Sir P. T. Sarvajanik College of Science

(Autonomous, Affiliated with VNSGU, Surat)

Re-Accredited 'A+' with CGPA 3.35

PROPOSED

SYLLABUS

FOR

SEM I & II

Program: B.Sc.

Course: Botany

From

Academic year

2025-26

(NEP-2020)

(To be effective from June, 2025)

Acknowledgement

At the outset, I would like to thank Principal Dr. Pruthul R Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies, for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Botany for the long and arduous work they have put in during the compiling of the restructured syllabus.

Dr Anjali V Varshney
Chairperson
Board of Studies in Botany

Graduate Attributes

After the successful completion of modules in different courses of B.Sc. BOTANY, the learner will be able to:

GA 1: Understand the basic concept of botany in relation to its allied core courses.

GA 2: Perceive the significance of microbes and plants for the animal life, human welfare, and structural and functional aspects of plants.

GA 3: Demonstrate simple experiments related to plant sciences, analyse data, and interpret them with the theoretical knowledge.

GA 4: Appraise the students about the diversity of plants, their classification, structure and growth.

GA 5: Acquaint the students with the fundamentals and present understanding of the mechanisms associated with development, differentiation and structure of different plant organs and the metabolic and physiological changes occurring in them.

GA 6: Effectively communicate scientific ideas.

Programme Specific Outcomes

PO-1 To build a strong academic bridge.

PO-2 To provide flexibility in the course offered and proactively adapt to the changing needs of students and the society.

PO-3 To establish a center for multidisciplinary activities.

PO-4 To mould individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.

Board of studies in Botany

Undergraduate and Post graduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Dr. Anjali V Varshney	Chairman	Sir P T Sarvajanik College of Science, Surat
Faculty of the specialization			
1	Dr. Jayshri D Chaudhari	Assistant Professor	Sir P T Sarvajanik College of Science, Surat
2	Dr. Vibhavari K Vyas	Adhyapak Sahayak	Sir P T Sarvajanik College of Science, Surat
3	Dr. Jagruti S Rana	Adhyapak Sahayak	Sir P T Sarvajanik College of Science, Surat
Subject Expert nominated by Vice-Chancellor Subject experts			
1	Dr. Meghna Adhwaryu	Head of the Department	Govt Arts, Commerce & Science College, Limbayat, Surat
Representative from Industry/corporate sector/allied area			
1	Ms. Prabhuta Patel	Director – Vision & Robotics	At Po. Ambach, F. Vaghshar, Ta. Pardi, Dist. Valsad, Gujarat
Meritorious Alumnus			
1	Dr. Minoo H Parabia	Start-up	Retired professor VNSGU 12/1768 A, Vakil Street, Shahpore, Surat
Two experts from other than the parent University			
1	Dr Lolly M. Jain	Associate Professor	K. J. Somaiya College of Science and Commerce, Mumbai
2	Prof. Bandu Konde	Professor	Wilson College (Autonomous), Mumbai

Content

Sr. No	Semester	Course number	Course Code	Course title
Core Course (CC)				
1.	**I**	CC I	BOTMJ-S1P1-3CR25	Prokaryotes, Phycology and Mycology
2.		CC II	BOTMJ-S1P2-3CR25	Physiology, Anatomy and Morphology
3.		PRACTICAL [MJ]-I	BOTMJ-S1PR1-1CR25	Practical (MJ)-I
4.		PRACTICAL [MJ]-II	BOTMJ-S1PR2-1CR25	Practical (MJ)-II
5.		MN	BOTMN-S1P1-2CR25	Basic Botany
6.		PRACTICAL [MN]	BOTMN-S1PR1-2CR25	Practical (MN)
7.		MDC	BOTMDC-S1P1-4CR25	Nursery Management and Gardening
8.		PRACTICAL (SEC)	BOTSEC- S1P1-2CR25	Practical (SEC)-1
1.	**II**	CC III [MJ]	BOTMJ-S2P3-3CR25	Higher Cryptogams and Phanerogams
2.		CC IV [MJ]	BOTMJ-S2P4-3CR25	Flowering plants and Systematics
3.		PRACTICAL [MJ]	BOTMJ-S2PR3- 1CR25	Practical (MJ)- I
4.		PRACTICAL [MJ]	BOTMJ-S2PR4- 1CR25	Practical (MJ)- II
5.		MN	BOTMN-S2P2-2CR25	Higher cryptogams and Phanerogams
6.		PRACTICAL [MN]	BOTMN-S2PR2-2CR25	Botany Practical II (MN)

7.		MDC	BOTMDC-S2P1-4CR25	Ethnobotany, Pharmacognosy and Economic Botany
8.		SEC	BOTSEC- S2P1-2CR25	Basics of crude herbal drugs Practical

Detailed B.Sc. Botany Syllabus

F. Y. B.Sc. Syllabus with effect from the Academic year 2025-26

Course No.	Course Title	Course Code	Credits	Hour	Module	Lectures per module (1 Hr)	Examination		
							Internal Marks	External Marks	Total Marks
SEMESTER I									
Major Courses THEORY									
I	Prokaryotes, Phycology and Mycology	BOTMJ-S1P1-3CR25	3	45	3	15	37	38	75
II	Physiology, Anatomy and morphology	BOTMJ-S1P2-3CR25	3	45	3	15	37	38	75
Major Courses PRACTICAL									
I	Practical (MJ)-I	BOTMJ-S1PR1-1CR25	1	30	1	15	12	13	25
II	Practical (MJ)-II	BOTMJ-S1PR2-1CR25	1	30	1	15	12	13	25
Minor Courses THEORY									
I	Basic Botany	BOTMN-S1P1-2CR25	2	30	2	15	25	25	50
Minor Courses PRACTICAL									
I	Practical (MN)	BOTMN-S1PR1-2CR25	2	60	2	30	25	25	50
Multidisciplinary (MDC) THEORY									
I	Nursery Management and Gardening	BOTMDC-S1P1-4CR25	4	60	4	15	50	50	100
Skill Enhance Course (SEC) PRACTICAL									
I	Bonsai Techniques Practical (SEC)	BOTSEC- S1P1-2CR25	2	60	2	30	25	25	50
SEMESTER II									
Major Courses THEORY									
III	Higher cryptogams and Phanerogams	BOTMJ-S2P3-3CR25	3	45	3	15	37	38	75
IV	Flowering plants and Systematics	BOTMJ-S2P4-3CR25	3	45	3	15	37	38	75

Major Courses PRACTICAL									
I	Practical (MJ)-1	BOTMJ-S2PR3-1CR25	1	30	1	15	12	13	25
II	Practical (MJ)-2	BOTMJ-S2PR4-1CR25	1	30	1	15	12	13	25
Minor Courses THEORY									
II	Higher cryptogams and Phanerogams	BOTMN-S2P2-2CR25	2	30	2	15	25	25	50
Minor Courses PRACTICAL									
II	Practical (MN)	BOTMN-S2PR2-2CR25	2	60	2	30	25	25	50
Multidisciplinary (MDC) THEORY									
I	Ethnobotany, Pharmacognosy and Economic botany	BOTMDC-S2P1-4CR25	4	60	4	30	50	50	100
Skill Enhance Course (SEC) PRACTICAL									
II	Basics of crude herbal drugs Practical (SEC)	BOTSEC- S2P1-2CR25	2	60	2	30	25	25	50

B.Sc. (BOTANY) SEMESTER- I

CORE COURSE- I

MAJOR COURSE (THEORY)

COURSE TITLE: Prokaryotes, Phycology and Mycology

COURSE CODE: BOTMJ-S1P1-3CR25 **[CREDITS - 03]**

Course learning outcome
After the successful completion of the Course, the learner will be able to: 1. Acquire a comprehensive knowledge on different aspects related to microbes and lower plants. 2. Ascertain latest developments in the field of Plant science with a practical approach. 3. Equip students to think independently, critically to discuss different aspects of plant life.

