ dated 28/07/2023)

Additional content to be added to SOP published by KCG (No: KCG/NEP-2020/2023-24/1149/ dated 23/08/2023)

Credit Framework for Four Year Undergraduate Programmes and General Guidelines for Implementation of Four Year Under Graduate Programmes for SAURASHTRA UNIVERSITY (No. Academic / 90882/2023, Dt. 10-10-2023)

Botany sem.-I & II Syllabus Effective from June – 2023 & onwards



Programme Outcomes (PO):

By the end of the program the students will be able to:

PO 1	Knowledge of Plant Biology: Students will acquire a strong foundation in plant anatomy, physiology, taxonomy, genetics, ecology and evolution. They will gain an in-depth understanding of plant structures, functions and interactions with the environment.
PO 2	Understanding of Plant Diversity: Students will develop an appreciation for the vast diversity of plant life, including their classification, evolution and ecological roles. They will be able to identify different plant species and understand their characteristics.
PO 3	Laboratory Skills: Students will develop practical skills in plant-based laboratory techniques, including plant tissue culture, microscopy, molecular biology and plant identification. They will be proficient in conducting experiments, analyzing data and interpreting results.
PO 4	Fieldwork and Plant Identification: Students will be trained in fieldwork techniques, enabling them to observe and study plants in their natural habitats. They will learn to identify various plant species and understand their ecological significance.
PO 5	Multidisciplinary Knowledge: Students will develop a comprehensive understanding of concepts, theories, and methodologies from multiple disciplines, enabling them to identify connections and synthesize information across different fields.
PO 6	Interdisciplinary understanding: B.Sc. students will gain interdisciplinary knowledge, enabling them to connect concepts and approaches from different scientific fields.
PO 7	Adaptability: Graduates will be able equipped to adapt to new technologies, emerging trends, and changes in their field.
PO 8	Research Skills: The programme emphasizes scientific research methodologies, equipping graduates with the skills to design and conduct experiments, collect and analyze data and draw conclusions based on empirical.
PO 9	Internship: An internship is an opportunity to enhance student's professionalism. Students will be able to learn how to conduct yourself in a work setting, interact with colleagues and superiors, and adhere to workplace norms and ethics.
PO 10	On Job training: Student will be able to gain hands-on experience and develop practical skills directly related to their job tasks and responsibilities. This will lead to increased efficiency and productivity in their roles.
PO 11	Research project: B.Sc. students engage in research projects or scientific investigations, and will be able foster research skills, including the ability to review scientific literature, design experiments, and interpret results.
PO 12	Environmental Awareness: B.Sc. Botany graduates will have a deep understanding of the relationship between plants and the environment. They will be aware of environmental issues, such as habitat destruction, climate change, biodiversity loss and understand the role of plants in addressing these challenges.
PO 13	Conservation and Sustainability: B.Sc. Botany Graduates will have knowledge of plant conservation strategies, including the protection and management of endangered plant species and ecosystems. They will be equipped to contribute to sustainable practices and advocate for the preservation of plant biodiversity.
PO 14	Communication and Presentation Skills: Students will develop effective written and oral communication skills necessary for scientific reports, presentations and collaborations. They will be able to convey complex scientific concepts to both specialized and non-specialized audiences.
PO 15	Indian knowledge system: Students will be able to understanding of the fundamental knowledge of any two special topics that are part of IKS.
PO 16	Value-added knowledge: Students will be able to understanding of the fundamental knowledge of any two special topics that are part of value-added course.
PO 17	Career Opportunities: B.Sc. Botany graduates will pursue various career paths. They may work as plant scientists, ecologists, environmental consultants, horticulturists, park



	rangers, educators or researchers. They may also choose to continue their studies at the postgraduate level in botany or related fields.
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Programme Specific Outcomes (PSO):

By the end of the program the students will be able to:

PSO 1	Fundamental Concepts of Plant: Graduates will have a comprehensive understanding of the fundamental principles and concepts in plant biology, including plant structure, growth, development, reproduction, physiology and ecology.
PSO 2	Taxonomy and Identification: Students will be able to identify and classify different plant species using appropriate taxonomic techniques and tools. They should have a good understanding of plant classification systems and be familiar with the diversity of plant life.
PSO 3	Proficiency in Plant Identification: Students will gain skills in identifying plants based on their morphological features, such as stems, leaves, inflorescences, flowers and fruits.
PSO 4	Understanding of Plant Structure and Function: Graduates will be able to describe and analyse the structure and function of plants at the cellular, tissue, organ and whole-plant levels.
PSO 5	Familiarity with Plant Ecology: Graduates will be familiar with the principles of plant ecology, including the interactions between plants and their environment, plant community dynamics and ecosystem processes.
PSO 6	Laboratory Skills: Graduates will possess practical skills in laboratory techniques commonly used in botany, such as microscopy, plant tissue culture, plant genetics and molecular biology techniques. They will be proficient in conducting experiments, analyzing data and interpreting results.
PSO 7	Fieldwork and Plant Collection: Students will have experience in conducting fieldwork and collecting plant specimens. They will know how to document and preserve plant samples for further study and analysis.
PSO 8	Plant Conservation and Biodiversity: Graduates will be aware of the importance of plant conservation and have a basic understanding of the principles and practices involved in preserving plant diversity. They will be able to identify threats to plant populations and suggest measures for their conservation.
PSO 9	Identify economically important plant species: Students will be able to recognize and distinguish plants that have economic significance, such as those used for food, medicine, fiber, fuel or industrial products.
PSO 10	Ethnobotany and Ethnopharmacology: Students will be able to understand the relationship between traditional medicinal practices and the scientific basis of herbal medicine through the study of ethnobotany and ethnopharmacology.
PSO 11	Understanding of Natural Products: Students will gain a comprehensive understanding of natural products, including plant-based drugs, herbal medicines and other biologically active compounds obtained from natural sources.
PSO 12	Understanding the Principles of Organic Farming: Students will be able to explain the basic principles and concepts that underpin organic farming, such as soil health, biodiversity, ecological balance and sustainability. Students will be able to design and implement an organic farm plan.
PSO 13	Skill enhancement in a botany: students will be developed skill enhancement in various field such as herbarium technique, mushroom cultivation, biofertilizers, nursery and gardening, soil and water analysis and organic farming.
PSO 14	Environmental and Ecological Awareness: Students will understand the interactions between plants and their environment. They will be able to analyse ecological processes, such as plant community dynamics, nutrient cycling and the impact of human activities on plant ecosystems.

**Evaluation Pattern for Four Years Course:**

Semester-I							
Course Code	Title of the Paper	Duration in the Hrs.		Credit	Max. Mark		Total
		Theory	Practical		CCE (Written, Oral, Practical, Integrated)	SEE (Summative – 50 Marks)	
23SI-BSCI-MA-01052	Cryptogamic Botany	45	30	4	50	50	100
23SI-BSCI-MA-02053	Fundamental Botany -I	45	30	4	50	50	100
23SI-BSCI-MI-01054	Cryptogamic Botany	45	30	4	50	50	100
23SI-BSCI-MD-01029	Introduction to Biology-I	45	30	4	50	50	100
AEC	English	30	00	2	25	25	50
23SI-BSCI-SE-01057	Principle of organic farming	15	30	2	25	25	50
IKS		30	-	2	25	25	50
Total		255	150	22	275	275	550

Semester-II							
Course Code	Title of the Paper	Duration in the Hrs.		Credit	Max. Mark		Total
		Theory	Practical		CCE (Written, Oral, Practical, Integrated)	SEE (Summative – 50 Marks)	
BOM203-1C	Phanerogams and Medicinal Botany	45	30	4	50	50	100
BOM204-1C	Plant Diversity -I	45	30	4	50	50	100
BOE202-1C	Phanerogams and Medicinal Botany	45	30	4	50	50	100
MDC202-1C	Pharmaceutical Products	45	30	4	50	50	100
AEC202-1C	Language English	30	00	2	25	25	50
SEC202-1C	Herbarium Technique	15	30	2	25	25	50
VAC	(NSS)	30	-	2	25	25	50
Total		255	150	22	275	275	550

Students Performance and Evaluation Systems: Following two components are included in the evaluation of students:

1) **Continuous and Comprehensive Evaluation (CCE)**

2) **Semester End Evaluation (SEE)**

Sr. No.	Evaluation	Weightage (%)	4 Credits / Course (Marks)	2 Credits / Course (Marks)
1	Continuous and Comprehensive Evaluation (CCE)	50%	50 (At College / Institute Level)	25 (At College / Institute Level)



2	Semester End Evaluation (SEE)	50%	50 (Written Exams will be conducted by University)	25 (Written Exams will be conducted by University)
Total		100%	100	50

Note: Minimum Passing marks required to be score by the students in each course and in each head (Internal and External) is **36%**.

Maximum Marks	Minimum Passing Marks
25	09
50	18
100	36

1) Continuous and Comprehensive Evaluation (CCE)

- ❖ Subject-wise CCE will be undertaken by the concerned faculty member(s). The mode of evaluation will be decided by the Colleges / Institutes in their Staff Council.
- ❖ Normally CCE consists of class participation, case analysis and presentation, assignment, tutorials, slip tests (announced / surprised), quizzes, attendance etc. or any combination of these.
- ❖ The students are expected to submit their answer scripts / reports of internal evaluation within the stipulated time. Failure to do so may result in the script not being valued. Another part of CCE consists of mid-term written evaluation, which is compulsory for all students. It can be done in a scheduled manner. The duration of the mid-term evaluation shall be one hour.

Note: The documentary records of all the students shall be kept by the college / institute for having the solution if any of the query raised by the students or if university asks for the same.

2) Semester End Evaluation (SEE):

The question paper structure of theory course for Semester End Evaluation (University / External Examination) for 04 Credits / 5 Units Course / paper will be as follow:

Question No.	Unit No.	Type of Questions	Marks (50)	Duration of Examination
1	1	Question with Internal Option	10	2 Hrs.
2	2	Question with Internal Option	10	
3	3	Question with Internal Option	10	
4	4	Question with Internal Option	10	
5	5	Question with Internal Option	10	
Total			50	

- ❖ The SEE carries 50% of the marks assigned to a course.
- ❖ For theory courses, SEE shall be of 2/1 hours for 4/2 credit courses.
- ❖ The Controller of the Examination will conduct these examinations.
- ❖ Paper setting and evaluation will be done by the internal / external examiners to an extent of 50% of the evaluation process.
- ❖ This examination shall be conducted as per a schedule which shall be notified in advance. The backlog exam will be conducted twice a year just.
- ❖ Appearance in all the evaluations is mandatory and no exemption can be granted except in the following case:
 1. In case of inability to attend the exam due to reasons considered genuine by the Principal / Head of the college.
 2. In case of medical emergency, a certificate from the registered medical practitioner must be produced to the Principal / Head before the commencement of exams.
- ❖ **Eligibility Criteria to appear in SEE**
To be able to appear for the SEE, a student must comply with the following conditions, if certified by the Principal / Head:
 1. Should have at least **75%** of attendance in all the courses put together
 2. Should have at least **70%** of attendance in each course / subject
 3. Should not have any disciplinary proceedings pending against him/her



4. Should have no pending due
5. Should have appeared in all components of CCE.
6. The mid-term written evaluation is compulsory for all students.

Evaluation of 100 Marks (4 Credits Paper)

Continuous and Comprehensive Evaluation (CCE) – Formative – 50 Marks				Semester End Evaluation (SEE) – Summative – 50 Marks
Written	Oral	Practical	Integrated	Final Test
(Select any 3 types from below list)	(Select any 2 types from below list)	(Select any 3 types from below list)	(Select any 2 types from below list)	
1. Weekly/Unit Test 2. Open book/note test 3. Online test 4. Essay/Article writing 5. Objective test 6. Class/Home assignment 7. Reports Writing 8. Research/ Dissertation 9. Case Studies 10. Project Writing 11. Journal Writing 12. Multiple Choice Questions 13. Seen/Open Question 14. Take Home 15. Assignment Writing	1. Viva/Oral exam 2. Group Discussion 3. Role Play 4. Authentic Problem Solving 5. Quiz 6. Interview 7. Open book reading 8. Inter Forum Debate 9. Speech 10. Reading Test	1. Lab work 2. Computer simulation/ virtual labs 3. Craft work 4. Co-curricular work 5. Activities and brainstorming games	1. Paper presentation/ Seminar 2. Field Assignment 3. Poster Presentation 4. Self and Peer Evaluation	1. Writing and Memory skill test
15	10	15	10	50

Evaluation of 50 Marks (2 Credits Paper)

Continuous and Comprehensive Evaluation (CCE) – Formative – 25 Marks				Semester End Evaluation (SEE) – Summative – 25 Marks
Written	Oral	Practical	Integrated	Final Test
(Select any 2 types from below list)	(Select any 1 type from below list)	(Select any 1 type from below list)	(Select any 1 type from below list)	
1. Weekly/Unit Test 2. Open book/note test 3. Online test 4. Essay/Article writing 5. Objective test	1. Viva/Oral exam 2. Group Discussion 3. Role Play 4. Authentic	1. Lab work 2. Computer simulation/ virtual labs 3. Craft work 4. Co-curricular	1. Paper presentation/ Seminar 2. Field Assignment 3. Poster	1. Writing and Memory skill test



6. Class/Home assignment 7. Reports Writing 8. Research/ Dissertation 9. Case Studies 10. Project Writing 11. Journal Writing 12. Multiple Choice Questions 13. Seen/Open Question 14. Take Home 15. Assignment Writing	Problem Solving 5. Quiz 6. Interview 7. Open book reading 8. Inter Forum Debate 9. Speech 10. Reading Test	work 5. Activities and brainstorming games	Presentation 4. Self and Peer Evaluation	
10	5	5	5	25

Note:

1. University will arrange practical and viva evaluation by internal faculty and external evaluator.

2. Marks of practical and viva will be considered under CCE.

❖ **Question Paper Format for 4 Credit Course (Practical/Performance)**

1. One Practical/Performance of **25 Marks (Viva – 10 Marks & Practical's – 15 Marks)** Each of Three Hours Duration.

2. 25 Students per practical batch per teacher / examiner.

