SAURASHTRA UNIVERSITY

FACULTY OF SCIENCE

Course Structure and Botany sem.-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.- II Syllabus Effective from November – 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.

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-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 Practical	-	60	2	25	25	50
VAC201-1C	(NSS)	60	-	2	25	25	50
Total		270	180	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**
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	1. Viva/Oral exam 2. Group Discussion 3. Role Play 4. Authentic Problem Solving 5. Quiz 6. Interview 7. Open book reading	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

10. Project Writing 11. Journal Writing 12. Multiple Choice Questions 13. Seen/Open Question 14. Take Home 15. Assignment Writing	8. Inter Forum Debate 9. Speech 10. Reading 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**
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
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.

Suggested End Semester Examination Pattern for Year-2023-24

Suggested Question Paper Format for 4 Credit Course (Theory)

Time: 2 Hours			**Marks: 50**
Q. 1.	Unit I	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 2.	Unit II	(A)	(10/7/6/5)

		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 3.	Unit III	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 4.	Unit IV	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 5.	Unit V	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)

- **Question Paper Format for 4 Credit Course (Practical/Performance)**
- One Practical/Performance of 25 Marks (Viva – 10 Marks & Practical's – 15 Marks) Each of Three Hours Duration
- 25 Students per practical batch per teacher / examiner

Suggested Question Paper Format for 2 Credit Course (Theory)

Time: 1 Hours			**Marks: 25**
Q. 1.	Unit I	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 2.	Unit II	(A)	(10/7/6/5)
		(B)	(0/3/4/5)
		OR	
		(A)	(10/7/6/5)
		(B)	(0/3/4/5)
Q. 3.	Unit III	(A)	5
		OR	
		(A)	5

- **Question Paper Format for 2 Credit Course (Practical/Performance)**
- One Practical/Performance of 10 Marks (Viva – 05 Marks & Practical's – 05 Marks) Each of One and Half Hours Duration
- 25 Students per practical batch per teacher/examiner

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 નાગુણો 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

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 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. Chand and Com. Ltd, New Delhi 1st edition reprints.

4. Kumaresan Annie. (2010.) Taxonomy of Angiosprems. 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, Culcutta.

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 નાગુણો 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.
14	To study Medicinal plants: Turmeric, Amla,
15	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.*

<table>
<tr><td colspan="6">B.Sc. Honours/ Honours with Research in Botany Semester- II
(NCrF Level- 4.5 First Year – Certificate in Botany)</td></tr>
<tr><td colspan="6">SAURASHTRA UNIVERSITY RAJKOT</td></tr>
<tr><td colspan="6">Practical Skeleton: Major (Core)-3 Practical: Phanerogams and Medicinal Botany Practical</td></tr>
<tr><td colspan="2">Time: - 3 hours</td><td colspan="2">Date: ----------</td><td colspan="2">Total Marks: - 25</td></tr>
<tr><td rowspan="3">Q-1</td><td colspan="4">Identify and describe the specimen “A” (Gymnosperm).</td><td rowspan="3">4 M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>A</td><td></td><td>A</td><td></td></tr>
<tr><td rowspan="3">Q-2</td><td colspan="4">Identify and describe the specimen “B” and specimen “C” with diagram (Vegetative Morphology, Reproductive Morphology)</td><td rowspan="3">4 M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>B</td><td></td><td>B</td><td></td></tr>
<tr><td></td><td>C</td><td></td><td>C</td><td></td><td></td></tr>
<tr><td>Q-3</td><td colspan="4">Rotation “D” and “E”.</td><td>4M</td></tr>
<tr><td>Q-4</td><td colspan="4">Journal.</td><td>3M</td></tr>
<tr><td>Q-5</td><td colspan="4">Viva - voce</td><td>10M</td></tr>
</table>

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 નાગુણો 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

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 (Rothmelar), 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 નાગુણો 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

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.

<table>
<tr><td colspan="6">B.Sc. Honours/ Honours with Research in Botany Semester- II
(NCrF Level- 4.5 First Year – Certificate in Botany)</td></tr>
<tr><td colspan="6">SAURASHTRA UNIVERSITY RAJKOT</td></tr>
<tr><td colspan="6">Practical Skeleton: Major (Core)-4 Practical: Plant Diversity – I Practical</td></tr>
<tr><td colspan="2">Time: - 3 hours</td><td colspan="2">Date: ----------</td><td colspan="2">Total Marks: - 25</td></tr>
<tr><td rowspan="4">Q-1</td><td colspan="4">Identify and describe the given specimen “A” and “B” (Algae, Fungi)</td><td rowspan="4">4 M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>A</td><td></td><td>A</td><td></td></tr>
<tr><td>B</td><td></td><td>B</td><td></td></tr>
<tr><td rowspan="4">Q-2</td><td colspan="4">Identify and describe the given specimen “C” and “D” with diagrams. (Bryophyte, Pteridophyte)</td><td rowspan="4">4M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>C</td><td></td><td>C</td><td></td></tr>
<tr><td>D</td><td></td><td>D</td><td></td></tr>
<tr><td rowspan="2">Q-3</td><td colspan="4">Rotation (Lichen & Algae or Fungi).</td><td rowspan="2">4M</td></tr>
<tr><td colspan="4">E- F-</td></tr>
<tr><td>Q-4</td><td colspan="4">Journal</td><td>3M</td></tr>
<tr><td>Q-5</td><td colspan="4">Viva - voce</td><td>10 M</td></tr>
</table>