Module 1	Microbes	[15L]

Learning objectives:

The module is intended to

- Ascertain the origins of life on the earth.
- Evaluate the ecological, ethnic and economic value of Microbes (virus and bacteria).
- Understand the need and basics of classification, learn range of structure, function and reproduction in microbes.

Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Explain the origins of life on the earth.
2. Illustrate diversity among the viruses and prokaryotic organisms and categorize them.
3. Evaluate the ecological, ethnic and economic value of microbes, virus and bacteria.

1.1	➢ General characters, structure and size. ➢ Virus types based on genetic material, Viroid, Virions and Prions. ➢ TMV and CaMV ➢ Economic importance of viruses.	[8L]
1.2	➢ Cellular forms of Life. ➢ Structure and reproduction (Binary fission, Budding, Fragmentation), Gram Staining. ➢ Types and shapes of Bacteria. ➢ Economic and ecological importance of bacteria	[7L]
Module 2	**Phycology**	**[15L]**
Learning objectives: This module is intended to ● Understand the ecological, ethnic and economic value of Algae. ● Understand the classification, structure and reproduction of Algae.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Describe the classification of algae based on the structure, reproduction and life cycles. 2. Evaluate the ecological, ethnic and economic value of Algae. 3. Enlist the algal products for human welfare.		
2.1	➢ Classification of algae by G.M. Smith. ➢ General characters and Occurrence. ➢ Thallus structure and reproduction of Cyanophyta and Chlorophyta.	[10L]
2.2	➢ Life cycle of ***Nostoc and Spirogyra.*** ➢ Economic and ecological importance of Algae	[5L]
Module3	**Mycology**	**[15L]**
Learning objectives: This module is intended to • Understand the ecological, ethnic and economic value of Fungi • Understand the classification, structure and reproduction of Fungi		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Classify the Fungi based on their structure, reproduction and life cycles. 2. Evaluate the ecological, ethnic, and economic value of Fungi. Fungi are summarized for their importance to human life.		

3. Acquaint with fungal products useful to human beings		
3.1	➢ Classification of Fungi by C.J. Alexopoulos ➢ General characters, occurrence, thallus structure and reproduction of fungi.	[8L]
3.2	➢ General characters zygomycetes and basidiomycetes. ➢ Life cycle of ***Mucor and Agaricus*** ➢ Economic and ecological importance of fungi.	[7L]

References:

- A.C. Datta (1964) Botany for Degree Student, Oxford University press
- Das Datta and Gangulee, (1990) College Botany Volume-I, 5th Edition New central book agency Calcutta
- Gangulee and Kar, (1990) College Botany Volume-II, New central book agency Calcutta
- Mukharjee, (1990) College Botany Volume-III, New central book agency Calcutta
- A. C. Datta (1989) College Botany 3rd Edi Oxford Bombay
- G.M. Smith (1955) Cryptogamic Botany Vol. I – II, Tata McGraw Hill Bombay Tata McGraw Hill Bombay
- Pandey S.N. and Trivedi P.S(2015) A text book of Botany vol. I (Algae, Fungi, Bacteria, Viruses, Lichen & Plant pathology)12th Edition, Vikash publishing House pvt. Ltd., New Delhi
- K.P. Saxena (1965) A Brief Course in Algae, Prakashan Kendra, Lucknow.
- S. Sundara Rajan. (2001) Introduction to Fungi1st Edition Anmol Publication, New Delhi
- Pandey B P (2011). College Botany -Vol. III. S. Chand & Co. Ltd, New Delhi, India
- P.C. Vashishta (1960) Botany for Degree Student: algae, S Chand publication Delhi
- P.C. Vashishta (1960) Botany for Degree Student: fungi, S Chand publication Delhi

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among microbes, algae and fungi.	X	X				
2. Explain the systematic structure of microbes, algae and fungi.		X	X			
3. Student will be able to explain the useful and harmful activities of microbes.		X	X	X		
4. Student will be able to cite specific examples of different types of microbes, algae and fungi and classify It		X	X	X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER I

Core Course- I

COURSE TITLE: Prokaryotes, Phycology and Mycology

COURSE CODE: BOTMJ-S1P1-3CR25 **[CREDITS - 03]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	28%	36%	36%	-	-	-	100%
II	25%	42%	33%	-	-	-	100%
III	25%	42%	33%	-	-	-	100%

B.Sc. (BOTANY) SEMESTER- I

CORE COURSE- I1

MAJOR COURSE (THEORY)

COURSE TITLE: Physiology, Anatomy and Morphology

COURSE CODE: BOTMJ-S1P2-3CR25 **[CREDITS - 03]**

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Perceive the significance of plants for human welfare cultivate insight into the structural and functional aspects of plants. 2. Demonstrate simple experiments related to plant sciences, analyze data and interpret them. 3. Elaborate on the diversity of lower plants, their classification, structure and growth. 4. Evaluate the metabolic, physiological and developmental changes occurring in plants.		
Module 1	**Physiology**	**[15L]**
Learning objectives: The module is intended to ● Deliver knowledge on the latest developments in plant sciences with a practical approach. ● Equip students to think independently and critically to discuss different aspects of plant life.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Comprehend the importance of water in plant life and mechanisms for the absorption and transport of water and solutes in plants. 2. Evaluate the role of minerals in plant nutrition and their deficiency symptoms. 3. Understand the light reactions and carbon assimilation processes responsible for the synthesis of food in plants.		
1.1	➢ Definition, mechanism and importance of: 1. Imbibition 2. Osmosis 3. Plasmolysis 4. Plant movement	[8L]

1.2	➢ Definition, mechanism and importance of: 1. Transpiration 2. Guttation 3. Ascent of Sap	[7L]
Module 2	**Anatomy**	**[15L]**
Learning objectives: This module is intended to • To impart basic knowledge about plant cells and tissue organisation in plant parts.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand the organization of tissues and tissue systems in plants. 2. Evaluate and appreciate the different anatomical features in plants. 3. Understand the difference between Dicotyledons and Monocotyledons plants.		
2.1	➢ Definition, types, structure and function of: • Tissues ➢ Anatomy of Dicotyledon and Monocotyledon: • Stem, Root and Leaf.	[8L]
2.2	➢ Definition, structure and occurrence of: • Non-living cell inclusions (Ergastic material) ➢ Definition, types and structure of: • Stele • Vascular bundle	[7L]
Module 3	**Morphology of angiosperms**	**[15L]**
Learning objectives: This module is intended to • Introduce a vision to look at the different plant parts arrangement and their structure.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Understand different taxonomical aids for the identification and classification of Angiosperms. 2. Analyse the morphology of the common angiosperm plants. 3. Appreciate variations in the roots, stems and leaves of plants and ability to describe them.		

