



भारत 2023 INDIA

वसुधैव कुटुम्बकम्

ONE EARTH · ONE FAMILY · ONE FUTURE



SAURASHTRA UNIVERSITY

Academic Section

University Campus, University Road,
Rajkot – 360005

Phone No.: (0281) 2578501 Ext. No. 202 & 304
FAX No.: (0281) 2576347 E-mail Id: academic@sauuni.ac.in



નં.એકે/વિજ્ઞાન/ ૮૪૩૪૮/૨૦૨૩

તા.૨૩/૦૮/૨૦૨૩

બોટની

પરિપત્ર:-

સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળની સ્નાતક કક્ષાના B.Sc.(બોટની)ના અભ્યાસક્રમ ચલાવતી સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓને આથી જાણ કરવામાં આવે છે કે, NEP-2020 અંતર્ગતના રાજ્ય સરકારશ્રીના તા.૧૧/૦૭/૨૦૨૩ના ઠરાવ ત્યારબાદ તા.૨૭/૦૭/૨૦૨૩ના રોજ પ્રકાશિત થયેલ સ્ટાન્ડર્ડ ઓપરેટિંગ પ્રોસિજર(SOP) તેમજ ત્યારબાદ તેને આનુસંગિક તા.૨૮/૦૭/૨૦૨૩ના રોજ આવેલ સુધારા મુજબના અભ્યાસક્રમો વિષયનિષ્ણાંતશ્રી(બોટની અભ્યાસ સમિતિના સભ્યશ્રી), બોટની વિષયની અભ્યાસ સમિતિ દ્વારા રજુ કરાયેલ B.Sc.(બોટની) સેમેસ્ટર-૦૧ના અભ્યાસક્રમો આગામી શૈક્ષણિક સત્ર જુન-૨૦૨૩થી અમલમાં આવે તે રીતે બોટની વિષયની અભ્યાસ સમિતિ, વિજ્ઞાન વિદ્યાશાખા, એકેડેમિક કાઉન્સિલ તથા સિલ્લિકેટની બહાલીની અપેક્ષાએ મંજુર કરવા માન.કુલપતિશ્રીને ભલામણ કરેલ, જે માન.કુલપતિશ્રીએ મંજુર કરેલ છે. જેથી સંબંધિત તમામે તે મુજબ તેની યુસ્તપણે અમલવારી કરવી.

(મુસદ્દો કુલસચિવશ્રીએ મંજુર કરેલ છે.)

સહી/-

(ડૉ. એચ.પી.રૂપારેલીઆ)

કુલસચિવ

બિડાણ:- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

રવાના કર્યું

22/8/23

એકેડેમિક ઓફીસર

પ્રતિ,

- (૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની બોટની વિષય ચલાવતી 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. ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨. પરીક્ષા વિભાગ
૩. પી.જી.ટી.આર.વિભાગ
૪. જોડાણ વિભાગ



SAURASHTRA UNIVERSITY



FACULTY OF SCIENCE

Course Structure and Botany sem.-I 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)

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



Table of Contents

Botany sem.-I Syllabus Effective from June – 2023 & onwards.....	1
Programme Outcomes (PO):.....	5
Programme Specific Outcomes (PSO):.....	6
Table-1: Course Category, Course Title, Credit, SEE Duration Hrs., Evaluation - Weightage CCE: SEE = 50:50, SEE Marks, SEE Marks and Total Marks	7
Table-2: Courses Offered by Board of study in Botany to other FYUGP- B.Sc. Program in Semester-I	9
Evaluation Scheme: (As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Chapter-7: Evaluation Reforms).....	10
Continuous and Comprehensive Evaluation (CCE).....	10
Semester End Evaluation (SEE)	10
Eligibility Criteria to appear in SEE.....	11
Continuum of Evaluation	11
Mode of Evaluation.....	11
Written Mode	12
Oral Mode	12
Practical Mode	13
Integrated Mode	13
Models of Evaluation	13
Model for Theory Courses- 3 Credit Course (Major-1 & 2, Minor-1 and MDC-1)	13
Model for Practical Courses- 1 Credit Course (Major-1 & 2, Minor-1 and MDC-1).....	14
Model for Project/Self-study Courses- 4 Credit Course	14
Model for Work Experience Courses – 4 Credit Course	14
Model for Skill Enhancement Course -2 Credit Course	14
Table-3: Evaluation - Weightage CCE: SEE = 50:50	15
Additional Information for SOP Click following Link: https://sihm.ac.in/public/upload/Sop/English_Version.pdf	15
Theory Question Paper Pattern (For: Major-1 &2, Minor-1 and MDC-1).....	16
The Theory Question Paper Skeleton is as follows (For: Major-1 &2, Minor-1 and MDC-1).....	16
Practical Question Paper Pattern for (For: Major-1 &2, Minor-1 and MDC-1).....	17
Practical Question Paper Pattern for Skill enhancement course (SEC)-1.....	17
Major (Core) -1: Cryptogamic Botany Theory	18
Theory Course Outcomes - COs	18
Theory Course content: Unit No., Topics, Hours and Marks	20