Practical Exam for 4 credit courses			
Course Name	Lab work (External)	Viva / oral exam. (Internal)	Total
Major- I, II, III, IV	15 mark	10 mark	25 Mark
Minor- I, II	15 mark	10 mark	25 Mark
MDC- I, II	15 mark	10 mark	25 Mark

Note: Online entry of 25 marks for theory internal and 25 marks for practical external will be opened separately.

❖ **Question Paper Format for 2 Credit Course (Practical/Performance)**

1. One Practical/Performance of **10 Marks (Viva – 05 Marks & Practical's – 05 Marks)** Each of One and Half Hours Duration.

2. 25 Students per practical batch per teacher/examiner.

3. Marks of practical and viva will be considered under CCE.

Exam for 2 credit courses					
	External Practical Exam – 10 Mark (Marks of practical and viva will be considered under CCE.)		Theory Internal Exam- 15 mark (as per CCE Evaluation of 50 Marks (2 Credits Paper))		
Course Name	Practical (Lab work (External))	Viva / oral exam. (Internal)	Written test (Any -2)	Integrated (Any-1)	Total Mark
SEC- I, II,	5 mark	5 mark	10 Mark	5 mark	25 mark

Note: A single online entry of 25 marks (SEC theory internal 15 marks and SEC practical external 10 marks) will be opened.



Suggested End Semester Examination Pattern

Paper style for sem.-I & II (NEP-2020) Botany paper: Major-I, II, III &IV, Minor-1& 2 and MDC-1&2.		
B.Sc. Botany Sem. –I & II (NEP-2020) Examination		
Faculty Code:		
Subject Code:		
[Time: 2 Hours]		[Total Marks :50]
Instructions:		
1	Attempt all the questions.	
2	Answer with draw neat and labelled diagram wherever necessary.	
3	Figures to the right side indicated total marks for the questions.	
Q-1	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-2	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-3	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-4	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-5	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5



B.Sc. Honours/ Honours with Research in Botany Semester – I & II Syllabus as per NEP-2020.

❖ **Question Paper Format for 4 Credit Course (Practical/Performance)**

1. One Practical/Performance of **25 Marks (Viva – 10 Marks & Practical's – 15 Marks)** Each of Three Hours Duration
2. 25 Students per practical batch per teacher / examiner

Suggested Question Paper Format for 2 Credit Course (Theory)

Paper style for sem.-I & II (NEP-2020) Botany: SEC theory paper-1 & 2		
B.Sc. Botany Sem. –I & II (NEP-2020) Examination		
Faculty Code:		
Subject Code:		
[Time :1 Hours]		[Total Marks :25]
Instructions:		
1	Attempt all the questions.	
2	Answer with draw neat and labelled diagram wherever necessary.	
3	Figures to the right side indicated total marks for the questions.	
Q-1	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-2	Write the answer in detail.	MARKS
	A.	5
	B.	5
	OR	
	A.	5
	B.	5
Q-3	Write the answer in detail.	MARKS
	A.	5
	OR	
	B.	5

❖ **Question Paper Format for 2 Credit Course (Practical/Performance)**

1. One Practical/Performance of **10 Marks (Viva – 05 Marks & Practical's – 05 Marks)** Each of One and Half Hours Duration
2. 25 Students per practical batch per teacher/examiner



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- I

Major (Core) -1: Cryptogamic Botany Theory	
Course Category	Major (Core) -1
Title of the Course	Cryptogamic Botany Theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Theory Course Outcomes - COs

On completion of the course, students are able to know:

1. Scope of Botany will be providing a foundation for students to pursue further studies or careers in various areas related to botany, including plant biology, ecology, agriculture, horticulture, forestry, conservation and biotechnology.
2. knowledge of different branches of botany students will be able to choose their future carrier.
3. Students will be able to explain the progression of plant classification systems over time, including the five-kingdom plant classification proposed by Whittaker and its limitations.
4. Students will gain a comprehensive understanding of plant taxonomy and the principles underlying the Eichler system of plant classification. They will learn about the hierarchical organization of plants into different taxonomic ranks, including families, orders, classes and divisions.
5. Students will be able to recognize and differentiate between different types of fixing agents and preservatives used in plant material.
6. Students will be able to know fundamental principles behind mounting media, including their purpose, composition and specific applications in microscopy.
7. By using different stains and mounting media students will be obtaining valuable information about plant morphology, anatomy and cellular composition.
8. The use of stains in botany leads to a deeper understanding of plant cell structure, tissue organization, and physiological processes. Students will be able to with a solid foundation for further studies in botany, plant biology and related fields.
9. Students will gain a comprehensive understanding of the structure and function of a dissecting microscope, including its various components such as the eyepiece, objective lenses stage, and illumination system.
10. Students will acquire knowledge about the principles and components of a compound microscope, including the eyepiece, objective lenses, condenser, diaphragm and stage.
11. Students will be able to distinguish between different types of microorganisms, including bacteria, viruses, fungi and archaeobacteria, based on their structural and functional characteristics.
12. Students will equip with a solid foundation in the ultrastructure, function and interactions of E. coli bacteria and T₄ phages, enabling them to pursue further research, careers in microbiology and virology.
13. Students will be able to identify and classify different types of algae, including their morphological and physiological characteristics.
14. Students will be able to identify and differentiate between the major divisions of algae according to the G. M. Smith classification. They will learn to recognize key features and traits associated with



- each division, such as pigmentation, cell structure and reproductive structures.
15. Students will develop an understanding of the importance of algae in various aspects of human welfare, including food, medicine, energy production, pollution control and environmental sustainability.
 16. Students will gain a solid understanding of the fundamental aspects of yeast cell structure, including the major organelles and their functions.
 17. Students will learn about the hierarchical structure of the Alexopoulos classification system, including the division of fungi into phyla, classes, orders, families, genera and species.
 18. Students will gain a comprehensive understanding of the biology of fungal spores, including their formation, structure and function.
 19. The economic importance of fungi will provide students with a broad understanding of the roles fungi play in various industries, ecosystems and human well-being.
 20. Students will become familiar with the principles and structure of the Rothmaler classification system specifically applied to bryophytes. They will understand the hierarchical organization of taxa and the criteria used to classify bryophytes into different groups.
 21. Students will be able to comprehend the alternation of generations in bryophytes, including the gametophyte and sporophyte stages and the transitions between them.
 22. Students will gain a comprehensive understanding of the different stages in the life cycle of Riccia, including the gametophyte and sporophyte phases. They will learn about the structures, functions and processes involved in each stage.
 23. Students will develop skills to assess the economic impact of bryophytes in various sectors, such as horticulture, agriculture, forestry and pharmaceutical industries.
 24. Students will acquire a thorough understanding of the G.M. Smith classification system, including its principles, groups, orders, families and genera.
 25. Students will be able to identify and describe the different stages of the Nephrolepis life cycle, including spore germination, gametophyte stage, fertilization and spore production.
 26. Students will be familiar with the economic uses of pteridophytes in industries such as agriculture, food, textile, medicine and paper production.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skillsના ગુણો ધરાવે છે?				No	
3	Major		Yes	Minor	No	
	Skill Enhancement Courses		No	Ability Enhancement Courses	No	
	Value Added Courses		No	Exit/ Vocational Courses	No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Theory Course content: Unit No., Topics, Hours and Marks			
Unit No.	Topics	Hours	Marks
1	Introductory Botany and basic techniques 1.1. Scope of Botany. 1.2. Branches of Botany. 1.3. Classification: Whittaker (Five Kingdom), Eicheler's Classification 1.4. Fixing agents and preservatives, stain and mounting media: 1.4.1. Fixing agents and preservatives: Carnoy's fluid, Formalin-acetic acid alcohol (FAA). 1.4.2. Recommended stains for: DNA, RNA, Nucleus, Nucleolus, Chromosomes, Cytoplasm, Suberized cell wall, Lignified cell wall, Cellulose cell wall, Cutinized cell wall, achromatic figure, Chitin, Proteins, Mitochondria, Plastids, Starch and glycogen, Polysaccharides, Lipid and Bacteria. 1.4.3. Recommended Stains and Mounting Media for: Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. 1.5. Microscopy: Principle, Structure and use of Dissecting and Compound microscope.	9	10
2	Microbes and Algae 2.1. Introduction to microbial diversity: Bacteria, Virus, Fungi, Archaeobacteria. 2.2. Ultra-structure of E. coli bacteria and T ₄ phages. 2.3. General characters of algae. 2.4. Classification of algae according to G. M. Smith. 2.5. Importance of Algae in human welfare.	9	10
3	Fungi 3.1. General characters of fungi. 3.2. Cell structure of fungi (yeast). 3.3. Classification of fungi according to Alexopoulos. 3.4. Different types of spores in fungi. 3.5. Economic importance of fungi.	9	10
4	Bryophyte 4.1. General Characters of bryophytes. 4.2. Classification of bryophytes by Rothmaller up to class. 4.3. Alternation of generation in Bryophytes. 4.4. Life history of Riccia. (Excluding development) 4.5. Economic importance of Bryophytes.	9	10
5	Pteridophytes 5.1. General characters of Pteridophytes. 5.2. Classification of Pteridophytes by G.M. Smith up to class. 5.3. Life history of Nephrolepis (Excluding development) 5.4. Economic importance of Pteridophytes.	9	10
Total		45	50



Reference Books:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
2. Anne. Regaed. , Kumaresan, V., Arumugam, N. (2014) Algae. Saras publication, Kattar P.O. Nagercoil, Tamilnadu. 1st edition.
3. Gangulee, H. C., Das, K. S., Dutta, C. (2005). College Botany Volume – 1. New Central Book Agency, India 1st edition.
4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Pteridophyta. Central Book Depot, Allahabad.
5. Singh, V., Pande, P. C., and Jain. D. K. (2015). A Text book of botany. Rastogi publications, Meerut, New Delhi. 4th edition.
6. Singh, V., Pande, P. C., Jain, D. K. (2014). A Text Book of Botany. Rastogi Publications, Meerut, New Delhi. 5th revised edition.
7. Smith, G. M. (1955). Cryptogamic Botany Vol. I Algae and Fungi. Tata McGrawhill Publishing Company Ltd., New Delhi. 2nd edition.
8. Vashishta, B.R. (1987). Botany for degree students - Algae. S. Chand and company (Pvt.)Ltd Ram Nagar-New Delhi. 7th edition.
9. Vashishta, B.R., Sinha, A.K. (2002). Botany for degree students. Fungi- S. Chand publication.
10. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Major (Core) Practical -1: Cryptogamic Botany Practical	
Course Category	Major (Core) Practical -1
Title of the Course	Cryptogamic Botany Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Practical Course Outcomes - COs	
On completion of the course, students are able to know:	
<ol style="list-style-type: none"> 1. Students will have gained the necessary knowledge and skills to prepare and utilize different types of stains effectively in their scientific work. 2. Students will be able to identify and differentiate the various parts of both dissecting and compound microscopes. 3. Students will develop the ability to identify and describe the morphological characteristics of various algae, such as Spirogyra, Sargassum, Nostoc and Batrachospermum. 4. Students will become familiar with the identification of common fungal species in various ecological niches, such as Yeast, Mucor, Agaricus and Peziza. 5. A comprehensive understanding of the morphology, internal structures, and reproductive structures of Riccia will have enabling students to identify and study this liverwort genus more effectively. 6. Students will be able to understand and describe the anatomy of Nephrolepis, including its key structures, functions and growth patterns. 7. Students will have a comprehensive understanding of the reproductive structures and mechanisms of Nephrolepis and their significance in the plant's life cycle and reproduction. 8. Due to the Field visits students will be able to explore different habitats, such as forests, wetlands, grasslands or coastal areas. They will learn about the unique plant species that thrive in each habitat and the specific adaptations that enable their survival. Understanding the relationship between plants and their habitats is a crucial outcome of a field visit. 	