3.1	➢ General and distinguishing characters of angiosperms. ➢ **Root-** Types, functions and modifications of root. ➢ **Stem-** Types, functions and modifications of stem.	[07]
3.2	➢ **Leaf-** Definition, structure, function and types. ➢ **Venation –** Types. ➢ **Phyllotaxy-** Definition and types.	[8L]

References:

- V. Singh (1981)1st Edi Taxonomy of Angiosperms: Rastogi pub.
- B. P. Pandey (2001) Taxonomy of Angiosperm: S. Chand and Co.
- Dr. S. K. Verma and Mohit Verma (2008) A textbook of Plant Physiology Biochemistry and Biotechnology: S. Chand and Co.
- A.C. Datta (1989) College Botany,3rd Edi. Oxford Bombay.
- B. P. Pandey (2001) Plant Anatomy: S. Chand and Co.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the structures and functions in plants.	X	X				
2. Explain the anatomical characters of the dicot and monocot plant		X	X			
3. Acquire ability to describe the morphological characters of a plant in hand.		X	X	X		
4. Shall be able to ascertain the types of arrangement of plant part in a given sample.		X		X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER I

Core Course- II

COURSE TITLE: Physiology, Anatomy and Morphology

COURSE CODE: BOTMJ-S1P2-3CR25 [CREDITS - 03]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	28%	36%	36%	-	-	-	100%
II	25%	42%	33%	-	-	-	100%
III	25%	42%	33%	-	-	-	100%

B.Sc. (BOTANY) SEMESTER I

COURSE TITLE: PRACTICAL MJ-I

COURSE CODE: BOTMJ-S1PR1-1CR25 [CREDIT- 01]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Demonstrate practical skills and relate their Botany theory concepts through practical.
2. Differentiate different types of bacteria and viruses.

PRACTICAL – I

1	Study of Microscope.
2	Study the structure of TMV and CaMV with the help of a chart.
3	Study different types of bacteria with the help of a chart.
4	Study gram staining technique using available bacterial samples.
5	Study different types of stains and fixatives.
6	To analyze living organisms in pond water samples.
7	**A.** Study the thallus structure and reproduction in ***Nostoc***. **B.** Study the permanent slides of ***Nostoc***.
8	**A.** Study the thallus structure and reproduction in ***Spirogyra***. **B.** Study the permanent slides of ***Spirogyra***.
9	**A.** Study the thallus structure and reproduction in ***Mucor***. **B.** Study the permanent slides of ***Mucor.***
10	**A.** Study the thallus structure and reproduction in ***Agaricus.*** **B.** study the permanent slides of ***Agaricus.***

11	Collection of algae and fungi during field visit.

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER I

COURSE TITLE: PRACTICAL MJ-I

COURSE CODE: BOTMJ-S1PR2-1CR25 [CREDIT- 01]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Identify and describe morphological, anatomical, and reproductive features of algae and fungi. 2. Explain the internal organization and functioning of various plant tissue system

PRACTICAL – II

1	Perform Physiological experiments to demonstrate. **A.** Force of imbibition. **B.** Osmosis by thistle funnel method. **C.** Geotropic movement in plants. **D.** Hydrotropic movement in plants. **E.** Phototropic movement in plants. **F.** Stomatal transpiration by four leaves method. **G.** Phenomenon of transpiration (bell jar method).
2	Ascertain the relative rate of photosynthesis by bubble counting method.
3	Study different types of tissues by permanent slides.
4	Study the internal structure of Monocotyledon stem.
5	Study the internal structure of Dicotyledon stem.
6	Study the internal structure of Monocotyledon root.
7	Study the internal structure of Dicotyledon root.
8	Study the internal structure of Monocotyledon leaf
9	Study the internal structure of Dicotyledon leaf.
10	Study ergastic matters in different plant materials.
11	**Study the different types of roots:** a. Types of roots • Tap roots *(Vinca)* • Fibrous Roots (Grass) • Adventitious (Bryophyllum)

		b. Modified roots: • Prop roots (Banyan tree) • Stilt root (Maize and Sugarcane) • Pneumatophores (Avicennia) • Storage roots (Carrot and Sweet Potato)
	12	**Study the different types of stems:** (any of the types as per the availability) a. Aerial Stems- • Caudex (Palms) • Culm (Bamboo) • Scape (Canna and Onions) • Excurrent (*Polyalthia longifolia and Casuarina)* • Deliquescent (Mango) • Weak Stem *(lpomoea)* b. Underground Stems: • Rhizome (Ginger, turmeric) • Tuber (Potato) • Bulb (Onion) • Corm (*Amorphophallus)* c. Specialized Stem**:** • Phylloclade (*Opuntia)* • Cladode *(Asparagus)*
	13	**Study the different types of leaves:** (any of the types as per the availability) a. Simple (Mango and Banana) b. Pinnate Compound Leaf 1. Unipinnate (Cassia and Rose) 2. Bipinnate (*Mimosa and Caesalpinia)* 3. Tripinnate *(Moringa)* 4. Decompound *(Coriander)* c. Palmately Compound Leaf 1. Unifoliate *(Citrus),* 2. Bifoliate (Bauhinia) 3. Trifoliate *(Crotalaria and Oxalis)* 4. Quadrifoliate *(Marsilea)* 5. Multifoliate *(Bombax)*

14	**Study the phyllotaxy of the following types:** 1. Alternate: (*Hibiscus rosa-sinensis)* 2. Opposite Superpose: (*Quisqualis indica)* 3. Opposite Decussate: (*Calotropis procera)* 4. Verticillate or Whorled: (*Nerium and Alstonia)*

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER I

MINOR COURSE THEORY

COURSE TITLE: BASIC BOTANY

COURSE CODE: BOTMN-S1P1-2CR25 [CREDITS- 02]

Course learning outcome		
After the successful completion of the Botany Minor Course, the learner will be able to: • Acquaint themselves with viruses, bacteria, algae and fungi. • Describe the morphology of angiosperm plants.		
Module 1	**Prokaryotes and Eukaryotes**	**[15L]**
Learning objectives: The module is intended to • Impart a thorough knowledge of general characters and classification of algae • Get information about thallus structure and the life cycle of Nostoc. • Acquire knowledge about general characters and classification of fungi. • Get information about thallus structure and the life cycle of Mucor.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Explain the origins of life on the earth. 2. Appreciate and categorize diversity among the viruses and prokaryotic organisms. 3. Evaluate the ecological, ethnic and economic value of Microbes, Algae and Fungi. 4. Summarizing their importance in human welfare. 5. Classify algae based on their structure, reproduction and life cycles.		
1.1	➢ **Virus:** • General characters. • Economic importance.	[3L]
1.2	➢ **Bacteria:** • General Characters. • Economic Importance.	[3L]
1.3	➢ **Algae:** • General characters. • Classification given by G.M. Smith.	[5L]

	• Classification, Occurrence, Thallus structure and Life cycle of **Nostoc.**	
1.4	➢ **Fungi:** • General characters. • Classification given by C.J. Alexopoulos. • Classification, Occurrence, Thallus structure, and Life cycle of **Mucor**.	[4L]
Module 2	**Morphology of angiosperms**	**[15L]**
Learning objectives: This module is intended to • Be aware of the importance of the different types of characters in Angiosperm/taxonomy. • Acquire knowledge of the morphology of the most common Angiosperm plants. • Gain knowledge about morphology and modification of stem, root, and leaf.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand need of different taxonomic aids for the identification of Angiosperms. 2. Analyze the morphology of the common Angiosperm plants. 3. Identify types of Root, Stem and Leaf.		
2.1	➢ **Angiosperm-** General and distinguishing character of angiosperm	[3L]
2.2	➢ **Root-** Parts, Types, Functions and modifications.	[4L]
2.3	➢ **Stem-** Types, function and modifications.	[4L]
2.4	➢ Definition, structure, function and types of: • Leaf • Venation • Phyllotaxy	[4L]

References:

- A. C. Datta (1964). Botany for Degree Student. Oxford University press
- Das Datta and Gangulee, (1990). College Botany Volume-I. 5th Edition New central book agency Calcutta
- Gangulee and Kar (1990). College Botany Volume-II. New central book agency Calcutta.