Reference Books:	21
Major (Core) Practical -1: Cryptogamic Botany Practical.....	22
Practical Course Outcomes - COs.....	22
Practical course content	23
Reference Books:	23
Practical Skeleton: Major (Core)-1 Practical: Cryptogrammic Botany Practical	24
Major (Core) -2: Fundamental Botany – I theory	25
Theory Course Outcomes - COs	25
Theory Course content: Unit No., Topics, Hours and Marks	26
Reference Books:	27
Major (Core) Practical -2: Fundamental Botany – I Practical.....	28
Practical Course Outcomes - COs.....	28
Practical course content	29
Reference Books:	29
Practical Skeleton: Major (Core)-2 Practical: Fundamental Botany – I Practical	30
Minor (Elective) -1: Cryptogamic Botany Theory.....	31
Theory Course Outcomes - COs	31
Theory Course content: Unit No., Topics, Hours and Marks	33
Reference Books:	34
Minor (Elective) Practical -1: Cryptogamic Botany Practical.....	35
Practical Course Outcomes - COs.....	35
Practical course content	36
Reference Books:	36
Practical Skeleton: Minor (Elective) -1 Practical: Cryptogrammic Botany Practical.....	37
Multi-Disciplinary Course -1 (MDC -1): Botany: Introduction to Biology-I Theory.....	38
Theory Course Outcomes	38
Theory Course content: Unit No., Topics, Hours and Marks	39
Reference Books:	40
Multi -Disciplinary Course -1 (MDC-1): Botany-1P: Introduction to Biology Practical-I.....	41
Practical Course Outcomes - COs.....	41
Practical course content	42
Reference Books:	42
Practical Skeleton: Multi-Disciplinary Course -1 (MDC-1): Botany- 1P: Introduction to Biology Practical-I.....	43

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



Skill Enhancement Course -1 (SEC-1): Principle of organic farming Practical	44
Practical Course Outcomes - COs.....	44
Practical course content	45
Reference Books:	46
Practical Skeleton: SEC-1: Principle of organic farming Practical.....	47



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.



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

Table-1: Course Category, Course Title, Credit, SEE Duration Hrs., Evaluation - Weightage CCE:

SEE = 50:50, SEE Marks, SEE Marks and Total Marks

SN	Course Category As per Government of Gujarat- NEP-SOP - July 2023& additional content 28/7/23	Course Title	Credit		SEE Duration Hrs.	Evaluation - Weightage CCE: SEE = 50:50		
			T	P		CCE Marks	SEE Marks	Total Marks
1	Major (Core) -1 (Botany)	Cryptogamic Botany Theory	3	-	2½	75	75	150 To be converted for 75
2	Major (Core) -1 Practical (Botany)	Cryptogamic Botany Practical	-	1	2	25	25	50 To be converted for 25
3	Major (Core)- 2 (Botany)	Fundamental Botany -1 Theory	3	-	2½	75	75	150 To be converted for 75
4	Major (Core) -2 Practical (Botany)	Fundamental Botany-1 Practical	-	1	2	25	25	50 To be converted for 25
5	Minor (Elective)*-1	(As per Government of Gujarat- NEP-SOP July 2023 & additional content 28/7/23 – Clause 3.3.2) Any One from Basket (As per the expertise and resources available in the college)	3	-	2½	75	75	150 To be converted for 75
6	Minor (Elective) Practical*-1	Practical of the Course selected as Minor	-	1	2	25	25	50 To be converted for 25
7	Multi/Inter Disciplinary Course -1 (MDC/IDC-1) (Elective)** Category: 1. Natural and Physical Science (Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry, Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Sciences), 2. Mathematics, Statistics,	(As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Clause 3.3.3) Any One from Basket (As per the expertise and resources available in the college)	3	-	2½	75	75	150 To be converted for 75