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skillsનું ગુણો ધરાવે છે?	No				
3	Major	Yes	Minor	No		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No



5	દિવ્યાંગમાટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?	No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?	No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No

Practical course content	
Pr. No.	Practical
1	Study of preparation of different types of stains. (As per theory unit 1.4)
2	Study of different parts of dissecting microscope.
3	Study of different parts of compound microscope.
4	To study the identification of different type of algae (<i>Spirogyra</i> , <i>Sargassum</i> , <i>Nostoc</i> , <i>Batrachospermum</i>).
5	To study the identification of different type of fungi (<i>Yeast</i> , <i>Mucor</i> , <i>Agaricus</i> , <i>Peziza</i>)
6	Study of morphology – Dorsal and ventral side of <i>Riccia</i> .
7	Study of internal structures of <i>Riccia</i> .
8	Study of reproductive structures of <i>Riccia</i> .
9	Study of morphology of <i>Nephrolepis</i> .
10	Study of anatomy of <i>Nephrolepis</i> .
11	Study of reproductive structures of <i>Nephrolepis</i> .
12	Field visit for observing different habitat of Algae, Fungi, Bryophytes and Pteridophytes plants. (Forest/ sea costal area/near the bank of river/near water bodies)

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- I (NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Major -I: Cryptogrammic Botany Practical					
Time: -3 hours		Date: -----			
Total Marks: - 25					
Q-1	Identify and describe the given specimen “A” and “B”.			4 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the specimen “C” and “D” with diagrams.			4M	
	X		Y		
	C		C		
	D		D		
Q-3	Identify and describe the specimen “E”.			4M	
	X		Y		
	E		E		
Q-4	Rotation F and G.			3M	
	F				
	G				
Q-5	Viva+ Journal.			10M	

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: 3 Hours.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Major (Core) -2: Fundamental Botany – I theory	
Course Category	Major (Core) -2
Title of the Course	Fundamental Botany – I theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Theory Course Outcomes - COs

On completion of the course, students are able to know:

1. Students will be able to apply their understanding of the cell theory to explain biological phenomena, such as the structure and function of organs and tissues.
2. Students will be able to distinguish the key characteristics and structural differences between eukaryotic cells and prokaryotic cells.
3. Students will be able to explain the fundamental concepts related to cell function, including metabolism, homeostasis, cellular communication, reproduction and differentiation.
4. Students will be able to describe and explain the processes of mitosis and meiosis, including the events that occur during each stage, the roles of key cellular structures and the significance of these processes in the formation of new cells.
5. Students will be able to recognize the importance of mitosis for growth, tissue repair and asexual reproduction and the significance of meiosis for sexual reproduction and genetic variation.
6. Students will learn about the different types of electron microscopes, such as transmission electron microscopy (TEM) and scanning electron microscopy (SEM).
7. Students will gain knowledge of various cytochemical techniques used to study cellular components and their chemical composition.
8. Students will gain hands-on experience in cell fractionation, which involves separating cellular components based on their physical and biochemical properties. They will learn about different fractionation methods, such as differential centrifugation, density gradient centrifugation and chromatography techniques.
9. Students will be able to interpret pH measurements and analyze pH data to draw conclusions about acidity, alkalinity and acid-base equilibria in various samples or solutions.
10. Students will be able to familiar with various cell fractionation techniques, such as differential centrifugation, density gradient centrifugation and cell disruption methods (homogenization, sonication, etc.).
11. Students will able to know a fundamental understanding of how X-ray diffraction works and the underlying principles behind the technique.
12. Students have a solid foundation in cytochemistry techniques, will be able to apply their knowledge in further research or other professional pursuits related to cellular biology and biomedical sciences.
13. Students will become familiar with different chromatographic techniques, such as paper chromatography.
14. Students will gain a comprehensive understanding of the different modes of nutrition in plants



beyond the typical autotrophic mode. This includes knowledge of parasitic, carnivorous, mycotrophic, saprophytic, and symbiotic modes of nutrition.

15. Students will be able to explain the concept of autotrophic plants and their ability to produce their own food through photosynthesis.
16. Students will learn about heterotrophic plants that rely on obtaining nutrients from external sources. They will explore different types of heterotrophic plants, such as parasitic plants, saprophytic plants and mycotrophic plants.
17. Students will explore the fascinating world of insectivorous plants and their unique adaptations to capture and digest insects.
18. Students will develop a comprehensive understanding of plant taxonomy, including the classification and identification of different ecological plant groups. They will be able to differentiate between various plant families, genera and species based on their morphological and ecological characteristics.
19. Students with a comprehensive understanding of hydrophyte morphology and anatomy students will be able to study, classify and analyze aquatic plant species and their adaptations to different aquatic environments.
20. Students with a comprehensive understanding of the external features and anatomical adaptations of xerophytic plants, students will be able to appreciate the remarkable strategies employed by these plants to thrive in arid environments.
21. Students will gain a comprehensive understanding of the morphological and anatomical adaptations exhibited by halophytes to survive and thrive in saline environments.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skillsના ગુણો ધરાવે છે?				No	
3	Major	Yes	Minor		No	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Theory Course content: Unit No., Topics, Hours and Marks			
Unit No.	Topics	Hours	Marks
1	The Cell Unit of Life 1.1. Overview of cells 1.2. Cell theory 1.3. Prokaryotic plant cell 1.4. Eukaryotic plant cell 1.5. Functions of the plant cell	9	10
2	Cellular Reproduction 2.1. Phase of cell cycle 2.2. Mitosis in plants 2.3. Meiosis in plants 2.4. Difference between mitosis and meiosis. 2.5. Significance of Mitosis and Meiosis.	9	10
3	Tools and Techniques 3.1. Electron Microscopy (TEM and SEM) 3.2. Different basic techniques: 3.2.1. Basic concept of cytochemistry technique. 3.2.2. Basic concept of cell fractionation technique. 3.2.3. Basic concept of x –ray diffraction technique. 3.2.4. Chromatography (Paper chromatography technique.) 3.2.5. Concept of pH and pH meter	9	10
4	Special Mode of nutrition in Plants 4.1. Autotrophic plants 4.2. Heterotrophic plants 4.2.1. Parasitic plants (Cuscuta, Orobanche) 4.2.2. Saprophytic plants (Monotropa) 4.2.3. Symbiotic plants (Mycorrhiza) 4.2.4. Insectivores plants (Nepenthes, Drosera, Dionaea)	9	10
5	Ecological plant Groups 5.1. Morphology (External features) of Hydrophytes 5.2. Morphology (External features) of Xerophytes 5.3. Morphology (External features) of Halophytes 5.4. General anatomical characters of Hydrophytes 5.5. General anatomical characters of Xerophytes 5.6. General anatomical characters of Halophytes	9	10
	Total	45	50

Reference Books:

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Bendra. A and Pande. P (2013) Introductory Botany, Rastogi publication, Meerut.
3. Cell and Molecular Biology by Gupta, P.K. (2003). Rastogi Publications, Meerut.
4. Cell and Molecular Biology by Rastogi, S.C. (2003). New era International (Pvt.) Ltd., (4835/24, Ansari Road, Daryaganj New Delhi.)
5. Cell Biology, Genetics, Molecular Biology, Evaluation and Ecology by Verma, P.S. and Agarwal, V.K. (2006). S. Chand and Company Pvt. Ltd., New Delhi.
6. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA
7. Ecology and Environment by Sharma, P.D. (2005). Rastogi Publications, Shivaji Road, Meerut.



B.Sc. Honours/ Honours with Research in Botany Semester – I & II Syllabus as per NEP-2020.

8. Hardin, J., Becker, G., Skliensmith, L.J. (2012). *Becker's World of the Cell*, Pearson Education Inc. U.S.A. 8th edition.
9. Karp, G. (2010). *Cell Biology*, John Wiley & Sons, U.S.A. 6th edition.
10. Odum, E.P. (2005). *Fundamentals of ecology*. Cengage Learning India Pvt. Ltd., New Delhi.
11. *The Cell, A Molecular Approach* 5th Edition by Cooper, G.M. and Hausman, R.E. (2009). ASM Press Washington, D.C. 820 pp.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Major (Core) Practical -2: Fundamental Botany – I Practical	
Course Category	Major (Core) Practical -2
Title of the Course	Fundamental Botany – I Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Practical Course Outcomes - COs

On completion of the course, students are able to know:

1. Through the study of onion leaf peels, students will gain insights into the various functions performed by different cell components.
2. Students will develop the ability to observe and interpret the structures and behaviors of blue-green algae cells using permanent slides.
3. Students will become familiar with various homogenization techniques commonly used in plant extraction, such as mechanical homogenization, ultrasonication and high-pressure homogenization.
4. Students will develop practical skills in performing paper chromatography experiments, including the preparation of chromatography paper, sample application and running the chromatogram.
5. Students will gain a clear understanding of pH as a measure of acidity or alkalinity in a solution.
6. Students will gain a comprehensive understanding of the stages involved in both mitosis and meiosis, including prophase, metaphase, anaphase and telophase. They will be able to identify and describe the key events that occur during each stage.
7. Students will apply their understanding of autotrophic, heterotrophic and symbiotic plants to real-life scenarios, such as agriculture, conservation and ecological restoration.
8. Student will be able to compare and contrast the external features of hydrophytes, xerophytes and halophytes.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skillsનું ગુણો ધરાવે છે?	No				
3	Major	Yes	Minor	No		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	



7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No

Practical course content	
Pr. No.	Practical
1	The study of cell structure through onion leaf peel.
2	The Study of prokaryotic cell (blue green algae) through permanent slide / chart /fresh material.
3	To study the preparation of plant extract by homogenization techniques.
4	To study the separation of chloroplast (pigment) through paper chromatography techniques.
5	To study the measurement of pH.
6	To the study the mitosis through permanent slide.
7	To the study the meiosis through permanent slide.
8	To study the observation of autotrophic plant through chart/ photo/ fresh sample. (As per theory)
9	To study the observation of heterotrophic plant through chart/ photo/ fresh sample. (As per theory)
10	To study the observation of symbiotic plant through chart/ photo/ fresh sample. (As per theory)
11	To study the observation of insectivore's plant through chart/ photo/ fresh sample. (As per theory)
12	To Study the external features of hydrophytes. (<i>Hydrilla / Nymphae / Vallisneria</i>)
13	To Study the external features of xerophytes. (<i>Cactus / Cassuarina/ Aloe</i>)
14	To Study the external features of <i>Halophytes</i> . (<i>Avicennia/ Rhizophora/ Salicornia</i>)

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- I (NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Major -II: Fundamental Botany – I					
Time: - 3 hours		Date: -----			
			Total Marks: - 25		
Q-1	Identify and describe the given specimen “A” and “B”.			4 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the given specimen “C” and “D” with diagrams.			4M	
	X		Y		
	C		C		
	D		D		
Q-3	Preparation of plant extract by homogenization techniques.			4M	
	OR				
Q-3	Separation of chloroplast (pigment) through paper chromatography techniques.				
Q-4	Mount the cell structure from given material.			3M	
	OR				
Q-4	Measure the pH of given sample.				
Q-5	Viva+Journal.			10M	

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours.**



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- I

Minor (Elective) -1: Cryptogamic Botany Theory	
Course Category	Minor (Elective) -1
Title of the Course	Cryptogamic Botany Theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Theory Course Outcomes - COs

On completion of the course, students are able to know:

1. Scope of Botany will be providing a foundation for students to pursue further studies or careers in various areas related to botany, including plant biology, ecology, agriculture, horticulture, forestry, conservation and biotechnology.
2. knowledge of different branches of botany students will be able to choose their future carrier.
3. Students will be able to explain the progression of plant classification systems over time, including the five-kingdom plant classification proposed by Whittaker and its limitations.
4. Students will gain a comprehensive understanding of plant taxonomy and the principles underlying the Eichler system of plant classification. They will learn about the hierarchical organization of plants into different taxonomic ranks, including families, orders, classes and divisions.
5. Students will be able to recognize and differentiate between different types of fixing agents and preservatives used in plant material.
6. Students will be able to know fundamental principles behind mounting media, including their purpose, composition and specific applications in microscopy.
7. By using different stains and mounting media students will be obtaining valuable information about plant morphology, anatomy and cellular composition.
8. The use of stains in botany leads to a deeper understanding of plant cell structure, tissue organization, and physiological processes. Students will be able to with a solid foundation for further studies in botany, plant biology and related fields.
9. Students will gain a comprehensive understanding of the structure and function of a dissecting microscope, including its various components such as the eyepiece, objective lenses stage, and illumination system.
10. Students will acquire knowledge about the principles and components of a compound microscope, including the eyepiece, objective lenses, condenser, diaphragm and stage.
11. Students will be able to distinguish between different types of microorganisms, including bacteria, viruses, fungi and archaeobacteria, based on their structural and functional characteristics.
12. Students will equip with a solid foundation in the ultrastructure, function and interactions of E. coli bacteria and T₄ phages, enabling them to pursue further research, careers in microbiology and virology.
13. Students will be able to identify and classify different types of algae, including their morphological and physiological characteristics.
14. Students will be able to identify and differentiate between the major divisions of algae according



to the G. M. Smith classification. They will learn to recognize key features and traits associated with each division, such as pigmentation, cell structure and reproductive structures.