- Mukharjee, (1990). College Botany Volume-III. New central book agency Calcutta.
- A. C. Datta (1989). College Botany 3rd Edi Oxford Bombay.
- G.M. Smith (1955). Cryptogamic Botany Vol. I – II, Tata McGraw Hill Bombay Tata McGraw Hill Bombay.
- Pandey S.N. and Trivedi P.S(2015). A text book of Botany vol. I (Algae, Fungi, Bacteria, Viruses, Lichen & Plant pathology)12th Edition, Vikash publishing House Pvt. Ltd., New Delhi.
- K.P. Saxena (1965). A Brief Course in Algae, Prakashan Kendra, Lucknow.
- S. Sundara Rajan. (2001). Introduction to Fungi1st Edition Anmol Publication, New Delhi.
- B. P. Pandey (2011). College Botany -Vol. III. S. Chand & Co. Ltd, New Delhi, India.
- P.C. Vashishta (1960). Botany for Degree Student: algae, S Chand publication Delhi.
- V. Singh (1981).1st Edi Taxonomy of Angiosperms: Rastogi pub.
- B.P. Pandey (2001). Taxonomy of Angiosperm: S. Chand and Co.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among prokaryotes, algae and fungi and their physiology and anatomy.	X	X				
2. Grasp the systematic structure of prokaryotes, algae, and fungi, and the Morphological characteristics of plants.	X	X				
3. Ascertain implement knowledge on the useful and harmful interaction of prokaryotes, with mankind.		X	X	X		
4. First-hand knowledge on the different types of prokaryotes, algae and fungi, and plant part arrangements.	X	X	X	X		

Question Paper Template

F.Y. B. Sc. (BOTANY) SEMESTER I

MINOR BOTANY (THEORY)

COURSE TITLE: BASIC BOTANY

COURSE CODE: BOTMN-S1P1-2CR25 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	25%	50%	25%		--	--	100%
II	23%	46%	--	31%	--	--	100%

B.Sc. (BOTANY) SEMESTER I

COURSE TITLE: PRACTICAL (MI)-I

COURSE CODE: BOTMN-S1PR1-2CR25 [CREDIT- 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Use of Microscope in Biology.
2. Life diversity within Pond water samples.
3. Macroscopic and microscopic appearance of bacteria, algae and fungi.
4. Interpreting plant morphology of angiosperm plants.

PRACTICAL Module – I (Course – I)

1	Study of Microscope.
2	Study the structure of TMV and CaMV by the help of a chart.
3	Study bacteria in curd.
4	To analyze living organisms in pond water sample.
5	Study thallus structure, reproduction and permanent slides of ***Nostoc***.
6	Study the habitat of fungi by field visit and collect any two fungi.
7	Study thallus structure, reproduction, permanent slides and cultural practice of ***Mucor*** at the laboratory.

PRACTICAL Module – II (course – I)

1	**Study different types of roots:** **a. Types of roots:** • Tap roots *(Vinca)* • Fibrous Roots (Grass) • Adventitious (Bryophyllum) **b. Modified roots:** • Prop roots (Banyan tree) • Stilt root (Sugarcane) • Pneumatophores (*Avicennia*) • Storage roots (Carrot and Sweet Potato)
2	**Study different types of stems:** **a. Aerial Stems-** • Caudex (Palms) • Culms (Bamboo) • Scape (*Canna* and onion)

3	• Excurrent (*Polyalthia longifolia, Casuarina)* • Deliquescent (Mango) • Weak Stem *(lpomoea)* **b. Underground Stems:** • Rhizome (Ginger and Turmeric) • Tuber (Potato) • Bulb (Onion) • Corm *(Amorphophallus)* **c. Specialized Stem:** • Phylloclade (*Opuntia)* • Cladode *(Asparagus)*
4	**To study different types of leaves:** (any of the type as per availability) a. Simple (Mango and Banana) b. Pinnate Compound Leaf: I. Unipinnate (*Cassia* and Rose) II. Bipinnate *(Mimosa and Caesalpinia)* III. Tripinnate *(Moringa)* IV. Decompound *(Coriander)* c. Palmately Compound Leaf I. Unifoliate *(Citrus)* II. Bifoliate (*Bauhinia*) III. Trifoliate *(Crotalaria and Oxalis)* IV. Quadrifoliate *(Marsilea)* V. Multifoliate *(Bombax)*
5	**To study phyllotaxy of the following type:** 1. Alternate: (*Hibiscus)* 2. Opposite Superpose: (*Quisqualis indica)* 3. Opposite Decussate: (*Calotropis)* 4. Verticillate or Whorled: (*Nerium and Alstonia)*

- Every candidate shall complete laboratory courses by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER I

Multidisciplinary

COURSE TITLE: Nursery management and Gardening

COURSE CODE: BOTMDC-S1P1-4CR25 [CREDITS - 04]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: 1. Propagate plants and develop the nursery on commercial basis. 2. Deal with the seed production technology of horticultural crops. 3. Cultivate plants in green house. (Types of green house, erection and management). 4. Get acquainted with the basics of Ornamental, Landscape gardening, Pests and Diseases management. 5. Acquire knowledge regarding the theory and practice of the plant production.		
Module 1	**Nursery management-1**	**[15L]**
Learning objectives: The module is intended to • Impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in a commercially viable way.		
Learning outcomes: After the successful completion of the module, the learner will be able to **1.** Develop skills in propagation of different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in a commercially viable way.		
1.1	➢ Nursery: Definition, objectives, scope and infrastructure of nursery. ➢ Planning and layout of nursery management.	[5L]
1.2	➢ Planting - direct seedlings and transplants. ➢ Vegetative propagation ➢ Types of Air-layering, Cutting, Grafting and Budding.	[10L]

Module -2	Nursery management-2	[15L]
Learning objectives: The module is intended to • Impart basic knowledge develop skills about propagation, different types of media and uses of green house for vegetative propagation.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Develop skills in propagation of plants in different type of media, selection of season for cutting and also get knowledge about seed, seed bank and seedlings.		
2.1	➢ Season for collection, selection of cutting and treatment of cutting. ➢ Rooting media and its types. ➢ "Hardening off" plants, uses of greenhouse for vegetative propagation. mist chamber, shade house.	[8]
2.2	➢ Seed: Structure and type. ➢ Seed storage: Seed bank, factor affecting seed viability. ➢ Sowing/raising of seeds and seedlings-Transplanting of seedlings.	[7]
Module 3	**Gardening-1**	**[15L]**
Learning objectives: This module is intended to • Impart basic knowledge about types of gardens, parks, plant material, design the computer applications in landscaping and production practices. • Develop and management of nursery business (financial, marketing and personnel).		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Apply gained knowledge of garden management, business development, site selection, financial aspects, legal regulations and production practices (nutrition, water management, pest-management, pruning, training, storage, handling and shipping). 2. Initiate entrepreneurial skills.		