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



	and Computer Applications, 3. Library, Information, and Media Sciences, 4. Commerce and Management, 5. Humanities and Social Sciences, 6. Sanskrit.							
8	Multi/Inter - Disciplinary Course Practical-1** (MDC/IDC-1) (Elective)	Practical of the Course selected as MDC/IDC-1	-	1	2	25	25	50 To be converted for 25
9	Ability Enhancement Course -1 (AEC-1)	(As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Clause 3.3.4) English Language: Development of Functional English	2	-	2	50	50	100 To be converted for 50
10	Skill Enhancement Course-1 (SEC-1)	Principle of organic farming practical (As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Clause 3.3.5)	-	2	2	50	50	100 To be converted for 50
11	Common Value-Added Course-1 (C-VAC-1) *** NSS/NCC/ Sports & Fitness/ Ethics and Culture/ Culture and Communication/ Ethics and Values in Ancient Indian Traditions/ Human Values and Ethics/IPDC	(As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Clause 3.3.6) VAC based on IKS: NSS/NCC/Sports & Fitness/Human Values and Ethics	-	2	2	50	50	100 To be converted for 50
Total Credits and Marks (Semester-I)			14	8	NA	550	550	1150 To be converted for 550

* Any one course from the basket is to be selected as a Minor elective course as per the expertise and resources available in the college. The same course will continue as a Minor in the semester-II as well.

** Any one course from the basket is to be selected as Multi/Inter disciplinary elective courses (MDC/IDC) as per the MDC/IDC in the semester-II as well.

*** Common **Value-Added Elective Courses** (C-VAC-1) common to all is to be selected from University Basket for semester 1, as per the expertise and resources available in the college.



Table-2: Courses Offered by Board of study in Botany to other FYUGP- B.Sc. Program in Semester-I

SN	Course Category As per Government of Gujarat- NEP-SOP - July 2023& additional content 28/7/23	Course Title	Credit		SEE Durati on Hrs.	Evaluation - Weightage CCE: SEE = 50:50		
			T	P		CCE Marks	SEE Marks	Total Marks
1	Minor (Elective)-1 (Chemistry/ Industrial Chemistry/ Physics/ mathematics/Statistics/ Computer Science/Zoology/Biochemistry/ Biotechnology/ Microbiology/etc.)	Cryptogamic Botany Theory (Zoology/ Physics/ Chemistry) (As per the expertise and resources available in the college)	3	-	2½	75	75	150 To be converted for 75
2	Minor (Elective) Practical-1	Cryptogamic Botany Practical	-	1	2	25	25	50 To be converted for 25
3	Multi/Inter - Disciplinary Course -1 (MDC/IDC-1) (Elective) (In addition to courses mentioned in SOP basket; Recommended for Chemistry/ Industrial Chemistry/ Physics/ Mathematics/ Statistics/Computer Science/Zoology/ Biochemistry/ Biotechnology/ Microbiology/etc.)	Botany: Introduction to Biology-I Theory (Zoology/Physics/ Chemistry) (As per the expertise and resources available in the college)	3	-	2½	75	75	150 To be converted for 75
4	Multi/Inter - Disciplinary Course Practical-1 (MDC/IDC Practical-1) (Elective) (In addition to courses mentioned in SOP basket; Recommended for Chemistry/ Industrial Chemistry/ Physics/ Mathematics/ Statistics/Computer Science/Zoology/ Biochemistry/ Biotechnology/ Microbiology/etc.)	Botany-1P: Introduction to Biology Practical-I	-	1	2	25	25	50 To be converted for 25



Evaluation Scheme: (As per Government of Gujarat - NEP-SOP July 2023 & additional content 28/7/23 – Chapter-7: Evaluation Reforms)

The evaluation process should be formulated to make a systematic evaluation of students' progress based on UGC guidelines. The evaluation must be designed with learner attributes in mind. These attributes have clear linkages to Programme Education Objectives and Outcomes. The evaluation consists of the following two components:

1. Continuous and Comprehensive Evaluation (CCE)- Formative
2. Semester End Evaluation (SEE)- Summative

CCE carries 50% of the total marks allotted to a subject and the other 50% being assigned to the SEE.