15. Students will develop an understanding of the importance of algae in various aspects of human welfare, including food, medicine, energy production, pollution control and environmental sustainability.
16. Students will gain a solid understanding of the fundamental aspects of yeast cell structure, including the major organelles and their functions.
17. Students will learn about the hierarchical structure of the Alexopoulos classification system, including the division of fungi into phyla, classes, orders, families, genera and species.
18. Students will gain a comprehensive understanding of the biology of fungal spores, including their formation, structure and function.
19. The economic importance of fungi will provide students with a broad understanding of the roles fungi play in various industries, ecosystems and human well-being.
20. Students will become familiar with the principles and structure of the Rothmaler classification system specifically applied to bryophytes. They will understand the hierarchical organization of taxa and the criteria used to classify bryophytes into different groups.
21. Students will be able to comprehend the alternation of generations in bryophytes, including the gametophyte and sporophyte stages and the transitions between them.
22. Students will gain a comprehensive understanding of the different stages in the life cycle of Riccia, including the gametophyte and sporophyte phases. They will learn about the structures, functions and processes involved in each stage.
27. Students will develop skills to assess the economic impact of bryophytes in various sectors, such as horticulture, agriculture, forestry and pharmaceutical industries.
28. Students will acquire a thorough understanding of the G.M. Smith classification system, including its principles, groups, orders, families and genera.
29. Students will be able to identify and describe the different stages of the Nephrolepis life cycle, including spore germination, gametophyte stage, fertilization and spore production.
30. Students will be familiar with the economic uses of pteridophytes in industries such as agriculture, food, textile, medicine and paper production.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skillsનાગુણો ધરાવે છે?				No	
3	Major	No	Minor		Yes	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Theory Course content: Unit No., Topics, Hours and Marks			
Unit No.	Topics	Hours	Marks
1	Introductory Botany and Basic techniques 1.1. Scope of Botany. 1.2. Branches of Botany. 1.3. Classification: Whittaker (Five Kingdom), Eicheler's Classification 1.4. Fixing agents and preservatives, stain and mounting media: 1.4.1. Fixing agents and preservatives: Carnoy's fluid, Formalin-acetic acid alcohol (FAA). 1.4.2. Recommended stains for: DNA, RNA, Nucleus, Nucleolus, Chromosomes, Cytoplasm, Suberized cell wall, Lignified cell wall, Cellulose cell wall, Cutinized cell wall, achromatic figure, Chitin, Proteins, Mitochondria, Plastids, Starch and glycogen, Polysaccharides, Lipid and Bacteria. 1.4.3. Recommended Stains and Mounting Media for: Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. 1.5. Microscopy: Principle, Structure and use of Dissecting and Compound microscope.	9	10
2	Microbes and Algae 2.1. Introduction to microbial diversity: Bacteria, Virus, Fungi, Archaeobacteria. 2.2. Ultra-structure of E. coli bacteria and T ₄ phages. 2.3. General characters of algae. 2.4. Classification of algae according to G. M. Smith. 2.5. Importance of Algae in human welfare.	9	10
3	Fungi 3.1. General characters of fungi. 3.2. Cell structure of fungi (yeast). 3.3. Classification of fungi according to Alexopoulos. 3.4. Different types of spores in fungi. 3.5. Economic importance of fungi.	9	10
4	Bryophyte 4.1. General Characters of bryophytes. 4.2. Classification of bryophytes by Rothmaller up to class. 4.3. Alternation of generation in Bryophytes. 4.4. Life history of Riccia. (Excluding development) 4.5. Economic importance of Bryophytes.	9	10
5	Pteridophytes 5.1. General characters of Pteridophytes. 5.2. Classification of Pteridophytes by G.M. Smith up to class. 5.3. Life history of Nephrolepis (Excluding development) 5.4. Economic importance of Pteridophytes.	9	10
	Total	45	50

Reference Books:

- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.



2. Anne. Regaed. , Kumaresan, V., Arumugam, N. (2014) Algae. Saras publication, Kattar P.O. Nagercoil, Tamilnadu. 1st edition.
3. Gangulee, H. C., Das, K. S., Dutta, C. (2005). College Botany Volume – 1. New Central Book Agency, India 1st edition.
4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Pteridophyta. Central Book Depot, Allahabad.
5. Singh, V., Pande, P. C., and Jain. D. K. (2015). A Text book of botany. Rastogi publications, Meerut, New Delhi. 4th edition.
6. Singh, V., Pande, P. C., Jain, D. K. (2014). A Text Book of Botany. Rastogi Publications, Meerut, New Delhi. 5th revised edition.
7. Smith, G. M. (1955). Cryptogamic Botany Vol. I Algae and Fungi. Tata McGrawhill Publishing Company Ltd., New Delhi. 2nd edition.
8. Vashishta, B.R. (1987). Botany for degree students - Algae. S. Chand and company (Pvt.)Ltd Ram Nagar-New Delhi. 7th edition.
9. Vashishta, B.R., Sinha, A.K. (2002). Botany for degree students. Fungi- S. Chand publication.
10. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Minor (Elective) Practical -1: Cryptogamic Botany Practical	
Course Category	Minor (Elective) Practical -1
Title of the Course	Cryptogamic Botany Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Practical Course Outcomes - COs	
On completion of the course, students are able to know:	
<ol style="list-style-type: none"> 1. Students will have gained the necessary knowledge and skills to prepare and utilize different types of stains effectively in their scientific work. 2. Students will be able to identify and differentiate the various parts of both dissecting and compound microscopes. 3. Students will develop the ability to identify and describe the morphological characteristics of various algae, such as Spirogyra, Sargassum, Nostoc and Batrachospermum. 4. Students will become familiar with the identification of common fungal species in various ecological niches, such as Yeast, Mucor, Agaricus and Peziza. 5. A comprehensive understanding of the morphology, internal structures, and reproductive structures of Riccia will have enabling students to identify and study this liverwort genus more effectively. 6. Students will be able to understand and describe the anatomy of Nephrolepis, including its key structures, functions and growth patterns. 7. Students will have a comprehensive understanding of the reproductive structures and mechanisms of Nephrolepis and their significance in the plant's life cycle and reproduction. 8. Due to the Field visits students will be able to explore different habitats, such as forests, wetlands, grasslands or coastal areas. They will learn about the unique plant species that thrive in each habitat and the specific adaptations that enable their survival. Understanding the relationship between plants and their habitats is a crucial outcome of a field visit. 	

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?	No				
3	Major	No	Minor	Yes		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No



5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?	No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?	No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No

Practical course content	
Pr. No.	Practical
1	Study of preparation of different types of stains. (As per theory unit 1.4)
2	Study of different parts of dissecting microscope.
3	Study of different parts of compound microscope.
4	To study the identification of different type of algae (<i>Spirogyra</i> , <i>Sargassum</i> , <i>Nostoc</i> , <i>Batrachospermum</i>).
5	To study the identification of different type of fungi (<i>Yeast</i> , <i>Mucor</i> , <i>Agaricus</i> , <i>Peziza</i>)
6	Study of morphology – Dorsal and ventral side of <i>Riccia</i> .
7	Study of internal structures of <i>Riccia</i> .
8	Study of reproductive structures of <i>Riccia</i> .
9	Study of morphology of <i>Nephrolepis</i> .
10	Study of anatomy of <i>Nephrolepis</i> .
11	Study of reproductive structures of <i>Nephrolepis</i> .
12	Field visit for observing different habitat of Algae, Fungi, Bryophytes and Pteridophytes plants. (Forest/ sea costal area/near the bank of river/near water bodies)

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- I (NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Minor -1: Cryptogrammic Botany					
Time: - 3 hours		Date: -----	Total Marks: - 25		
Q-1	Identify and describe the given specimen “A” and “B”.			4M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the specimen “C” and “D” with diagrams.			4M	
	X		Y		
	C		C		
	D		D		
Q-3	Identify and describe the specimen “E”.			4M	
	X		Y		
	E		E		
Q-4	Rotation F and G.			3M	
	F				
	G				
Q-5	Viva + Journal.			10M	

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours.**



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester-I

Multi-Disciplinary Course -1 (MDC -1): Botany: Introduction to Biology-I Theory	
Course Category	Multi-Disciplinary Course -1 (MDC -1)
Title of the Course	Botany: Introduction to Biology-I Theory
Course Credit	03
Teaching Hours per Semester (15 week / 90 working days)	45
Total Marks	50

Theory Course Outcomes

On the completion of course, students are able to know:

1. Studying the contributions of the scientists in biology not only imparts knowledge about specific discoveries to students but also teaches them critical thinking, scientific methodology and the collaborative nature of scientific progress.
2. Students will be able to explain the progression of plant classification systems over time, including the Five Kingdom Plant Classification proposed by Whittaker and its limitations.
3. Students will be able to apply their understanding of the cell theory to explain biological phenomena, such as the structure and function of organs and tissues.
4. Students will be able to distinguish the key characteristics and structure of eukaryotic cells and prokaryotic cells.
5. They will understand the world of microbes, fungi and lichens.
6. Studying bacterial morphology can help students recognize and understand the differences between harmless and harmful bacteria and they also gain a comprehensive understanding of the diverse world of bacteria and their significance in various aspects of life, health and the environment.
7. Student will be able to understand molecular biology, genetics, and cellular processes of virus. Studying the structure of the Tobacco Mosaic Virus can provide students with insights into basic virology concepts, genetic material, self-assembly, host-pathogen interactions, disease mechanisms and the broader implications of virus research in various fields.
8. Students will gain a solid understanding of the fundamental aspects of yeast cell structure, including the major organelles and their functions.
9. They will be able to understand the pattern of inheritance in various life forms through genetics.
10. They develop strong fundamentals basics for further molecular studies.
11. Students will be able to understand the various basic physiological processes in plants which is useful to give the idea for the plants and plant cells in relation to water.
12. Student will gain knowledge about soil water which is useful for agricultural Productivity, Water Resource Management, Soil Conservation and Environmental Impact.



1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skillsના ગુણો ધરાવે છે?				No	
3	Major	No	Minor		No	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	Yes	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	

Theory Course content: Unit No., Topics, Hours and Marks			
Unit No.	Topics	Hours	Marks
1	Fundamental biology 1.1. Contributions of Aristotle in biology. 1.2. Works of Louis Pasteur and Robert Koch, Robert Hooke and Antonie van Leeuwenhoek 1.3. Principles of systematics: Linnaean classification and taxonomic hierarchy. 1.4. Five kingdom classification of R. H. Whittaker. 1.5. Eichler's classification of plants.	9	10
2	The Cell 2.1. Cell theory and cell as the basic unit of life. 2.2. Difference between prokaryotic and eukaryotic cell. 2.3. Plant cell and animal cell. 2.4. Functions of cells.	9	10
3	Microbiology 3.1. Introduction to akryotes, virus, archea & bacteria, cyanobacteria. 3.2. Types of bacteria. 3.3. Introduction of virus: Structure of Tobacco Mosaic Virus. 3.4. Ultra-Structure of Cyanobacteria. 3.5. Ultra-Structure of Yeast cell.	9	10
4	Genetics 4.1. Basic Concept of Gene. 4.2. Mendelian laws of hereditary: Mono hybrid cross, Di	9	10



	hybrid cross. 4.3. Structure of DNA. 4.4. Types of RNA.		
5	Osmotic relation of plant cell. 5.1. Basic concept of Osmosis and its significance in plants. 5.2. Basic concept of Diffusion and its significance in plants 5.3. Basic concept of Imbibition and its significance in plants 5.4. Difference between Plasmolysis and Deplasmolysis. 5.5. Permeability of membrane and its factor affecting. 5.6. Types of Soil water.	9	10
	Total	45	50

Reference Books:

1. A text book of Botany by Singh, V. C, Pandey. P.C. and Jain. D. K. Rastogi Publication, Meerut.
2. An Introduction to Embryophyta 5th Edition by N.S., Parihar (1965). Central Book Deport, Allahabad, India
3. Cell and Molecular Biology by Gupta, P.K. (2003). Rastogi Publications, Meerut.
4. Cell Biology, Genetics, Molecular Biology, Evaluation and Ecology by Verma, P.S. and Agarwal, V.K. (2006). S. Chand and Company Pvt. Ltd., New Delhi.
5. Microbiology by Pelezar Michael, J., Chan, E.C.S. and Krieg Noel, R., Tata Mcgraw Hill Publishing Company, Ltd.
6. Modern Genetics Anaysis: Integrating Genes and Genomes, by Griffith, J.F., Gelbart, M., Lewontin, C and Miller, W.H. Freeman and Company, New York, USA.
7. Plant Physiology & Development by Taiz et.al. (2015), 6th Edition, Sinauer Associates Inc. USA.
8. Plant Physiology and Biochemistry by H.S. Srivastava (2008), Rastogi Publication, Meerut.
9. Plant Physiology by Pandey, S.N. and Sinha, B.K. (2009). Vikas Publishing House, Pvt. Ltd. New Delhi
10. Principles of Genetics, Snustad and Simmons, John Wiley & Sons, USA
11. Text book of microbiology. Trivedi, P.C., Pandey, S. and Bhadauria, S., 2010.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- I

Multi -Disciplinary Course -1 (MDC-1): Botany-1P: Introduction to Biology Practical-I	
Course Category	Multi -Disciplinary Course -1 (MDC-1)
Title of the Course	Botany-1P: Introduction to Biology Practical-I
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Practical Course Outcomes - COs

On completion of the course, students are able to know:

1. Students will develop the ability to identify and describe the morphological characteristics of various algae, such as Sargassum, Mucor, Funaria, Nephrolepis, Cycus, Hibiscus
2. Through the study of onion leaf peels, students will gain insights into the various functions performed by different cell components.
3. Students will develop the ability to observe and interpret the structures and behaviors of blue-green algae cells using permanent slides.
4. Student can get understanding the structure, function, and significance of prokaryotic cells in various biological contexts, including health, ecology, industry, and research.
5. Morphology refers to the size, shape, arrangement, and structure of bacterial cells, and studying these changes can provide valuable insights into the behavior and outcome of bacterial infections.
6. Students can learn several important concepts from experiments that explore Imbibition, osmosis, diffusion and plasmolysis process.
7. Students will gain hands-on experience with laboratory techniques, including using solutions of different concentrations.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?			Yes		
2	Value added Courses Imparting Transferable and Life Skillsનું ગુણો ધરાવે છે?			No		
3	Major	No	Minor	No		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	Yes	Interdisciplinary	No



5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?	No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?	No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No

Practical course content	
Pr. No.	Practical
1	To study the identification of different type of organism (<i>Sargassum, Mucor, Funaria, Nephrolepis, Cycus, Hibiscus</i>) through fresh material.
2	To study the cell structure through onion leaf peel.
3	To study the cell structure through chick cell.
4	To study prokaryotic cell (blue green algae) through permanent slide / chart /fresh material.
5	To study Morphological characters of bacteria through permanent slide.
6	To demonstrate the phenomenon of imbibition.
7	To demonstrate the phenomenon of diffusion.
8	To demonstrate the phenomenon of osmosis through thistle funnel experiment.
9	To study the phenomenon of plasmolysis through Tradescantia leaf.
10	To study the effect of temperature on the permeability of plasma membrane.