3.1	➢ Definition, objectives and scope of gardening. ➢ Types of Gardening, landscape and home gardening. ➢ Parks and its components.	[7L]
3.2	➢ Gardening operations: Soil layering and manuring. ➢ Types and methods of manuring. ➢ Types and methods of irrigation. ➢ Management of pests, diseases and harvesting.	[8L]
Module-4	**Gardening-2**	**[15L]**
Learning objectives: This module is intended to • Impart basic knowledge about kitchen garden, indoor garden and plant material. • Learn best practices for maintaining a kitchen garden and gardening tools. • Knowledge of kitchen garden, improve nutrition and reduce food costs.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Learn which plants are best for different garden locations. 2. Apply gained knowledge for fruits and vegetables growth and development. 3. Understand how to grow fruit, vegetables and crops without soil. 4. Develop a sense of responsibility and improve their nutritional well-being.		
4.1	➢ **Kitchen garden:** • Advantages of kitchen garden. • Site selection of kitchen garden. • Layout of Kitchen Garden. • Selection of plants for kitchen garden.	[7]
4.2	➢ **Indoor gardening:** • Plant for indoor gardening. • Common Types of Indoor Gardening Systems: Soil-Based Systems, Hydroponic Systems, Aquaponic Systems, Terrariums, Living wall. • Indoor garden plant care.	[8]

References:

- Dr. Arunkumar Singh and Abhinav kumar (2020). Propagation and nursery management.
- R.R. Sharma and Manish Srivastav (2004). Plant propagation and nursery management.
- B.S. Chundawat (2017). Plant propagation and nursery management
- Krishnan, P. R., Kalia, R. K., Tewari, J. C., & Roy, M. M. (2014). Plant nursery management: principles and practices. Central Arid Zone Research Institute, Jodhpur.
- P.K. Ray (2012). Plant Nursery Management: How to Start and Operate a Plant Nursery. Scientific Publishers.
- Hartmann, H.T., Kester D.E., Davis, F.T and R.L Geneve (2010) Plant Propagation: Principles and practices (8th Edition)
- Mason, J. (2004). Nursery management. Landlinks Press. 5. Sharma, R.R and Srivastav M (2004). Plant propagation and nursery management (First Edition) International Book Distributing Co.
- Bose, T.K. Sanyal, D and Sandhu, M.L. (1998). Propagation of Horticultural crops. Naya Prakash Publishers, Kolkatta.
- K. K. Nanda and V.K. Kochhar (1985). Vegetative propagation of plants. Kalyani Publisher- New Delhi-Ludhiana.
- Floriculture in India. Allied publishers private limited. New Delhi.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the management and methods of nursery and gardening.	X	X				
2. Muster the process of propagation, manuring and irrigation.	X	X				
3. Students will be able to designing structure of gardens, park and landscaping.		X	X	X		
4. Students will be able to identify and select the taxa for the kitchen garden and indoor garden and apply its skill for future earning		X	X	X	X	

Question Paper Template

B. Sc. (BOTANY) SEMESTER I

Multidisciplinary

COURSE TITLE: Nursery management and gardening

COURSE CODE: BOTMDC-S1P1-4CR25 **[CREDITS - 04]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%
III	20%	40%	40%	-	-	-	100%
IV	20%	40%	40%	-	-	-	100%

B.Sc. (BOTANY) SEMESTER I

Skill Enhanced Course

COURSE TITLE: Bonsai Technique (Practical)

COURSE CODE: BOTSEC-S1P1-2CR25 [CREDIT- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate practical skills. 2. Correlate their Botany theory concepts through practical. 3. Develop an understanding of nursery business management (finance, marketing and personnel).

PRACTICAL Module – I

1	Study different tools used in Bonsai by chart/specimens.
2	Study different styles of bonsai by chart/specimens.
3	Study different containers of Bonsai.
4	Perform wiring branches on Bonsai.
5	Perform clamping for shaping branch.
6	Study the potting and repotting of Bonsai.
7	Study the soil composition of Bonsai.
8	Selecting planting material viz. seeds, cuttings and overcome beginnings problems.
9	Study the watering and feeding of Bonsai.
10	Study the pest and disease of Bonsai.

PRACTICAL Module – 2

1	Study suitable plants for Bonsai.
2	Study the preparation of basic soil for Bonsai.

3	Study the sowing technique of Bonsai seed.
4	Study the different fertilizer used for Bonsai.
5	Prepare one Bonsai of suitable plant and submit it in college.
6	Visit Bonsai nursery and submit its report.

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand about pharmacognosy and crud drugs.	X	X	X			
2. Explain the different types of plants' traditional uses and pharmacognosy.		X	X			
3. Students will be able to cultivate medicinal plants and make crud drugs.		X	X	X		
4. Students will be able to use different types of extraction methods for crud drug preparation.		X	X	X		

B.Sc. (BOTANY) SEMESTER- II

CORE COURSE- I
MAJOR COURSE (THEORY)

COURSE TITLE: Higher cryptogams and Phanerogams

COURSE CODE: BOTMJ-S2P3-3CR25 [CREDITS - 03]

Course learning outcome		
After the successful completion of the course, the learner will be able to: 1. Gain Knowledge of diversity among the bryophytes, pteridophytes and gymnosperms Understand about the habit, habitats and diversity of higher cryptogamic plants, their classification, structure, growth and life cycle. 2. Acquaint with differentiation and structure of different plant organs.		
Module 1	**Bryophytes**	**[15L]**
Learning objectives: This module is intended to introduce: • Awareness of structure, development and life cycle of bryophytes. • Skill to identify different bryophytes.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Illustrate diversity among the bryophyte and general characters of bryophytes. 2. Classify bryophytes based on their structure, reproduction and life cycles. 3. Aware of ecological, ethnic and economic importance of bryophytes.		
1.1	• General Characters of Bryophytes. • Classification of Bryophytes. • Economic and Ecological importance of Bryophytes.	[7L]
1.2	• Occurrence, Morphology, Anatomy and Life cycles of ***Riccia*** and ***Marchantia.***	[8L]
Module 2	**Pteridophytes**	**[15L]**
Learning objectives: This module is intended to: • Create awareness in morphology, anatomy, development and life cycle of Pteridophytes. • Identify different Pteridophytes and classify them.		
Learning outcome: After the successful completion of the module, the learner will be able to:		

1. Grasp the overall diversity among the Pteridophytes. Illustrate general characters of Pteridophytes.
2. Classify pterophytes based on their structure, reproduction, and life cycles.
3. Understand the ecological, ethnic, and economic importance of pteridophytes.

2.1	• General Characters of Pteridophytes • Classification of Pteridophytes. • Economic and ecological importance of Pteridophytes.	[7L]
2.2	• Occurrence, morphology, anatomy and life cycle of ***Nephrolepis.***	[8L]
Module 3	**Gymnosperms**	**[15]**

Learning objectives:

This module is intended to make students

- Aware of gymnosperms, their morphology, anatomy, development and life cycle.
- Identify different gymnosperms and classify them.

Learning outcome:

After the successful completion of the module, the learner will be able to

1. Illustrate diversity among the gymnosperms. General characters of gymnosperms.
2. Classify gymnosperms based on their structure, reproduction, and life cycles.
3. Understand the ecological, ethnic, and economic importance of gymnosperms.

3.1	• General Characters of Gymnosperms. • Classification of Gymnosperms. • Economic and Ecological importance of Gymnosperms.	[8L]
3.2	• Occurrence, morphology, anatomy and life cycle of the genera: ***Cycas***	[7L]

References:

- Pandey B. P. (2011). College Botany (Vol. 3). S. Chand & Co. Ltd, New Delhi, India
- Pandey S.N. and Trivedi P.S(2015). A text book of Botany vol. I (Algae, Fungi, Bacteria, Viruses, Lichen & Plant pathology)12th Edition, Vikash publishing House Pvt. Ltd., New Delhi
- Biswas C. and Johri, B.M. (1977). The Gymnosperms. Narosa publishing House, NewDelhi.
- Sharma O. P. (2012). Pteridophyta. Tata McGraw-Hill Education, Delhi.
- Vashishta, P.C. (1991). Gymnosperms. S. Chand & Company Ltd., Ram Nagar, NewDelhi.
- Vashishta, P.C. (1991). Vascular Cryptogams. S. Chand & Company Ltd., RamNagar, New Delhi.