In each course, every credit carries 25 marks, of which 50% marks is assigned for CCE and rest 50% marks for SEE. The 50% marks assigned to the CCE is distributed between the continuous classroom evaluation and mid-term evaluation. The pattern may be as follow:

SN	Evaluation	4 credit subjects (Marks)	2 credit subjects (Marks)
1	CCE (50%)		
	Classroom & Mid-Term Evaluation	50	25
2	SEE (50%)	50	25
	Total	100	50

Continuous and Comprehensive Evaluation (CCE)

Subject-wise CCE will be undertaken by the concerned faculty member. The mode of evaluation will be decided by the faculty member concerned with the subject. 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.

Semester End Evaluation (SEE)

The SEE carries 50% of the marks assigned to a course. SEE shall be of 2 ½ hours for 4 credit course and 2 hours in case of 2 credit courses. The controller of the examination will conduct these examinations. Paper setting and evaluation will be done by the 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 after the result declared of the semester evaluation. Students shall have a second chance to clear their backlog and avoid the burden to carry forward the backlog with the next semester exam.

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 controller of examination in consultation with the Director/Board.



2. In case of medical emergency, a certificate from the registered medical practitioner must be produced before the commencement of exams. The evaluation board will then take final decision on the recommendation for exemption.

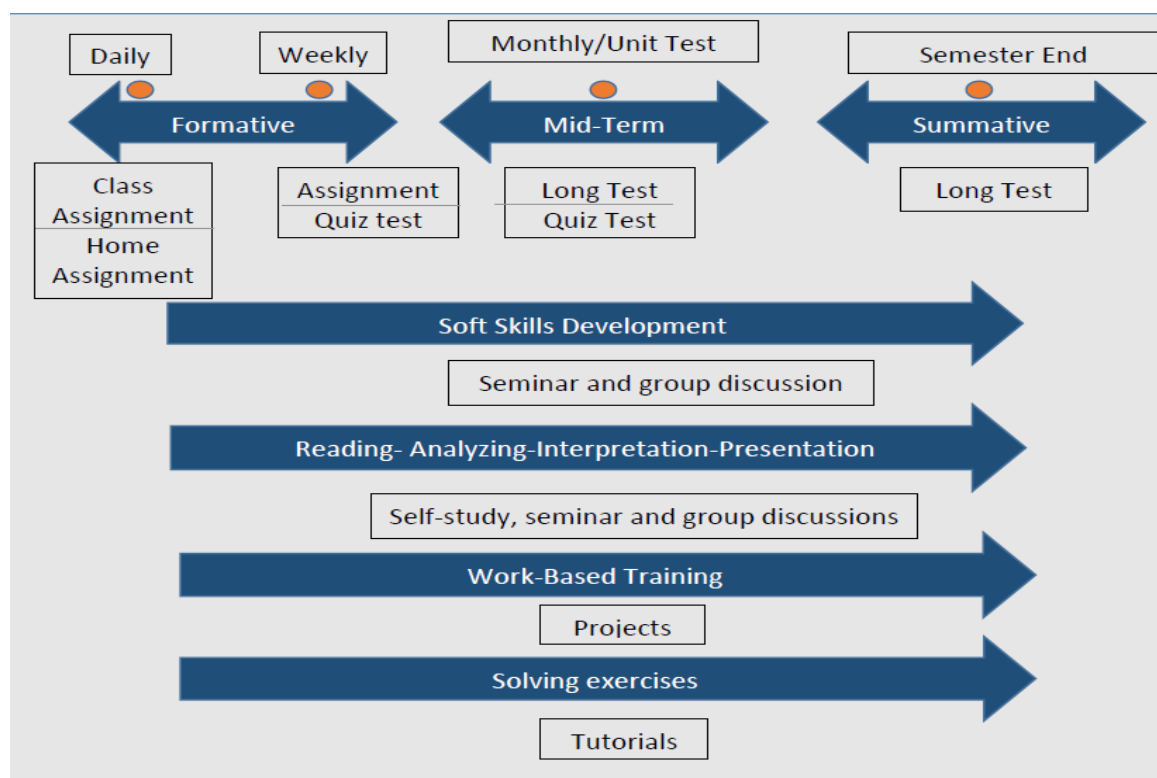
Eligibility Criteria to appear in SEE

To be able to appear for the SEE, a student must comply with the following conditions:

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.