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- I (NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Minor -1: Cryptogrammic Botany					
Time: - 3 hours		Date: -----		Total Marks: - 25	
Q-1	Identify and describe the given specimen “A” and “B”.				4M
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the specimen “C” and “D” with diagrams.				4M
	X		Y		
	C		C		
	D		D		
Q-3	Identify and describe the specimen “E”.				4M
	X		Y		
	E		E		
Q-4	Rotation F and G.				3M
	F				
	G				
Q-5	Viva + Journal.				10M

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours.**



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Skill Enhancement Course -1 (SEC-1): Principle of organic farming	
Course Category	Skill Enhancement Course -1 (SEC-1)
Title of the Course	Principle of organic farming Theory
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	15
Total Marks	25

Practical Course Outcomes - COs

On completion of the **Principle of organic farming** course, students are able to know:

1. Students will be able to well-rounded understanding of organic farming principles, methods, and applications, enabling them to make informed decisions and contribute positively to sustainable agriculture.
2. Students will be equipped with knowledge and skills to apply sustainable agricultural practices that enrich the soil, manage temperature, conserve soil and rainwater and harness solar energy for a more resilient and environmentally friendly farming system.
3. Students will be equipped with the knowledge and practical skills necessary to apply green manure and farm yard manure practices effectively in agricultural settings.
4. Participants will explore the ecological and agronomic advantages of using bio-gas slurry and biodynamic compost in crop production.
5. Students will be aware of the nutrient cycling process in organic farming systems and how biofertilizers interact with other components, such as organic matter and compost, to enhance nutrient availability for plants.
6. Students will be able to make informed decisions about when and how to apply green leaf manuring techniques based on their understanding of soil health, ecological dynamics and crop management principles in organic farming.
7. Students will study how neem extract, cow urine, and other natural substances can be used for pest and disease management in plants and animals.
8. Students will be able to recognize and differentiate between various weed control tools like Country Plough II, Melur Plough, Small Handle Hoe, Weed Removing Tool and Spade Weeder, understanding their specific purposes and how to use them effectively.
9. Students will be able to knowledge and skills needed to implement environmentally friendly and sustainable agricultural practices, including the use of natural inputs like Panchagavya, Beejamrut, and Jeevamrut.
10. A field visit to an organic farm aim to educate and empower participants to make informed decisions about organic farming practices, promote sustainable agriculture and contribute to a healthier and more environmentally friendly food system.



1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?				No	
3	Major	No	Minor	No		
	Skill Enhancement Courses	Yes	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	

Theory Course content: Unit No., Topics, Hours and Marks			
Unit No.	Topics	Hours	Marks
1	Introduction and Components of organic farming: 1.1. Introduction, definition and principles of organic farming. 1.2. Components of organic farming: Enrichment of soil, Management of temperature, Conservation of soil and rain water, Harvesting of sun energy, Self-reliance in inputs and Maintenance of life forms. 1.3. Organic Farming component vs Conventional Farming component.	5	10
2	Nutrients, Pest, and diseases management: 2.1. Nutrient preparation methods: Bio-gas slurry and Biodynamic Compost (BD- 501 to BD- 507), Green Manure and Farm Yard Manure (FYM). 2.2. Bio fertilizers: Nitrogen fixer bacteria, Azolla, Mycorrhiza and plant growth promoting rhizobacteria. 2.3. Pest and diseases controller such as Cow urine + Neem extract, cow dung smoking, Neem cake application, seed treatment with cow urine.	5	10
3	Weed management and extract Preparation: 3.1. Weed management tools: Country plough II, Melur plough, Small handle hoe, weed removing tool and Spade weeder. 3.2. Preparation and production cost of panchagavya, Beejamrut, Jeevamrut, Dasparni and Neem seed extract in organic farming.	5	5
	Total	15	25



Reference Books:

1. Chandra, K. 2005. Organic Manures. In: Proceedings of Training programme on Production & Quality Control of Organic Inputs., Regional Centre of Organic Farming, Bangalore-24. pp 1-45.
2. <https://bscagristudy.online/wp-content/uploads/2021/03/AGRO-248-PRACTICAL-MANUAL.pdf.pdf>
3. <https://ncof.dacnet.nic.in/uploads/ebook/NoPDFpdf-2a74a7859fdf29e0bf8e66b1df3461e8.pdf>
4. Linker, H. M. D. B.; Orr, D.B. and Barbercheck, M. E. (2014) Insect Management on Organic Farms. North Carolina Cooperative Extension Service. 36p.
5. NPOP (2014). National Programme for Organic Farming, Ministry of Commerce, New Delhi.
6. Rao, A.N. and Nagamani, N. 2010. Integrated Weed Management in India–Revisited. Indian J. Weed Sci. 42 (3 & 4): 123-135.
7. Rathore, S.S., Krose, N., Moe, N. Shekhawat, K. and Bhatt, B.P. 2012. Weed management through salt application: an indigenous method from shifting cultivation area, Eastern Himalaya, India. Indian Journal of Traditional Knowledge 11(2): 254-357.
8. Wiese, A.F., J.M. Sweeten, B.W. Bean, C.D. Salisbury, and E.W. Chenault. 1998. High temperature composting of cattle feedlot manure kills weed seed. Applied Engineering in Agriculture. 14(4):377-380.
9. Yadav, A. K. (2011). Organic management an integrated approach. In: Recent Developments in organic Farming (Eds. J.M.L.Gulati and T. Barik). OUAT, Bhubaneswar – 751 003.pp: 178-199.
10. Yadav, A.K. (2010). Training Manual on Certification and Inspection Systems in Organic Farming in India. National Centre of Organic Farming CGO-II, Kamla Nehru Nagar, Ghaziabad, UP – 201 002.



B.Sc. Honours/ Honours with Research in Botany Semester-I
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -I

Skill Enhancement Course -1 (SEC-1): Principle of organic farming	
Course Category	Skill Enhancement Course -1 (SEC-1)
Title of the Course	Principle of organic farming Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Practical Course Outcomes - COs

On completion of the Mushroom cultivation Practical course, students are able to know:

1. Students will be equipped with the knowledge and practical skills necessary to apply green manure and farm yard manure practices effectively in agricultural settings.
2. Participants will explore the ecological and agronomic advantages of using bio-gas slurry and biodynamic compost in crop production.
3. Students will be aware of the nutrient cycling process in organic farming systems and how biofertilizers interact with other components, such as organic matter and compost, to enhance nutrient availability for plants.
4. Students will study how neem extract, cow urine, and other natural substances can be used for pest and disease management in plants and animals.
5. Students will be able to recognize and differentiate between various weed control tools like Country Plough II, Melur Plough, Small Handle Hoe, Weed Removing Tool and Spade Weeder, understanding their specific purposes and how to use them effectively.
6. Students will be able to knowledge and skills needed to implement environmentally friendly and sustainable agricultural practices, including the use of natural inputs like Panchagavya, Beejamrut, and Jeevamrut.
7. A field visit to an organic farm aim to educate and empower participants to make informed decisions about organic farming practices, promote sustainable agriculture and contribute to a healthier and more environmentally friendly food system.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?	No				
3	Major	No	Minor	No		
	Skill Enhancement Courses	Yes	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No



5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે ?	No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?	No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No
8	ઈન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No

Practical course content	
Pr.No.	Practical
1	Study the nutrient preparation methods: Green Manure, Farm Yard Manure (FYM) and Compost.
2	Study the nutrient preparation methods: Bio-gas slurry and Biodynamic Compost (BD).
3	Study the indigenous technology knowledge for weed management by chart /PPT (Country plough II, Melur plough, Small handle hoe, weed removing tool and Spade weeder).
4	Study the methods of preparation and production cost of Panchagavya in organic farming.
5	Study the methods of preparation and production cost of Beejamrut in organic farming.
6	Study the methods of preparation and production cost of Jeevamrut in organic farming.
7	Study the method of preparation and production cost of Dasparni in organic farming.
8	Study the method of preparation and production cost of Neem seed extract in organic farming.
9	Visit the organic farm to study various components and their utilization.

Reference Books:

1. Chandra, K. 2005. Organic Manures. In: Proceedings of Training programme on Production & Quality Control of Organic Inputs., Regional Centre of Organic Farming, Bangalore-24. pp 1-45.
2. <https://bscagristory.online/wp-content/uploads/2021/03/AGRO-248-PRACTICAL-MANUAL.pdf.pdf>
3. <https://ncof.dacnet.nic.in/uploads/ebook/NoPDFpdf-2a74a7859fdf29e0bf8e66b1df3461e8.pdf>
4. Linker, H. M. D. B.; Orr, D.B. and Barbercheck, M. E. (2014) Insect Management on Organic Farms. North Carolina Cooperative Extension Service. 36p.
5. NPOP (2014). National Programme for Organic Farming, Ministry of Commerce, New Delhi.
6. Rao, A.N. and Nagamani, N. 2010. Integrated Weed Management in India–Revisited. Indian J. Weed Sci. 42 (3 & 4): 123-135.
7. Rathore, S.S., Krose, N., Moe, N. Shekhawat, K. and Bhatt, B.P. 2012. Weed management through salt application: an indigenous method from shifting cultivation area, Eastern Himalaya, India. Indian Journal of Traditional Knowledge 11(2): 254-357.
8. Wiese, A.F., J.M. Sweeten, B.W. Bean, C.D. Salisbury, and E.W. Chenault. 1998. High temperature composting of cattle feedlot manure kills weed seed. Applied Engineering in Agriculture. 14(4):377-380.
9. Yadav, A. K. (2011). Organic management an integrated approach. In: Recent Developments in organic Farming (Eds. J.M.L.Gulati and T. Barik). OUAT, Bhubaneswar – 751 003.pp: 178-199.
10. Yadav, A.K. (2010). Training Manual on Certification and Inspection Systems in Organic Farming in India. National Centre of Organic Farming CGO-II, Kamla Nehru Nagar, Ghaziabad, UP – 201 002.



B.Sc. Honours/ Honours with Research in Botany Semester-I (NCrF Level- 4.5 First Year – Certificate in Botany)				
SAURASHTRA UNIVERSITY RAJKOT				
Practical Skeleton: SEC-1: Principal of organic farming Practical				
Time: - 1.5 hours		Date: -----		
			Total Marks: - 10	
Q-1	Describe the nutrient preparation methods: “A” and “B”. (Green Manure, Farm Yard Manure (FYM), Compost, Bio-gas slurry and Biodynamic Compost (BD)).			2M
	X		Y	
	A		A	
	B		B	
Q-2	Describe the indigenous technology knowledge for weed management: “C” and “D”. (Country plough II, Melur plough, Small handle hoe, weed removing tool and Spade weeder).			2M
	X		Y	
	C		C	
	D		D	
Q-3	Describe the methods of preparation and production cost of Panchagavya/ Beejamrut / Jeevamrut specimen “E”.			1M
	X		Y	
	E		E	
Q-4	Viva + Journal			5M

Note:

1. University will arrange practical and viva evaluation by internal faculty and external evaluator.
2. Marks of practical and viva will be considered under CCE.

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **1.5** Hours.