- Chopra, R. N. (2005). Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.

Question Paper

B. Sc. (BOTANY) SEMESTER II

Core Course- II

COURSE TITLE: HIGHER CRYPTOGAMS AND PHENEROGAMS

COURSE CODE: BOTMJ-S2P3-3CR25 **[CREDITS - 03]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	28%	36%	36%	-	-	-	100%
II	25%	42%	33%	-	-	-	100%
III	25%	42%	33%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among the higher cryptogams and Gymnosperm.	X	X				
1. Explain the systematic structure of Bryophytes, Pteridophytes and Gymnosperm.		X	X			
2. Students will be able to classify the Bryophytes, Pteridophytes and Gymnosperms.	X	X		X		
3. Students will be able to identify the different types of Bryophytes, Pteridophytes and Gymnosperms.	X	X		X		

B.Sc. (BOTANY) SEMESTER- II

CORE COURSE- I1

MAJOR COURSE (THEORY)

COURSE TITLE: Flowering Plants and Systematics

COURSE CODE: BOTMJ-S2P4-3CR25 [CREDITS - 03]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Enlightened on the process of gradual evolution in plants. 2. Equipped to understand the increasing complexity in plant body with introduction to flowers and their parts, arrangement of flowers, arrangement of calyx, corolla, stamens and carpels. 3. Understand principles of taxonomy and importance of characters in taxonomy. 4. Appraise the characters obtained from different sources over and above morphological characters. 5. Study the morphology of some common Angiosperm plants found around with their identification and classification.		
Module 1	**Structure of flower**	**[15L]**
Learning objectives: The module is intended to ● Provide an overview of morphological features of the flowers. ● Be acquainted with the fundamental mechanisms associated with the development, differentiation and structure of different plant organs.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Describe the morphological characteristics of a flower. 2. Use morphology for the identification of flowering plants.		

1.1	➢ Types of Inflorescences. ➢ Introduction, types, and parts of a flower. • Aestivation • Placentation • Androecium • Gynoecium	[15L]
Module 2	**Introductory Plant Systematics**	**[15L]**
Learning objectives: This module is intended to • Discuss naming of plants and the binomial nomenclature.		
Learning outcome: After the successful completion of the module, the learner will be able to ● Compare different methods of classification. ● Gain Knowledge on the botanical survey of India, importance and functions of gardens and herbaria. Prepare Herbarium specimens.		
2.1	➢ Binomial Nomenclature, Types of Classification (Artificial, Natural and Phylogenetic), APG. ➢ Bentham and Hooker's System of classification (up to series). Herbarium technique, Botanical Garden and Botanical Survey of India (BSI).	[15L]
Module 3	**Angiosperm Families**	**[15L]**
Learning objectives: This module is intended to ● Describe the morphological characteristics of flowers and their variations. Understand characters good and bad characters		
Learning outcome: After the successful completion of the module, the learner will be able to Classify plants as per Bentham and Hooker's system of classification and know their economic importance.		

3.1	➢ Classification (as per Bentham and Hooker's), general and distinguishing characters and economic importance of following angiosperm families: • Malvaceae • Fabaceae • Nyctaginaceae • Amaryllidaceae	[15L]

References:

- College Botany Vol. I - III Gangulee, et al. 5th Edi. 1990 New central book agency Calcutta.
- Taxonomy of Angiosperms V. Singh 1st Edi. 1981 Rastogi pub.
- V. Singh (1981).1st Edi Taxonomy of Angiosperms: Rastogi pub.
- B.P. Panday (2001). Taxonomy of Angiosperm: S. Chand.
- A. C. Datta (1964). Botany for Degree Student. Oxford University press
- Das Datta and Gangulee, (1990). College Botany Volume-I. 5th Edition New central book agency Calcutta
- Gangulee and Kar (1990). College Botany Volume-II. New central book agency Calcutta
- Mukharjee (1990). College Botany Volume-III. New central book agency Calcutta
- A. C. Datta (1989). College Botany 3rd Edi Oxford Bombay.

Question Paper Template

F.Y. B. Sc. (BOTANY) SEMESTER II

Core Course- II

COURSE TITLE: Flowering Plants and Systematics

COURSE CODE: BOTMJ-S2P2-3CR25 **[CREDITS - 03]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	28%	36%	36%	-	-	-	100%
II	25%	42%	33%	-	-	-	100%
III	25%	42%	33%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand about flower parts arrangements.	X	X				
2. Explain the types of classification of plants.		X	X			
3. Students will be able to identify and classify the plants species according their characters.		X	X	X		
4. Students will be able to prepare an herbarium of different plants			X		X	X

B.Sc. (BOTANY) SEMESTER II

COURSE TITLE: PRACTICAL MJ-I

COURSE CODE: BOTMJ-S2PR3-1CR25 [Credit- 01]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Identify and classify the plants to their respective family based on morphological characteristics. 2. Describe the plants morphology with live specimens.

PRACTICAL – I	
1	**A.** study the external features of Gametophyte and sporophyte, Anatomy of ***Riccia*** using fresh or preserved specimens. **B.** To study the permanent slide of ***Riccia.***
2	**A.** Study external features of Gametophyte and sporophyte, Anatomy of ***Marchantia*** using fresh or preserved specimens. **B.** Study permanent slides of ***Marchantia.***
3	**A.** Study of the morphology of **Sporophyte of Nephrolepis** using fresh or preserved material. **B.** Preparation of slides from the fresh/preserved material of **Stolon (T.S.) of Nephrolepis.** **C.** Preparation of slides from the fresh/preserved material of leaflet passing through the **sori of Nephrolepis.** **D.** Preparation of slides from the fresh/preserved material **Rachis (T.S.) of Nephrolepis.**
4	**A.** Study fresh/preserved specimens of **Cycas coralloid roots** **B.** Study fresh/preserved specimens of **Cycas Megasporophyll.** **C.** Study fresh/preserved specimens of **Cycas Microsporophyll.** **D.** Study fresh/preserved specimens of **Cycas Rachis.** **E.** Preparation of slides from fresh or preserved specimen material of **Cycas leaflet.**

B.Sc. (BOTANY) SEMESTER II

COURSE TITLE: PRACTICAL MJ-II

COURSE CODE: BOTMJ-S2PR4-1CR25 **[Credit- 01]**

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 3. Assign the plants to their respective family based on morphological characteristics. 4. Describe plant morphology with live specimens.