Continuum of Evaluation

Evaluation must be continuous which may include both formative and summative components in a timely manner for continuous feedback as follow:



Mode of Evaluation

A wide range of modes of evaluation for evaluating students is available for the teachers/ institutions to use. A suitable compendium of such a mode needs to be carefully chosen for a particular program depending on its nature, objectives, and available resources. The mode of evaluation can be as below:



Written Mode	Oral Mode	Practical Mode	Integrated Mode
<ol style="list-style-type: none"> Semester Exam Class Test Open book exam/test Open note exam/test Self-test/Online test Essay/Article writing Quizzes/Objective test Class assignment Home assignment Reports writing Research/Dissertation Class Studies 	<ol style="list-style-type: none"> Viva/Oral exam Group Discussion Role Play Authentic Problem Solving Quiz Interview 	<ol style="list-style-type: none"> Lab work Computer simulation/virtual labs Craft work Co-curricular work 	<ol style="list-style-type: none"> Paper presentation/Seminar Field Assignment Poster Presentation

Written Mode		
Evaluation Type	Nature	Objective
Semester Exam	Traditionally essay type with objective/short answer questions to evaluate Lower Ordered Thinking (LOT) OBE skills	For depth and planned preparation
Class test	Traditionally essay type	Fixed date forces students to learn
Open book test	Allowed choice of reference book	Measures what students can do with resources, less stress on memory
Open note test	To get used to the system	Encourage good note taking
Self-test	For subjective and objective items	Mastery learning occurs with proper feedback
Article/essay writing	Individual long written assignment	Individual expression and creativity
Quizzes/Objective test	Short duration structured test	Excellent validity as greater syllabus coverage
Class assignment	With defined time	Student's performance to make decision
Home assignment	With undefined time	Reinforce learning and facilitate mastery of specific skills
Reports Writing	On activities performed or event observed	Develop a key transferable skill
Research/Dissertation	Detailed research-based report	To judge creativity and research skills
Case Studies	Analyse a given case (real or fictional)	To assess thinking, value, and attitude
Oral Mode		
Evaluation Type	Nature	Objective
Viva/Oral exam	Individually or in small group	Practical experience towards job interview situation



Group discussion	Small group of 2-5 members work on a joint task	Encourage teamwork
Role Play	Small group of 2-5 members work on a joint task	Develop personality
Authenticate problem solving	Small group of 2-5 members work on a joint task	Communication of ideas
Quiz	Small group of 2-5 members work on a joint task	Assess memory power
Interview	Individually	Judge the personal confidence level

Practical Mode		
Evaluation Type	Nature	Objective
Lab work	Component of working with one's hand	Keep the students on the task
Computer simulation/virtual labs	Component of working with one's hand	To understand the practical exposure
Craft work	Component of working with one's hand	Encourage application of concepts learnt
Co-curricular work	Component of working with one's hand	For immediate feedback

Integrated Mode		
Evaluation Type	Nature	Objective
Paper presentation/Seminar	Group or individual work	Learn from others presentation
Field Assignment	Field visit with report	Develop observation and recording skills
Poster presentation	Group or individual work	Develop research, creativity, and discussion skills
Paper presentation/Seminar	Group or individual work	Learn from others presentation

Models of Evaluation

Based on the types of evaluation, various models of evaluation implementation are suggested for theory, practical, self-study and work-based learning. The focus of these models is to encourage the students to improve on skills and performance.

Model for Theory Courses- 3 Credit Course (Major-1 & 2, Minor-1 and MDC-1)	
CCE-50% (75) & SEE-50% (75)	
Exam Pattern	Marks
Class Test (Average of TWO tests)	15
Quiz (Average of TWO quiz)	15
Home Assignment	15



Active Learning- PBL (Problem based learning) /CSBL (case study-based learning) /Seminar/Flipped Class Room etc. OBE (outcome-based education) tools.	10
Class Assignment	10
Attendance	10
Continuous and Comprehensive Evaluation	75
Semester-End Evaluation	75

*Similarly Model for Theory 4 Credit Courses be formulated and can be implemented after discussion and approval.

Model for Practical Courses- 1 Credit Course (Major-1 & 2, Minor-1 and MDC-1)	
CCE-50% (25) & SEE-50% (25)	
Exam Pattern	Marks
Lab work assessment	10
Viva voce/Lab quiz	10
Attendance	05
Continuous and Comprehensive Evaluation	25
Semester-End Evaluation	25

*Similarly Model for Practical 2-Credit Courses be formulated and can be implemented after discussion and approval.