B.Sc. Honours/ Honours with Research in Botany Semester-II

(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- II

Course Category	Major (Core) -3
Title of the Course	Phanerogams and Medicinal Botany Theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Course Outcomes - COs

On completion of the course, students are able to know

1. Students will become familiar with the major groups of gymnosperms and their characteristics.
2. Students will be able to identify and describe the major groups of Bierhorst Classification of Gymnosperms, including Cycadopsida, Coniferopsida and Gnetopsida. Student will be familiar with the characteristics and distinguishing features of each group.
3. Students will be able to describe and differentiate the different stages of the cycas life cycle, from germination and seedling development to maturity and eventual reproduction. They will learn about the specific characteristics and changes that occur in each life stage.
4. Students will be able to categorize plants into different groups based on their growth habits (e.g., trees, shrubs, herbs) and their natural habitats (e.g., aquatic, desert, forest).
5. Students will be able to recognize and differentiate types of roots and stems in various plant species.
6. Students will be able to identify different types of roots, stems, and leaves of various plant species. They will learn to recognize the characteristic features and variations in vegetative morphology.
7. Students will be acquiring the knowledge of different definition such as bract, pedicel, symmetry, sexuality, hypogynous, epigynous and perigynous.
8. Students with a solid foundation in the study of calyx, enabling them to understand the importance of this plant structure in reproduction.
9. Students will gain knowledge about the various types of corollas found in different plant species, including variations in shape, size, and color, and how these characteristics relate to pollination strategies.
10. Students will understand the role of the corolla and other flower parts in the reproductive process of plants.
11. Students will explore the diverse range of perianth structures found in different



plant species. They will study the morphological variations in perianth organs and their significance in plant adaptation, and reproduction.

12. Students will be able to recognize the different components of the androecium, such as stamens, anther, and filament. They should understand the role of androecium in the overall process of plant reproduction.
13. Students will be able to identify and label the various components of the gynoecium, including the stigma, style, and ovary. They should understand their morphological features and their roles in reproduction.
14. Students will be able to recognize and label the different parts of a typical flower, including petals, sepals, stamens, pistils (carpel), ovules, and receptacle.
15. Students will gain a comprehensive understanding of different inflorescence types, including racemes, Cymose and special types – Cyathium, Verticillate, Hypanthodium. They will be able to identify and describe the characteristics of each type.
16. Students will be able to read and interpret floral formulae, which are concise representations of floral structures and their relationships.
17. Students will learn how to create accurate floral diagrams to visually represent the arrangement and organization of floral parts within a flower.
18. To create awareness amongst students about various plant parts used for therapeutic purpose or used as precursors for synthesis of useful drugs.
19. Studying the medicinal value of Neem, Tulsi, Aloe Vera, Turmeric and Amla, can provide students with a comprehensive understanding of their therapeutic applications, enabling them to recommend and use these natural remedies for various health conditions.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?				No	
3	Major	Yes	Minor		No	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Unit No.	Topics	Hours	Marks
1	Gymnosperms 1.1. General characters of Gymnosperms 1.2. Classification of Gymnosperms by Bierhorst up to class 1.3. Life history of Cycas (Excluding development)	9	10
2	Vegetative Morphology 2.1. Habit, Habitat of plants 2.2. Root and Stem (Excluding modification) 2.3. Parts of leaf; phyllotaxy; types of leaves; venation. 2.4. Leaf shapes; leaf margin; leaf apex.	9	10
3	Reproductive Morphology – I 3.1. Inflorescences: Racemose and Cymose and special types – Cyathium, Verticillate, Hypanthodium, 3.2. Typical Flowers 3.3. Definition: bract; pedicel; symmetry; sexuality; hypogynous; epigynous; perigynous. 3.4. Calyx: function and types. 3.5. Corolla: function, forms and aestivation.	9	10
4	Reproductive Morphology – II 4.1. Introduction of Perianth 4.2. Androecium: Parts of a Stamen, Attachment of stamen, Types of stamen. 4.3. Gynoecium: Parts of carpels; Types of gynoecium; placentation. 4.4. Floral formula 4.5. Floral diagram	9	10
5	Medicinal Botany 5.1. Definition, history of medicinal plant. 5.2. Study of following medicinal plants (Morphology, parts used, chemical constituents, uses) <ul style="list-style-type: none"> 5.2.1. Neem 5.2.2. Tulsi 5.2.3. Aloe 5.2.4. Turmeric 5.2.5. Amla 	9	10
Total		45	50

Reference Books:

1. Sundara Rajan, S., (1996). Introductory Taxonomy of Angiosperms. Himalaya



- PublishingHouse, Bombay/Delhi/Nagpur. 1st edition.
2. Datta, S. C. (1988). Systematic botany. Wiley eastern limited- New Delhi.4th edition.
 3. Pandey, B.P. (1999). Taxonomy of Angiosperms. For university student. S. Chandand Com. Ltd, New Delhi 1st edition reprints.
 4. Kumaresan Annie. (2010.) Taxonomy of Angiosperms. Saras publication, Nagarcoil Tamilnadu. 3rd edition.
 5. Sutariya, R. N. (1958). A text book of Systematic Botany. Khadayata Book Depot, Ahmedabad. 2nd edition.
 6. Singh,V. and Jain, D. K. (1996). Taxonomy of Angiosperms. Rastogi publications, Meerut, India. 2nd edition
 7. Economic Botany by A.F. Hill & O.P. sharma Tata McGraw Hill, New Delhi.
 8. Sen, S. 1992. Economic Botany, New Central Book Agency, Calcutta.
 9. Verma, V. 1974. A Textbook of Economic Botany, Emcay Publication, New Delhi.
 10. Kochar, S.L. 2011. Economic Botany in the Tropics, 4th edition, Mc Millan Publications, New Delhi.



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Major (Core) Practical -3
Title of the Course	Phanerogams and Medicinal Botany Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Course Outcomes - COs

On completion of the course, students are able to know

1. A comprehensive understanding of the morphology and anatomy of Cycas, enabling them to appreciate the diversity and adaptations of this ancient plant genus and apply their knowledge to various disciplines within plant biology.
2. Students will learn about the specific reproductive structures of Cycas, including male and female cones. They will study the structure and functions of these cones in the reproductive cycle of Cycas.
3. Morphological studies of different parts of angiosperm leaves provide valuable information about plant taxonomy, ecological adaptations, and physiological functions. They contribute to our understanding of plant diversity and their interactions with the environment.
4. Students will explore the morphological characteristics of leaves, including their Types of leaf, Phyllotaxy, Leaf margin, Leaf Apex, Leaf Shape.
5. floral morphology knowledge students able to apply them to understand the diversity, adaptation, and evolutionary significance of angiosperm flowers.
6. Students will equip with a solid foundation of knowledge on Tulsi, Aloe Vera, and Neem, allowing to appreciate their medicinal value, make informed decisions regarding their use, and potentially explore further research or applications in the field of herbal medicine.
7. Students will explore the medicinal properties of Turmeric, Amla, and Hibiscus. They will learn about the active compounds present in these plants, such as curcumin in Turmeric, vitamin C in Amla, and anthocyanins in Hibiscus.
8. The field visit, students understanding of the morphological characteristics of phanerogams and medicinal plants, their identification, and the practical applications of this knowledge in the field of medicinal plant research and conservation.



1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?	No				
3	Major	Yes	Minor	No		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગમાટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?	No				
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?	No				
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?	No				
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No				

Pr. No.	Practical
1	Study of morphology and anatomy of Cycas.
2	Study of reproductive structures of Cycas.
3	Morphological studies of different parts of leaf.
4	Morphological studies of different plants parts – Types of leaf.
5	Morphological studies of different plants parts – Phyllotaxy.
6	Morphological studies of different plants parts – Leaf margin (Entire, Undulate, Serrate, Spinous, Crenate)
7	Morphological studies of different plants parts – Leaf Apex (Acute, Acuminate, Emarginate, Mucronate, obtuse)
8	Morphological studies of different plants parts – Leaf Shape (Linear, Lanceolate, Ovate, Cordate, Lyrate, Reniform)
9	Morphological studies of different plants parts – Inflorescences.
10	Morphological studies of different plants parts – Flowers (Calyx, Corolla, Perianth).
11	Morphological studies of different plants parts – Flowers (Androecium).
12	Morphological studies of different plants parts – Flowers (Gynoecium).
13	To study Medicinal plants: Tulsi, Aloe, Neem, Turmeric and Amla,
14	Field visit for observation of Morphological characteristic of Phanerogams and Medicinal plants.

Reference Books:

2. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- II				
(NCrF Level- 4.5 First Year – Certificate in Botany)				
SAURASHTRA UNIVERSITY RAJKOT				
Practical Skeleton: Major (Core)-3 Practical: Phanerogams and Medicinal Botany Practical				
Time: - 3 hours		Date: -----		
Total Marks: - 25				
Q-1	Identify and describe the specimen “A” (Gymnosperm).			4 M
	X		Y	
	A		A	
Q-2	Identify and describe the specimen “B” and specimen “C” with diagram (Vegetative Morphology, Reproductive Morphology)			4 M
	X		Y	
	B		B	
	C		C	
Q-3	Rotation “D” and “E”.			4M
Q-4	Journal.			3M
Q-5	Viva - voce			10M

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours**.



B.Sc. Honours/ Honours with Research in Botany Semester-II

(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Major (Core) - 4
Title of the Course	Plant Diversity - I Theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Course Outcomes - COs

On completion of the course, students are able to know

1. Students will explore the life cycle of Spirogyra, which typically involves both sexual and asexual reproduction. They will learn about the different stages, including the haploid and diploid phases, as well as the conditions that trigger reproductive events.
2. Students will acquire a thorough understanding of the life cycle of Sargassum, including the different stages, such as gametophyte, sporophyte, and the production of specialized structures like receptacles and floaters. They will gain knowledge about the factors influencing each stage and the transitions between them.
3. Students gain insight into the diverse reproductive strategies employed by fungi through the study of Mucor's life cycle. They learn about both asexual and sexual modes of reproduction, including spore production, sporangia formation, and zygospore formation.
4. Students will gain a thorough understanding of the different stages in the life cycle of Agaricus, including spore germination, mycelium formation, fruiting body development, and spore dispersal.
5. Marchantia is a bryophyte, a group of non-vascular plants. Studying its life cycle provides insights into the reproductive strategies employed by bryophytes. Students can learn about the production and dispersal of spores, the formation of gametangia (antheridia and archegonia), fertilization, and the development of sporophytes.
6. Students will be able to describe and explain the alternation of generations in Selaginella, including the structures and processes involved in both the gametophyte and sporophyte phases.
7. Students will be able to describe the structure and anatomy of lichens, including the different components such as the fungal partner (mycobiont) and the photosynthetic partner (phycobiont).
8. Students will gain knowledge about the reproductive strategies of lichens, including both sexual and asexual reproduction methods.
9. Students will explore the nature of the symbiotic relationship between algae and fungi in lichens. They will learn how these organisms interact and benefit from each other, forming a mutualistic association.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?		Yes
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?		No
3	Major	Yes	Minor
	Skill Enhancement Courses	No	Ability Enhancement Courses
	Value Added Courses	No	Exit/ Vocational Courses



4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે ?					No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?					No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?					No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?					No

Unit No.	Topics	Hours	Marks
1	Algae Taxonomic Position (as per smith), structure of Thallus, vegetative, asexual and sexual modes of reproduction of the following genus (Life history -Excluding development): 1.1. Spirogyra (Chlorophyceae). 1.2. Sargassum (Phaeophyceae).	9	10
2	Fungi Taxonomic Position (as per Alexopoulos), structure of Thallus, vegetative, asexual and sexual modes of reproduction of the following genus (Life History-Excluding development): 2.1. Mucor (Zygomycotina). 2.2. Agaricus (Basidiomycotina)	9	10
3	Bryophytes Taxonomic Position (Rothmelaar), structure of Thallus, vegetative, asexual and sexual modes of reproduction of the following genus: (Excluding development). 3.1. Life history of Marchantia.	9	10
4	Pteridophytes Taxonomic Position, structure of Thallus, vegetative, asexual and sexual modes of reproduction of the following genus (Life history - Excluding development): 4.1. Life history of Selaginella.	9	10
5	Lichens 5.1. Occurrence 5.2. Structure 5.3. Reproduction 5.4. Relationship between algae and fungal components of Lichens 5.5. Economic importance of Lichens	9	10
	Total	45	50



Reference Books:

1. Smith, G. M. (1955). Cryptogamic Botany Vol. I Algae and Fungi. Tata McGraw hill Publishing Company Ltd., New Delhi. 2nd edition.
2. Singh, V., Pande, P. C., Jain, D. K.. (2014). A Text Book of Botany. Rastogi Publications, Meerut, New Delhi. 5th revised edition.
3. Singh, V., Pande, P. C., and Jain. D. K. (2015). A Text book of botany. Rastogi publications, Meerut, New Delhi. 4th edition.
4. Vashishta, B.R. (1987). Botany for degree students - Algae. S. Chand and company (Pvt.) Ltd Ram Nagar-New Delhi. 7th edition.
5. Anne. Regaed. , Kumaresan, V., Arumugam, N. (2014) Algae. Saras publication, Kattar P.O. Nagercoil, Tamilnadu. 1st edition.
6. Gangulee, H. C., Das, K. S., Dutta, C. (2005). College Botany Volume – 1. New Central Book Agency, India 1st edition.
7. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Major (Core) Practical -4
Title of the Course	Plant Diversity - I Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Course Outcomes - COs