PRACTICAL – II

1	**Study Flower: (any of the type as per availability)** • Regular Flower- *lpomoea* • Irregular Flower- *Clitoria and Caesalpinia* • Unisexual Flower- Coccinea/ Papaya • Bisexual *Flower-Hibiscus*
2	**Study of inflorescence of the following:** **A. Racemose:** *a.* *Raceme: Caesalpinia pulcherrima, Brassica juncea.* *b.* Spike: *Achyranthes aspera, Polianthes tuberosa.* *c.* Spadix: *Colocasia* *d.* Catkin: *Acalypha hispida* *e.* Corymb: *Cassia, lxora* *f* Umbel: *Coriander* *g.* Capitate: *Acacia, Albizia* *h.* Capitulum: *Helianthus and Tridax* **B. Cymose:** • Unbranched a. Solitary Terminal: *Datura* b. Solitary Axillary: *Hibiscus* • Branched a. Monochasial Helicoid: *Hamellia patens* b. Scorpoid: *Heliotropium*

		Dichasial or Biparous: *Clerodendrum, Nyctanthes and Jasminum* c. Polychasial or Multiparous: *Nerium and Calotropis*	
	3	**Study the following placentation types:** Marginal, Axile, Free central, Parietal, Basal and Superficial.	
	4	Study types of **Aestivations.**	
	5	Study types of **Bracts.**	
	6	Study types of **Stamen.**	
	7	Study of morphological characters, floral dissection, T.S of ovary and floral formula of **Malvaceae.**	
	8	Study of morphological characters, floral dissection, T.S of ovary and floral formula of **Fabaceae.**	
	9	Study of morphological characters, floral dissection, T.S of ovary and floral formula of **Nyctaginaceae.**	
	10	Study of morphological characters, floral dissection, T.S of ovary and floral formula of **Amaryllidaceae.**	

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER II

MINOR COURSE THEORY

COURSE TITLE: Higher Cryptogams and Phenerogams

COURSE CODE: BOTMN-S2P2-2CR25 [CREDITS - 02]

Course learning outcome
After the successful completion of the Botany Minor Course, the learner will be able to: • Familiarize and identify Bryophytes, Pteridophytes and Gymnosperm. • Describe morphology of angiosperms like root, stem, leaf, flower and inflorescence.

Module 1	Bryophytes and Pteridophytes	[15L]

Learning objectives:

The module is intended to

- Provide a thorough knowledge of general characters and classification of Bryophytes.
- Describe Vegetative structure and Life cycle of ***Marchantia*.**
- Acquire knowledge about general characters and classification of pteridophytes.
- Describe the Vegetative structure and Life cycle of ***Nephrolepis.***

Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Gain knowledge about diversity among the bryophytes and pteridophytes with their general characters.
2. Understand the Classification of bryophytes and pteridophytes based on their structure, reproduction and life cycles.
3. Evaluate the ecological, ethnic, and economic value of bryophytes and pteridophytes

1.1	**BRYOPHYTES-1** • General Characters of Bryophytes. • Classification of Bryophytes.	[3L]
1.2	**BRYOPHYTES-2** • Morphology, anatomy, occurrence and life cycle of Riccia and ***Marchantia.*** • Economic and Ecological importance of Bryophytes	[4L]

1.3	**PTERIDOPHYTES-1** • General Characters of Pteridophytes. • Classification of Pteridophytes.	[4L]
1.4	**PTERIDOPHYTES-2** • Morphology, anatomy, occurrence, and life cycle of the genera: ***Nephrolepis*** • Economic and ecological importance of Pteridophytes.	[4L]
Module 2	**Gymnosperm and Angiosperm**	**[15L]**

Learning objectives:

This module is intended to

- Acquire knowledge about the morphology, internal structure and importance of gymnosperms and Angiosperm.
- Discuss the importance of characters obtained from some modern disciplines as an aid to plant taxonomy.
- Realize the values of diversity and its importance in human welfare.
- To understand the basis of plant nomenclature and classification.

Learning outcome:

After the successful completion of the module, the learner will be able to

1. Identify flowers and their parts, arrangement of flowers, arrangement of calyx and corolla, and arrangement of the placenta.
2. Study basic principles of taxonomy and use of rules of nomenclature.
3. Identify the local angiosperms to the families prescribed and prepare herbarium specimen.

2.1	**GYMNOSPERM-1** • General Characters of Gymnosperms. • Classification of Gymnosperms.	[3L]
2.2	**GYMNOSPERM-2** • Occurrence, morphology, anatomy and life cycle of the genera: ***Cycas.*** • Economic and Ecological importance of gymnosperm.	[4L]

2.3	**ANGIOSPERM-1** • Introduction, types and parts of flower. • Inflorescence • Aestivation • Placentation	[4L]
2.4	**ANGIOSPERM-2** • Introduction to code and some rules of nomenclature. • Binomial nomenclature, Types of Classification (Artificial, Natural and Phylogenetic) • Bentham and Hooker's System of classification (up to series) .	[4L]

REFERENCES:

- A.C. Datta (1964). Botany for Degree Student. Oxford University press
- Das Datta and Gangulee (1990). College Botany Volume-I. 5th Edition New central book agency Calcutta
- Gangulee and Kar (1990). College Botany Volume-II. New central book agency Calcutta
- Mukharjee. (1990). College Botany Volume-III. New central book agency Calcutta.
- A. C. Datta(1989). College Botany 3rd Edi Oxford Bombay.
- V. Singh (1981).1st Edi Taxonomy of Angiosperms: Rastogi pub.
- B.P. Pandey (2001). Taxonomy of Angiosperm: S. Chand
- Pandey B. P. (2011). College Botany (Vol. 3). S. Chand & Co. Ltd, New Delhi, India.
- Pandey S.N. and Trivedi P.S(2015). A text book of Botany vol. I (Algae, Fungi, Bacteria, Viruses, Lichen & Plant pathology)12th Edition, Vikash publishing House Pvt. Ltd., New Delhi
- Biswas, C. and Johri B.M. (1977). The Gymnosperms. Narosa publishing House, NewDelhi.
- Sharma, O.P. (2012). Pteridophyta. Tata McGraw-Hill Education, Delhi

- Vashishta, P.C. (1991). Gymnosperms. S. Chand & Company Ltd., Ram Nagar, NewDelhi.
- Vashishta, P.C. (1991). Vascular Cryptogams. S. Chand & Company Ltd., Ram Nagar, New Delhi.
- Chopra, R. N. (2005). Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the diversity among the Higher Cryptogams and Phanerogams.	X	X				
2. Explain the systematic structure of Bryophytes, Pteridophytes and Phanerogams.		X	X			
3. Students will be able to classify the Bryophytes, Pteridophytes, and Phanerogams.		X	X	X		
4. Students will be able to identify the different types of Bryophytes, Pteridophytes and Phanerogams according there morphological character.		X	X	X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER II

MINOR BOTANY (THEORY)

COURSE TITLE: Higher Cryptogams and Phenerogams

COURSE CODE: BOTMN-S2P2-2CR25 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	25%	50%	25%	--	--	--	100%
II	23%	46%	--	31%	--	--	100%

B.Sc. (BOTANY) SEMESTER II

COURSE TITLE: PRACTICAL(MN)-II

COURSE CODE: BOTMN-S2PR2-2CR25 [CREDIT- 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Understand the anatomical structure of ***Marchantia***.
2. Differentiate the sporophytic and gametophytic structure.
3. Study the morphological characters of Angiosperms.