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 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. Chand

and Com. Ltd, New Delhi 1st edition reprints.

4. Kumavesan Annie. (2010.) Taxonomy of Angiosprems. 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, Culcutta.

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 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	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.
14	To study Medicinal plants: Turmeric, Amla.
15	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.*

<table>
<tr><td colspan="6">B.Sc. Honours/ Honours with Research in Botany Semester- II
(NCrF Level- 4.5 First Year – Certificate in Botany)</td></tr>
<tr><td colspan="6">SAURASHTRA UNIVERSITY RAJKOT</td></tr>
<tr><td colspan="6">Practical Skeleton: Minor (Elective)-2 Practical: Phanerogams and Medicinal Botany Practical</td></tr>
<tr><td colspan="2">Time: - 3 hours</td><td colspan="2">Date: ----------</td><td colspan="2">Total Marks: - 25</td></tr>
<tr><td rowspan="3">Q-1</td><td colspan="4">Identify and describe the specimen “A” (Gymnosperm).</td><td rowspan="3">4 M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>A</td><td></td><td>A</td><td></td></tr>
<tr><td rowspan="4">Q-2</td><td colspan="4">Identify and describe the specimen “B” and specimen “C” with diagram (Vegetative Morphology, Reproductive Morphology)</td><td rowspan="3">4 M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>B</td><td></td><td>B</td><td></td></tr>
<tr><td></td><td>C</td><td></td><td>C</td><td></td><td></td></tr>
<tr><td rowspan="3">Q-3</td><td colspan="4">Rotation “D” and “E”.</td><td rowspan="2">4M</td></tr>
<tr><td>D</td><td></td><td>D</td><td></td></tr>
<tr><td></td><td>E</td><td></td><td>E</td><td></td><td></td></tr>
<tr><td>Q-4</td><td colspan="4">Journal.</td><td>3M</td></tr>
<tr><td>Q-5</td><td colspan="4">Viva - voce</td><td>10M</td></tr>
</table>

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 કરાયેલછે ?					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	**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	ઇન્ડીયન 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.

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

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 Practical**
Course Credit	**02**
Teaching Hours per Semester (15 Week/ 90 Working days)	**60**
Total Marks	**50**

Course Outcomes - COs

On completion of the Mushroom cultivation 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 labeling 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, labeling 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

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, 10ml 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

<table>
<tr><td colspan="6">B.Sc. Honours/ Honours with Research in Botany Semester-II
(NCrF Level- 4.5 First Year – Certificate in Botany)</td></tr>
<tr><td colspan="6">SAURASHTRA UNIVERSITY RAJKOT</td></tr>
<tr><td colspan="6">Practical Skeleton: SEC-2: Herbarium Techniques Practical</td></tr>
<tr><td colspan="2">Time: - 3 hours</td><td colspan="2">Date: ----------</td><td colspan="2">Total Marks: - 25</td></tr>
<tr><td rowspan="4">Q-1</td><td colspan="4">Identify and Describe the specimen “A” and “B”. (Equipment’s of herbarium technique)</td><td rowspan="4">4M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>A</td><td></td><td>A</td><td></td></tr>
<tr><td>B</td><td></td><td>B</td><td></td></tr>
<tr><td rowspan="3">Q-2</td><td colspan="4">Describe the preparation of ,,,,,,,,,,,,,,,,, liquid mixture (F.A.A. / liquid mixture for preserving bryophytes specimen)</td><td rowspan="3">2M</td></tr>
<tr><td colspan="2">X</td><td colspan="2">Y</td></tr>
<tr><td>C</td><td></td><td>C</td><td></td></tr>
<tr><td>Q-3</td><td colspan="4">Submit the 10 herbariums of medicinal plant.</td><td>10M</td></tr>
<tr><td>Q-4</td><td colspan="4">Journal.</td><td>4M</td></tr>
<tr><td>Q-5</td><td colspan="4">Viva - Voce</td><td>05M</td></tr>
</table>

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.