On completion of the course, students are able to know

1. Students will learn how to prepare microscope slides of Spirogyra algae samples and use a compound microscope to observe and analyze the cellular structure. They will gain hands-on experience in adjusting the focus, magnification, and illumination to observe Spirogyra algae at different levels of detail.
2. Students will be able to identify and differentiate between various reproductive structures of Spirogyra, such as the conjugation tubes, conjugation papillae, and conjugation cells.
3. Students will develop a comprehensive understanding of the morphology and anatomy of Sargassum algae. They will become familiar with the various structural components of the algae, such as thalli, holdfasts, stipes, blades, receptacles, and air bladders.
4. By studying the reproductive structures of Sargassum algae, students will learn how to identify and differentiate between different types of reproductive structures, such as conceptacles, receptacles, oogonia, and antheridia.
5. Students will develop the ability to identify different species of Mucor fungi based on their morphology and anatomical characteristics.
6. Students will learn to identify and differentiate the various reproductive structures of Mucor fungi, such as sporangia, sporangiophores, sporangiospores, and zygospores.
7. By studying the morphology and anatomy of different Agaricus species, students will develop skills in species identification. They will learn to recognize distinguishing characteristics that help differentiate between various species within the genus.
8. Students will learn to identify and differentiate the various reproductive structures of Agaricus fungi, such as basidia, basidiospores, gills, and other related structures. This knowledge is crucial for accurate species identification.
9. Students will gain a comprehensive understanding of the external structure and various morphological features of Marchantia. They will learn to identify and differentiate between different parts of the plant, such as the thallus, rhizoids, gemmae cups, and archegoniophores.
10. Students will gain a thorough understanding of the reproductive structures present in Marchantia. This includes studying the male and female reproductive organs, such as antheridia and archegonia, and their respective functions in sexual reproduction.
11. Students will gain a comprehensive understanding of the external morphology of Selaginella plants, including the identification and description of various vegetative and reproductive structures. This includes studying features like stems, leaves, roots,



sporophylls, strobili, and sporangia.

12. Students will become proficient in identifying and distinguishing the reproductive structures of Selaginella, such as strobili (cones), microsporangia (male reproductive structures), megasporangia (female reproductive structures), sporophylls, and sporangia.

13. Students will gain a thorough understanding of the different morphological structures found in lichens, such as thalli, apothecia, soredia, isidia, and rhizines.

14. Students will develop the ability to identify different plant species based on their characteristics, such as leaf shape, flower structure, stem morphology, and other distinguishing features. The field study provides an opportunity for hands-on experience in identifying plants in their natural habitats, reinforcing the knowledge gained in the classroom.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?				No	
3	Major	Yes	Minor		No	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	

Pr. No.	Practical
1	To Study the morphology and anatomy structures in Spirogyra algae.
2	To Study the reproductive structures in Spirogyra algae.
3	To Study the morphology and anatomy structures in Sargassum algae.
4	To Study the reproductive structures in Sargassum algae.
5	To Study the morphology and anatomy structures in Mucor fungi.
6	To Study the reproductive structures in Mucor fungi
7	To Study the morphology and anatomy structures in Agaricus fungi.
8	To Study the reproductive structures in Agaricus fungi.
9	To Study the morphology and anatomy structures in Marchantia.
10	To Study the reproductive structures in Marchantia.
11	To Study the morphology and anatomy structures in Selaginella.
12	To Study the reproductive structures in Selaginella.
13	To Study the morphological structures in Lichens.
14	Field visit for observation of different plant diversity.

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- II (NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Major (Core)-4 Practical: Plant Diversity – I Practical					
Time: - 3 hours		Date: -----			
Total Marks: - 25					
Q-1	Identify and describe the given specimen “A” and “B” (Algae, Fungi)			4 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the given specimen “C” and “D” with diagrams. (Bryophyte, Pteridophyte)			4M	
	X		Y		
	C		C		
	D		D		
Q-3	Rotation (Lichen & Algae or Fungi).			4M	
	E-	F-			
Q-4	Journal			3M	
Q-5	Viva - voce			10 M	

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours**.



B.Sc. Honours/ Honours with Research in Botany Semester-II

(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- II

Course Category	Minor (Elective) -2
Title of the Course	Phanerogams and Medicinal Botany theory
Course Credit	03
Teaching Hours per Semester (15 week/ 90 working days)	45
Total Marks	50

Course Outcomes - COs

On completion of the course, students are able to know

1. Students will become familiar with the major groups of gymnosperms and their characteristics.
2. Students will be able to identify and describe the major groups of Bierhorst Classification of Gymnosperms, including Cycadopsida, Coniferopsida and Gnetopsida. Student will be familiar with the characteristics and distinguishing features of each group.
3. Students will be able to describe and differentiate the different stages of the cycas life cycle, from germination and seedling development to maturity and eventual reproduction. They will learn about the specific characteristics and changes that occur in each life stage.
4. Students will be able to categorize plants into different groups based on their growth habits (e.g., trees, shrubs, herbs) and their natural habitats (e.g., aquatic, desert, forest).
5. Students will be able to recognize and differentiate types of roots and stems in various plant species.
6. Students will be able to identify different types of roots, stems, and leaves of various plant species. They will learn to recognize the characteristic features and variations in vegetative morphology.
7. Students will be acquiring the knowledge of different definition such as bract, pedicel, symmetry, sexuality, hypogynous, epigynous and perigynous.
8. Students with a solid foundation in the study of calyx, enabling them to understand the importance of this plant structure in reproduction.
9. Students will gain knowledge about the various types of corollas found in different plant species, including variations in shape, size, and color, and how these characteristics relate to pollination strategies.
10. Students will understand the role of the corolla and other flower parts in the reproductive process of plants.
11. Students will explore the diverse range of perianth structures found in different plant species. They will study the morphological variations in perianth organs and



their significance in plant adaptation, and reproduction.

12. Students will be able to recognize the different components of the androecium, such as stamens, anther, and filament. They should understand the role of androecium in the overall process of plant reproduction.
13. Students will be able to identify and label the various components of the gynoecium, including the stigma, style, and ovary. They should understand their morphological features and their roles in reproduction.
14. Students will be able to recognize and label the different parts of a typical flower, including petals, sepals, stamens, pistils (carpel), ovules, and receptacle.
15. Students will gain a comprehensive understanding of different inflorescence types, including racemes, Cymose and special types – Cyathium, Verticillate, Hypanthodium. They will be able to identify and describe the characteristics of each type.
16. Students will be able to read and interpret floral formulae, which are concise representations of floral structures and their relationships.
17. Students will learn how to create accurate floral diagrams to visually represent the arrangement and organization of floral parts within a flower.
18. To create awareness amongst students about various plant parts used for therapeutic purpose or used as precursors for synthesis of useful drugs.
19. Studying the medicinal value of Neem, Tulsi, Aloe Vera, Turmeric and Amla can provide students with a comprehensive understanding of their therapeutic applications, enabling them to recommend and use these natural remedies for various health conditions.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills નાગુણો ધરાવે છે?				No	
3	Major	No	Minor		Yes	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Unit No.	Topics	Hours	Marks
1	Gymnosperms 1.1. General characters of Gymnosperms 1.2. Classification of Gymnosperms by Bierhorst up to class 1.3. Life history of Cycas (Excluding development)	9	10
2	Vegetative Morphology 2.1. Habit, Habitat of plants 2.2. Root and Stem (Excluding modification) 2.3. Parts of leaf; phyllotaxy; types of leaves; venation. 2.4. Leaf shapes; leaf margin; leaf apex.	9	10
3	Reproductive Morphology – I 3.1. Inflorescences: Racemose and Cymose and special types – Cyathium, Verticillate, Hypanthodium, 3.2. Typical Flowers 3.3. Definition: bract; pedicel; symmetry; sexuality; hypogynous; epigynous; perigynous. 3.4. Calyx: function and types. 3.5. Corolla: function, forms and aestivation.	9	10
4	Reproductive Morphology – II 4.1. Introduction of Perianth 4.2. Androecium: Parts of a Stamen, Attachment of stamen, Types of stamen. 4.3. Gynoecium: Parts of carpels; Types of gynoecium; placentation. 4.4. Floral formula 4.5. Floral diagram	9	10
5	Medicinal Botany 5.1. Definition, history of medicinal plant. 5.2. Study of following medicinal plants (Morphology, parts used, chemical constituents, uses) 5.2.1. Neem 5.2.2. Tulsi 5.2.3. Aloe 5.2.4. Turmeric 5.2.5. Amla	9	10
Total		45	50

Reference Books:

1. Sundara Rajan, S., (1996). Introductory Taxonomy of Angiosperms. Himalaya Publishing House, Bombay/Delhi/Nagpur. 1st edition.
2. Datta, S. C. (1988). Systematic botany. Wiley eastern limited- New Delhi. 4th edition.
3. Pandey, B.P. (1999). Taxonomy of Angiosperms. For university student. S.



- Chandand Com. Ltd, New Delhi 1st edition reprints.
4. Kumavesan Annie. (2010.) Taxonomy of Angiosperms. Saras publication, Nagercoil, Tamilnadu. 3rd edition.
 5. Sutariya, R. N. (1958). A text book of Systematic Botany. Khadayata Book Depot, Ahmedabad. 2nd edition.
 6. Singh, V. and Jain, D. K. (1996). Taxonomy of Angiosperms. Rastogi publications, Meerut, India. 2nd edition
 7. Economic Botany by A.F. Hill & O.P. Sharma Tata McGraw Hill, New Delhi.
 8. Sen, S. 1992. Economic Botany, New Central Book Agency, Calcutta.
 9. Verma, V. 1974. A Textbook of Economic Botany, Emcay Publication, New Delhi.
 10. Kochar, S.L. 2011. Economic Botany in the Tropics, 4th edition, Mc Millan Publications, New Delhi.



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Minor (Elective) Practical -2
Title of the Course	Phanerogams and Medicinal Botany Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Course Outcomes - COs

On completion of the course, students are able to know

1. A comprehensive understanding of the morphology and anatomy of Cycas, enabling them to appreciate the diversity and adaptations of this ancient plant genus and apply their knowledge to various disciplines within plant biology.
2. Students will learn about the specific reproductive structures of Cycas, including male and female cones. They will study the structure and functions of these cones in the reproductive cycle of Cycas.
3. Morphological studies of different parts of angiosperm leaves provide valuable information about plant taxonomy, ecological adaptations, and physiological functions. They contribute to our understanding of plant diversity and their interactions with the environment.
4. Students will explore the morphological characteristics of leaves, including their Types of leaf, Phyllotaxy, Leaf margin, Leaf Apex, Leaf Shape.
5. floral morphology knowledge students able to apply them to understand the diversity, adaptation, and evolutionary significance of angiosperm flowers.
6. Students will equip with a solid foundation of knowledge on Tulsi, Aloe Vera, and Neem, allowing to appreciate their medicinal value, make informed decisions regarding their use, and potentially explore further research or applications in the field of herbal medicine.
7. Students will explore the medicinal properties of Turmeric, Amla, and Hibiscus. They will learn about the active compounds present in these plants, such as curcumin in Turmeric, vitamin C in Amla, and anthocyanins in Hibiscus.
8. The field visit, students understanding of the morphological characteristics of phanerogams and medicinal plants, their identification, and the practical applications of this knowledge in the field of medicinal plant research and conservation.



1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills નાગુણી ધરાવે છે?				No	
3	Major	No	Minor		Yes	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગમાટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	

Pr. No.	Practical
1	Study of morphology and anatomy of Cycas.
2	Study of reproductive structures of Cycas.
3	Morphological studies of different parts of leaf.
4	Morphological studies of different plants parts – Types of leaf.
5	Morphological studies of different plants parts – Phyllotaxy.
6	Morphological studies of different plants parts – Leaf margin (Entire, Undulate, Serrate, Spinous, Crenate)
7	Morphological studies of different plants parts – Leaf Apex (Acute, Acuminate, Emarginate, Mucronate, obtuse)
8	Morphological studies of different plants parts – Leaf Shape (Linear, Lanceolate, Ovate, Cordate, Lyrate, Reniform)
9	Morphological studies of different plants parts – Inflorescences.
10	Morphological studies of different plants parts – Flowers (Calyx, Corolla, Perianth).
11	Morphological studies of different plants parts – Flowers (Androecium).
12	Morphological studies of different plants parts – Flowers (Gynoecium).
13	To study Medicinal plants: Tulsi, Aloe, Neem, Turmeric and Amla.
14	Field visit for observation of Morphological characteristic of Phanerogams and Medicinal plants.

Reference Books:

1. Bendre, A. M. and Ashok Kumar, (2009) A Text book of Practical Botany Vol. I & II. Rastogi Publications, Meerut. 9th edition.



B.Sc. Honours/ Honours with Research in Botany Semester- II					
(NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Minor (Elective)-2 Practical: Phanerogams and Medicinal Botany					
Practical					
Time: - 3 hours		Date: -----		Total Marks: - 25	
Q-1	Identify and describe the specimen “A” (Gymnosperm).				4 M
	X		Y		
	A		A		
Q-2	Identify and describe the specimen “B” and specimen “C” with diagram (Vegetative Morphology, Reproductive Morphology)				4 M
	X		Y		
	B		B		
	C		C		
Q-3	Rotation “D” and “E”.				4M
	D		D		
	E		E		
Q-4	Journal.				3M
Q-5	Viva - voce				10M

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: 3 Hours.