Model for Project/Self-study Courses- 4 Credit Course	
CCE-50% (100) & SEE-50% (100)	
Exam Pattern	Marks
Project Evaluation (Best 4 out of 5)	80
Participation in discussion	10
Attendance	10
Continuous and Comprehensive Evaluation	100
Semester-End Evaluation	100

*Model for Project/Self-study Courses will be implemented from semester-6 after discussion and approval.

Model for Work Experience Courses – 4 Credit Course	
CCE-50% (100) & SEE-50% (100)	
Exam Pattern	Marks
Project Evaluation (Best 4 out of 5)	80
Participation in discussion	10
Attendance	10
Continuous and Comprehensive Evaluation	100
Semester-End Evaluation	100

*Model for Work Experience Courses will be implemented from semester-6 after discussion and approval.

Model for Skill Enhancement Course -2 Credit Course	
CCE-50% (50) & SEE-50% (50)	
Exam Pattern	Marks
Lab work assessment or Project based Assessment	20
Viva voce/Lab quiz	20
Attendance & Performance	10
Continuous and Comprehensive Evaluation	50
Semester-End Evaluation	50



Table-3: Evaluation - Weightage CCE: SEE = 50:50						
Component	Marks	SEE Duration Hrs.	Evaluation - Weightage CCE: SEE = 50:50			
			CCE Marks	SEE Marks	Total Marks	Total Marks To be Converted for
Theory (Major-1 & 2, Minor-1 and MDC-1)	75	2$\frac{1}{2}$	75	75	150	75
Practical (Major-1 & 2, Minor-1 and MDC-1)	25	2	25	25	50	25
Total	100	NA	100	100	200	100

*Similarly Model for Theory 4 Credits Courses and Practical 2 Credit Courses be formulated and can be implemented after discussion and approval.

Additional Information for Standard Operating Procedure Click following Link:

https://sihm.ac.in/public/upload/Sop/English_Version.pdf



**Theory Question Paper Pattern (For: Major-1 &2, Minor-1 and MDC-1)
Semester End Examination (SEE)**

Instructions:

- All Units/ Module carry equal weightage of 15 Marks each
- There must be One Question from each Unit/ Module
- Each Subtopic/ Chapter must be given due weightage in the Question paper
- Time duration: 2½Hours

The Theory Question Paper Skeleton is as follows (For: Major-1 &2, Minor-1 and MDC-1)

Question 1 (Unit/Module 1)		Marks
A	Answer all the Three.	03
B	Answer Any Two out of Three	06
C	Answer Any One out of Two	06
Total Marks Question 1		15
Question 2 (Unit/Module 2)		Marks
A	Answer all the Three.	03
B	Answer Any Two out of Three	06
C	Answer Any One out of Two	06
Total Marks Question 2		15
Question 3 (Unit/Module 3)		Marks
A	Answer all the Three.	03
B	Answer Any Two out of Three	06
C	Answer Any One out of Two	06
Total Marks Question 3		15
Question 4 (Unit/Module 4)		Marks
A	Answer all the Three.	03
B	Answer Any Two out of Three	06
C	Answer Any One out of Two	06
Total Marks Question 4		15
Question 5 (Unit/Module 5)		Marks
A	Answer all the Three.	03
B	Answer Any Two out of Three	06
C	Answer Any One out of Two	06
Total Marks Question 5		15



**Practical Question Paper Pattern for (For: Major-1 &2, Minor-1 and MDC-1)
Semester End Examination (SEE)**

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: **2 Hours**.

Exam Pattern	Marks
As per Major-1, Minor-1 and MDC-1 practical syllabus	20
Journal	05
Semester-End Evaluation	25

**Practical Question Paper Pattern for Skill enhancement course (SEC)-1
Semester End Examination (SEE)**

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: **2 Hours**.

Exam Pattern	Marks
As per SEC practical syllabus	45
Journal	05
Semester-End Evaluation	50



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	75

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 archaebacteria, 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	ઇન્ડિયન 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	15
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	15
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	15
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	15
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	15
Total		45	75



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 CentralBook Agency, India 1st edition.
4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Pteridophyta. CentralBook 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 McGrawhillPublishing 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:

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. Morphology refers to the size, shape, arrangement and structure of bacterial cells and studying these changes will be able to provide valuable insights into the behavior and outcome of bacterial infections.
4. Students will develop the ability to identify and describe the morphological characteristics of various algae, such as Spirogyra, Sargassum, Nostoc and Batrachospermum.
5. Students will become familiar with the identification of common fungal species in various ecological niches, such as Yeast, Mucor, Agaricus and Peziza.
6. 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.
7. Students will be able to understand and describe the anatomy of Nephrolepis, including its key structures, functions and growth patterns.
8. 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.
9. 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	The morphological study of bacteria through permanent slide (Cocci, Bacillus, Spirillum, Spirochete, Vibrio)
5	To study the identification of different type of algae (<i>Spirogyra</i> , <i>Sargassum</i> , <i>Nostoc</i> , <i>Batrachospermum</i>).
6	To study the identification of different type of fungi (<i>Yeast</i> , <i>Mucor</i> , <i>Agaricus</i> , <i>Peziza</i>)
7	Study of morphology – Dorsal and ventral side of <i>Riccia</i> .
8	Study of internal structures of <i>Riccia</i> .
9	Study of reproductive structures of <i>Riccia</i> .
10	Study of morphology of <i>Nephrolepis</i> .
11	Study of anatomy of <i>Nephrolepis</i> .
12	Study of reproductive structures of <i>Nephrolepis</i> .
13	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 (Core)-1 Practical: Cryptogrammic Botany Practical					
Time: - 2 hours		Date: -----	Total Marks: - 25		
Q-1	Identify and describe the given specimen “A” and “B”.			6 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the specimen “C” and “D” with diagrams.			6M	
	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.			4M	
	F				
	G				
Q-5	Journal.			5M	

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: **2 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	75

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 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	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	15



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	15
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	15
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	15
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	15
	Total	45	75

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.
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 Skillsનળ 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 (Core)-2 Practical: Fundamental Botany – I Practical					
Time: - 2 hours		Date: -----			
			Total Marks: - 25		
Q-1	Identify and describe the given specimen “A” and “B”.			6 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the given specimen “C” and “D” with diagrams.			6M	
	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.			4M	
	OR				
Q-4	Measure the pH of given sample.				
Q-5	Journal.			5M	

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: 2 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	75

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	15
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	15
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	15
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	15
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	15
	Total	45	75



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

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:

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. Morphology refers to the size, shape, arrangement and structure of bacterial cells and studying these changes will be able to provide valuable insights into the behavior and outcome of bacterial infections.
4. Students will develop the ability to identify and describe the morphological characteristics of various algae, such as Spirogyra, Sargassum, Nostoc and Batrachospermum.
5. Students will become familiar with the identification of common fungal species in various ecological niches, such as Yeast, Mucor, Agaricus and Peziza.
6. 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.
7. Students will be able to understand and describe the anatomy of Nephrolepis, including its key structures, functions and growth patterns.
8. 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.
9. 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 નાગુણો ધરાવે છે?		No
3	Major	No	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 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	The morphological study of bacteria through permanent slide (Cocci, Bacillus, Spirillum, Spirochete, Vibrio)
5	To study the identification of different type of algae (<i>Spirogyra</i> , <i>Sargassum</i> , <i>Nostoc</i> , <i>Batrachospermum</i>).
6	To study the identification of different type of fungi (<i>Yeast</i> , <i>Mucor</i> , <i>Agaricus</i> , <i>Peziza</i>)
7	Study of morphology – Dorsal and ventral side of <i>Riccia</i> .
8	Study of internal structures of <i>Riccia</i> .
9	Study of reproductive structures of <i>Riccia</i> .
10	Study of morphology of <i>Nephrolepis</i> .
11	Study of anatomy of <i>Nephrolepis</i> .
12	Study of reproductive structures of <i>Nephrolepis</i> .
13	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 (Elective) -1 Practical: Cryptogrammic Botany Practical					
Time: - 2 hours		Date: -----	Total Marks: - 25		
Q-1	Identify and describe the given specimen “A” and “B”.			6 M	
	X		Y		
	A		A		
	B		B		
Q-2	Identify and describe the specimen “C” and “D” with diagrams.			6M	
	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.			4M	
	F				
	G				
Q-5	Journal.			5M	

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: **2** 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	75