B.Sc. Honours/ Honours with Research in Botany Semester-II

(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Multi-Disciplinary Course -2 (MDC -2)
Title of the Course	Pharmaceutical Products Theory
Course Credit	03
Teaching Hours per Semester (15 week / 90 working days)	45
Total Marks	50

Course Objectives

On the completion of course, students are able to know:

1. Students will acquire knowledge and skills that are valuable in various sectors including pharmaceuticals, healthcare, research, and academia. It also fosters an appreciation for the potential of natural products in medicine and healthcare.
2. Understanding Pharmacognosy can aid in drug discovery and development. Students learn how to identify and evaluate natural compounds for their potential use as medicines or as leads for drug development.
3. Students learning about the processing of herbal raw materials gain insights into various crucial aspects that contribute to the preparation, preservation, and utilization of medicinal plants for therapeutic purposes.
4. Student can learn the appropriate techniques for drying and storing herbal materials to maintain their potency, prevent spoilage, and minimize contamination.
5. Students studying these traditional systems of medicine will delve deeper into these principles, understanding diagnosis, treatment approaches, medicinal preparations, lifestyle recommendations, and the holistic philosophies that form the basis of each system's practice.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skillsના ગુણો ધરાવે છે?	No				
3	Major	No	Minor	No		
	Skill Enhancement Courses	No	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic Education	No	Multidisciplinary	Yes	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	



8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	No
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Unit No.	Topics	Hours	Marks
1	Introduction of Pharmacognosy 1.1. Definition of Pharmacognosy. 1.2. Scope of Pharmacognosy. 1.3. Source of drugs: Plants, Animals, Marine, Mineral and Microorganisms.	9	10
2	Drugs and its classification 2.1. Introduction to Organized Drugs. 2.2. Introduction to Unorganized drugs. 2.3. Classification of crude drugs (Alphabetical, Morphological, Taxonomical, Biological and Chemical)	9	10
3	Herbs as raw material 3.1. Definition of herb. 3.2. Herbal medicine – (Phudino, Bramhi and Bhangro) 3.3. Selection of herbal material. 3.4. Processing of herbal raw materials: Collection of crude drugs, harvesting of crude drugs, Garbling of crude drugs, Drying of crude drugs, Packaging of crude drugs, Storage of crude drugs.	9	10
4	Indian systems of medicine 4.1. Basic principles involved in Ayurveda, Unani and Homeopathy. 4.2. Common Indian drug sources: 4.2.1. Oil yielding plants – Nagod, Nilgiri 4.2.2. Dye yielding plants – Heena, Kesudo 4.2.3. Gum yielding plants – Neem, Baval	9	10
5	Medicinal Plants for Wellness 5.1. Usage of plants for wellness of respiratory disease – Ardusi, Tulsi. 5.2. Usage of plants for wellness of gastrointestinal disease – Kariyatu, Harde. 5.3. Usage of plants for wellness of dermatological disease – Turmeric, Chandan. 5.4. Usage of plants for wellness of cancer disease – Kuvarpathu, Barmasi. 5.5. Scope and future of medicinal plants.	9	10
	Total	45	50

Reference Books:

1. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
2. Agnes Arber (1999). Herbal plants and Drugs. Mangal Deep Publications.
3. V. Singh D. K. Jain P. C. Pande (2010) A Text Book of Botany: Angiosperms, Rastogi Publications-Meerut.



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester- II

Course Category	Multi -Disciplinary Course Practical (MDC-2)
Title of the Course	Pharmaceutical Products Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Course Outcomes - COs

On completion of the course, students are able to know:

1. Pharmacognosy practical offer students a hands-on learning experience focused on the study of medicinal plants and natural sources of drugs.
2. Students learn to identify medicinal plants based on their morphological features, such as leaves, flowers, roots, and fruits. This skill is crucial in understanding the diversity of plant species used in medicine.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?				Yes	
2	Value added Courses Imparting Transferable and Life Skills નાગુણો ધરાવે છે?				No	
3	Major	No	Minor		No	
	Skill Enhancement Courses	No	Ability Enhancement Courses		No	
	Value Added Courses	No	Exit/ Vocational Courses		No	
4	Holistic Education	No	Multidisciplinary	Yes	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				No	
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No	



Pr. No.	Practical
1	To study plants used as herbal medicine - Phudino, Bramhi, Bhangro
2	To study and identify plant for oil products as per theory.
3	To study and identify plant for dye products as per theory.
4	To study and identify plant for gum products as per theory.
5	To study the medicinal plants used in wellness of respiratory disease (as per theory).
6	To study of medicinal plants used in wellness of Gastrointestinal disease (as per theory).
7	To study of medicinal plants used in wellness of dermatological disease (as per theory).
8	To study of medicinal plants used in wellness of Cancer disease (as per theory).
9	To study local medicinal plants flora by field visit.
10	Submission of project/ field report.

Reference Books:

1. Kokte, Practical Pharmacognosy, Vallabh Prakashan, Pune.



B.Sc. Honours/ Honours with Research in Botany Semester-II					
(NCrF Level- 4.5 First Year – Certificate in Botany)					
SAURASHTRA UNIVERSITY RAJKOT					
Practical Skeleton: Multi-Disciplinary Course-2 (MDC-2)-: Pharmaceutical Products practical					
Time: - 3 hours		Date: -----		Total Marks: - 25	
Q-1	Identify and describe the specimen “A” used as Herbal medicine.				3M
	X		Y		
	A.		A.		
Q-2	Identify and describe the specimen “B” used as Oil and Dye yielding plants.				3M
	X		Y		
	B.		B.		
Q-3	Identify and describe the specimen “C” used as Gum, Respiratory and Gastrointestinal disease plants.				3M
	X		Y		
	C.		C.		
Q-4	Identify and describe the specimen “D” used as Dermatological and Cancer disease plants.				3M
	X		Y		
	D.		D.		
Q-5	Journal.			3M	
Q-6	Viva-voce			10M	

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **3 Hours.**



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)
Semester -II

Course Category	Skill Enhancement Course -2 (SEC-2)
Title of the Course	Herbarium Techniques Theory
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	15
Total Marks	25

Course Outcomes - COs

On completion of the course, students are able to know

1. The primary objective of a herbarium is to serve as a reference resource for plant biodiversity, allowing for the study of plant taxonomy, distribution, ecology, and evolution.
2. Students will learn the techniques and best practices for collecting, pressing, drying and preserving plant specimens.
3. Students will acquire skills in mounting plant specimens on herbarium sheets, labelling them accurately and maintaining proper storage condition.
4. Students will learn about the importance of herbarium collections in documenting and preserving rare and endangered plant species and the role of herbaria in promoting environmental awareness and conservation efforts.
5. Students will learn about best practices in herbarium curation, specimen storage and preservation techniques to ensure the long-term viability of collections.
6. Students will understand the importance of accurate labelling and documentation to ensure the scientific value of the specimens.
7. Students will learn about the different fumigation methods used to control pests and prevent insect damage in herbarium collections.
8. Students will learn how controlled heating can help eliminate pests, fungi, and bacteria from plant specimens while minimizing damage to the delicate structures.
9. Students will learn the selection and application of appropriate chemical treatments for disinfection, fixing and preserving plant specimens.
10. Knowledge of botanical survey of India students will have comprehensive understanding of plant diversity, conservation and research methodologies, enabling them to contribute effectively to botanical science and conservation efforts in the country.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes				
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?	No				
3	Major	No	Minor	No		
	Skill Enhancement Courses	Yes	Ability Enhancement Courses	No		
	Value Added Courses	No	Exit/ Vocational Courses	No		
4	Holistic	No	Multidisciplinary	No	Interdisciplinary	No



	Education				
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?				No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?				No
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				No

Unit No.	Topics	Hours	Marks
1	Objectives, Collection of Plant and Processing of Specimens 1.1. Objective of Herbarium and Herbarium sheet. 1.2. Field equipment of herbarium technique. 1.3. Kinds of field work: Collection trip, Exploration. 1.4. Processing of specimens: Poisoning and Pressing, Drying and Mounting, Stitching and Labelling, Identification / determination of plants and Incorporation and Arrangement of specimens.	5	10
2	Maintenance of Herbarium 2.1. Fumigation 2.2. Heating 2.3. Chemical treatment 2.4. Handling of specimens	5	10
3	Types of Herbaria 3.1. National herbaria (Central National Herbarium, Howrah). 3.2. Regional herbaria (Andaman and Nicobar Regional Centre, BSI, Port Blair).	5	5
	Total	15	25

Reference Books:

1. Jain, S.K., 1977. Handbook of field and herbarium methods.
2. Singh, H.B., 2008. Field manual on herbarium techniques. National Institute of Science Communication and Information Resources.
3. Paul, P., Dhar, S., Chowdhury, M. and Das, D., 2020. Herbarium Technique: Evolution from Conventional to Digitization. Orange Books Publication.
4. Manual of herbarium technique: ENVIS Centre on Floral Diversity Botanical Survey of India.
5. TRAINING COURSE ON HERBARIUM TECHNIQUES AND METHODOLOGY
https://bsi.gov.in/uploads/userfiles/file/Training/Manual_Herbarium%20Technique.pdf



B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)

Semester -II

Course Category	Skill Enhancement Course -2 (SEC-2)
Title of the Course	Herbarium Techniques Practical
Course Credit	01
Teaching Hours per Semester (15 Week/ 90 Working days)	30
Total Marks	25

Course Outcomes - COs

On completion of the practical course, students are able to know

1. On completion of the Herbarium technique Practical course, students are able to know
2. Students will gain hands-on experience in preparing herbarium sheets, including labelling specimens with relevant information such as collection date, location, habitat, and collector's name.
3. Students will become familiar with the different types of equipment used in herbariums, such as plant presses, drying ovens, drying cabinets, mounting supplies, labelling materials, and storage facilities.
4. Studying liquid preservatives for microscopic plant samples can provide students with valuable knowledge and skills related to sample preservation, long-term storage, and experimental techniques.
5. By maintaining a field diary, students will develop strong documentation skills.
6. Students should become familiar with different types of preservatives commonly used for plant specimens, such as desiccants, fixatives, fungicides, and insecticides.
7. Field trips provide an opportunity for students to learn and apply fieldwork techniques specific to plant collection. They can practice methods such as specimen collection, pressing and drying plant samples, documenting important details, and taking accurate measurements.

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?	Yes		
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?	No		
3	Major	No	Minor	No
	Skill Enhancement Courses	Yes	Ability Enhancement Courses	No



	Value Added Courses		No	Exit/ Vocational Courses		No
4	Holistic Education	No	Multidisciplinary	No	Interdisciplinary	No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ?					No
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?					No
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?					No
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?					No

Pr.No.	Practical
1	To study the method of preparation of herbarium sheet.
2	To study the equipment's of herbarium technique.
3	To study the field diary through the chart /PPT.
4	To prepare the liquid mixture for Poisoning of specimens.
5	To study the dry preservation (Herbarium) technique for algae and bryophytes through the chart /PPT.
6	To prepare the liquid mixture F.A.A. for preserving algae specimen.
7	To prepare the liquid mixture for preserving bryophytes specimen.
8	Field trip: for plant collection arranged one field trip near the campus/ Forest/sea coast /other place.

Note:

1. Liquid mixture for Poisoning of specimens: 70% ethyl alcohol with 5 cc of 10% Formalin.
2. Preservation for algae: Formalin – acetic acid – ethyl alcohol (FAA): {50ml of 95% ethyl alcohol, 5ml of glacial acetic acid, 10 ml of 40% formalin and 35ml of water}
3. Preservation for Bryophytes: 1: 1: 8: 10 – formaldehyde: glacial acetic acid: 95% ethanol: water

Reference Books:

1. Manual of herbarium technique: ENVIS Centre on Floral Diversity Botanical Survey of India.
2. TRAINING COURSE ON HERBARIUM TECHNIQUES AND METHODOLOGY
https://bsi.gov.in/uploads/userfiles/file/Training/Manual_Herbarium%20Technique.pdf



B.Sc. Honours/ Honours with Research in Botany Semester-II (NCrF Level- 4.5 First Year – Certificate in Botany)				
SAURASHTRA UNIVERSITY RAJKOT				
Practical Skeleton: SEC-2: Herbarium Techniques Practical				
Time: - 1.5 hours		Date: -----	Total Marks: - 10	
Q-1	Identify and Describe the specimen “A” and “B”. (Equipment’s of herbarium technique)			1M
	X		Y	
	A		A	
Q-2	Submit the 5 herbariums of medicinal plant.			2M
Q-3	Journal.			2M
Q-4	Viva – Voce			05M

Note:

1. University will arrange practical and viva evaluation by internal faculty and external evaluator.
2. Marks of practical and viva will be considered under CCE.

Instructions:

- Certified journal is must and minimum requirement to appearing for semester end practical examination.
- Should have at least 75% attendance in practical sessions during the semester.
- Time duration: **1.5** Hours.