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 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	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	15
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	15
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	15
4	Genetics 4.1. Basic Concept of Gene. 4.2. Mendelian laws of hereditary: Mono hybrid cross, Di hybrid cross. 4.3. Structure of DNA.	9	15



	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	15
	Total	45	75

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 Depart, 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</i> , <i>Mucor</i> , <i>Funaria</i> , <i>Nephrolepis</i> , <i>Cycus</i> , <i>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: Multi-Disciplinary Course -1 (MDC-1): Botany- 1P: Introduction to Biology Practical-I					
Time: - 2 hours		Date: -----	Total Marks: - 25		
Q-1	Identify and describe the specimen “A” and specimen “B” with diagram.			6 M	
	X		Y		
	A		A		
	B		B		
Q-2	Perform theexperiment given by the examiner.			5M	
	X		Y		
	C		C		
Q-3	Rotation D, E and F.			9M	
	D				
	E				
	F				
Q-4	Journal.			5M	

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: 2 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 Practical	
Course Category	Skill Enhancement Course -1 (SEC-1)
Title of the Course	Principle of organic farming Practical
Course Credit	02
Teaching Hours per Semester (15 Week/ 90 Working days)	60
Total Marks	50

Practical Course Outcomes - COs

On completion of the Mushroom cultivation Practical 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 gain a comprehensive understanding of bio-inoculants, including their definition, types and mechanisms of action in the context of organic farming.
7. Students will be able to make informed decisions about when and how to apply stubble mulching, sheep penning and green leaf manuring techniques based on their understanding of soil health, ecological dynamics and crop management principles in organic farming.
8. Students will study how neem extract, cow urine, and other natural substances can be used for pest and disease management in plants and animals.
9. 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.
10. Students will gain a comprehensive understanding of post-harvest processes, including harvesting techniques, grading, sorting, cleaning, and storage, all while adhering to organic guidelines.
11. 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.
12. 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 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 introduction, definition and principles of organic farming by chart /PPT.
2	To study the 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 by chart /PPT.
3	Study the nutrient preparation methods: Green Manure, Farm Yard Manure (FYM) and Compost.
4	Study the nutrient preparation methods: Bio-gas slurry and Biodynamic Compost (BD).
5	Study the biofertilizers: Nitrogen fixer bacteria, <i>Azolla</i> , <i>Mycorrhiza</i> and plant growth promoting <i>rhizobacteria</i> .
6	Study the preparation of bio-inoculants used in organic farming: Granules, pellets, capsules and briquettes.
7	Study the indigenous technology knowledge for soil management (Stubble mulching, Sheep penning and Green leaf manuring).
8	Study the indigenous technology knowledge for pest and diseases management, make different organic pest and diseases controller such as - Cow urine + Neem extract, cow dung smoking, Neem cake application, Cow urine tonic, Bird perch, seed treatment with cow urine).
9	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).
10	To study the post-harvest management practices permitted for organically raised crops.
11	Study of quality aspect: Grading, packing and handling.
12	Study the methods of preparation and production cost of panchagavya, Beejamrut and Jeevamrut in organic farming.
13	Study the method of preparation and production cost of Dasparni, Neem seed extract in organic farming.
14	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://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., Moa, 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: Principle of organic farming Practical					
Time: - 2 hours		Date: -----	Total Marks: - 50		
Q-1	Describe the nutrient preparation methods: “A” and “B”. (Green Manure, Farm Yard Manure (FYM), Compost, Bio-gas slurry and Biodynamic Compost (BD)).		10M		
	X			Y	
	A			A	
	B			B	
Q-2	Describe the indigenous technology knowledge for soil management: “C” and “D”. (Stubble mulching, Sheep penning and Green leaf manuring).		10M		
	X			Y	
	C			C	
	D			D	
Q-3	Describe the indigenous technology knowledge for pest and diseases management: “E” and “F”. (Cow urine + Neem extract, cow dung smoking, Neem cake application, Cow urine tonic, Bird perch, seed treatment with cow urine).		10M		
	X			Y	
	E			E	
	F			F	
Q-4	Rotation: Identify and describe the given specimen G, H, I and J. (weed management instrument).		08M		
	G			I	
	H			J	
Q-5	Describe the methods of preparation and production cost of Panchagavya/ Beejamrut / Jeevamrut.		07M		
Q-6	Journal.		05M		

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: 2 Hours.