PRACTICAL Module – I (Course – II)

1	**A.** Study external features of gametophyte & sporophyte, anatomy of ***Marchantia*** using fresh or preserved specimens. **B.** Study permanent slides of ***Marchantia.***
2	**A.** Study of the morphology of Sporophyte of ***Nephrolepis*** using fresh or preserved specimens. **B.** Preparation of slides from the fresh/preserved material of Stolon (T.S.) of ***Nephrolepis*** **C.** Preparation of slides from the fresh/preserved material of leaflet passing through the sori of ***Nephrolepis.*** **D.** Preparation of slides from the fresh/preserved material Rachis (T.S.) of ***Nephrolepis***

PRACTICAL Module – I (Course – II)

3.	**A.** Study fresh/preserved specimens of ***Cycas*** coralloid roots, **B.** Study fresh/preserved specimens of ***Cycas*** Megasporophyll **C.** Study fresh/preserved specimens of ***Cycas*** Microsporophyll. **D.** Study fresh/preserved specimens of ***Cycas*** Rachis **E.** Study T.S. of fresh/preserved specimens of ***Cycas*** Leaflet
4.	**Study of inflorescence of the following:** **A. Racemose:** *a.* *Raceme: Caesalpinia pulcherrima, Brassica juncea.* *b.* Spike: *Achyranthes aspera, Polianthes tuberosa.*

4.	*c.* Spadix: *Colocasia* *d.* Catkin: *Acalypha hispida* *e.* Corymb: *Cassia, lxora* *f* Umbel: *Coriander* *g.* Capitate: *Acacia, Albizia* *h.* Capitulum: *Helianthus and Tridax* **B. Cymose:** • Unbranched a. Solitary Terminal: *Datura* b. Solitary Axillary: *Hibiscus* • Branched c. Monochasial a. Helicoid: *Hamellia patens* b. Scorpoid: *Heliotropium* f. Dichasial or Biparous: *Clerodendrum, Nyctanthes and Jasminum* g. Polychasial or Multiparous: *Nerium and Calotropis*
5	**Study the following placentation types:** Marginal, Axile, Free central, Parietal, Basal and Superficial.
6	Study types of **Aestivations.**

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER II

Multidisciplinary

COURSE TITLE: Ethnobotany, Pharmacognosy and Economic botany

COURSE CODE: BOTMDC-S2P1-4CR25 [CREDITS - 04]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Understand delimits and scopes of ethnobotany, pharmacognosy & economic botany. 2. Learn to identify the useful medicinal plants and crop plants found around you. 3. Effectively communicate scientific ideas both orally and in writing. 4. Collect crude drugs from field/market and test their genuineness and quality.		
Module 1	**Introduction to Ethnobotany**	**[15L]**
Learning objectives: The module is intended to ● Provide comprehensive knowledge on different aspects related to medicinal plants. ● Acquire knowledge on the status and the developments in ethnobotany with a practical approach. ● To produce a student who thinks independently, and critically and discusses various aspects of medicinal plants and crop plant. ● **P**repar**e** drugs of natural origin and test their quality.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Be able to discuss patterns of cultural evolution with plants. 2. Understand and interrelate the different systems of medicine. 3. Discuss the role, importance and contribution of ethnomedicine, and active compounds of pharmacological importance.		
1.1	➢ Introduction, aim, scope and importance of Ethnobotany.	[5L]
1.2	➢ Classification of ethnobotany. ➢ International, national and regional contribution of ethnobotany ➢ Ethnobotany and its importance in medicine. Common and rare medicinal plants of South Gujarat.	[10L]
Module 2	**Introduction to Pharmacognosy**	**[15L]**
Learning objectives: The module is intended to ● Provide comprehensive knowledge on different aspects related to medicinal plants.		

- Acquire knowledge on the status and the developments in pharmacognosy with a practical approach.
- To produce a student who thinks independently, and critically and discusses various aspects of medicinal plants and crop plant.
- **P**repar**e** drugs of natural origin and test their quality.

Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Be able to discuss patterns of cultural evolution with plants.
2. Understand and interrelate the different systems of medicine.
3. Discuss the role, importance and contribution of ethnomedicine, and active compounds of pharmacological importance.

2.1	➢ Introduction, aim, scope and importance of pharmacognosy.	[5L]
2.2	➢ Introduction to different systems of medicine AUSH (Ayurvedic, Unani, Siddha and Homeopathy) ➢ Principal active compounds and pharmacological uses.	[10L]
Module 3	**Economic Botany – I**	**[15L]**

Learning objectives:

The module is intended to

- Capacitate students to stand and face national and international examinations related to ethnobotany, pharmacognosy & economic botany.
- Empower the student to become an employee or an entrepreneur in Botany, Pharma companies, NGOs, BSI, ZSI and forest department.

Learning outcomes:

After the successful completion of the module, the learner will be able to:

1. Understand the importance of botanical resources around them.
2. Appreciate economic and ecological importance of plants and strive to cultivate and conserve them.

3.1	➢ Be aware the following plants: botanical name, family, parts used, external morphology, cultivation and economic uses. A. **Cereals** – Rice (*Oryza sativa*), wheat (*Triticum aestivum*), Maize (*Zea mays*).	[15L]

	B. **Pulses** – Pigeon pea (Toor- *Cajanus cajan*), Chick Pea (Chana- *Cicer arietinum*), Green gram (Moong- *Vigna radiata*). C. **Spices** – Cardamom (*Elettaria cardamomum*), Black pepper (*Piper nigrum*), Turmeric (*Curcuma longa*). D. **Oils** – Groundnut (*Arachis hypogaea*), Castor (*Ricinus communis*), Sesame (*Sesamum indicum*).	
Module 4	**Economic Botany – II**	**[15L]**
Learning objectives: The module is intended to • Capacitate students to stand and face national and international examinations related to ethnobotany, pharmacognosy & economic botany. • Empower the student to become an employee or an entrepreneur in Botany, Pharma companies, NGOs, BSI, ZSI and forest department.		
Learning outcomes: After the successful completion of the module, the learner will be able to: 1. Understand the importance of botanical resources around them. 2. Appreciate economic and ecological importance of plants and strive to cultivate and conserve them.		
4.1	➢ Be aware the following plants: botanical name, family, parts used, external morphology, cultivation and economic uses. A. **Fibres** – Cotton (*Gossypium herbaceum*), Jute (*Corchorus*) and coir (cocos nucifera). B. **Timbers–** Teak (*Tectona grandis*), Shisham (*Dalbergia latifolia* and *D. Sissoo*) and Sevan (*Gmelina arborea*) C. **Dyes-**Sinduri (*Bixa orellana*), Mehendi (*Lawsonia inermis*) D. **Beverages –** Tea (*Camelia sinensis*), Coffee (*Coffea arabica),* Cocoa (*Theobroma cacao*).	
References: • Vinod D Rangari(2017). Pharmacognosy & Phytochemistry Vol.1and 2. Career publication		

- Biren Shah & A. K. Seth(2019). Textbook of Pharmacognosy & Phytochemistry. Elseviers.
- S. B Gokhale, C.K. Koktae, and A.R Purohit(2009) A text book of Pharmacognosy. Nirali Prakashan.
- Michael Heinrich and Joanne Barnes(2017). Fundamentals of Pharmacognosy and Phytotherapy4th Edition. Elseviers..
- Bendre and Kumar(1999) Economic Botany. Rastogi Publications
- Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
- Samba Murty and Subrahmanyam (2011). Text Book of Modern Economic Botany, CBS Publishers and Distributors, New Delhi.
- Hill, Albert F(2016) Economic Botany : A Text book of useful plants and Plant products , Surjeet Publication.
- Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
- Singh, Pandey and Jain (2017). Economic Botany, Rastogi Publication, Meerut.
- B. Baruah (2017). Economic Botany, Kalyani Publishers, New Delhi.

Question Paper Template

B. Sc. (BOTANY) SEMESTER II

Multidisciplinary

COURSE TITLE: Ethnobotany, Pharmacognosy and Economic Botany

COURSE CODE: BOTMDC-S2P1-4CR25 **[CREDITS - 04]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%
III	20%	40%	40%	-	-	-	100%
IV	20%	40%	40%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the different systems of Medicine.	X	X				
2. Explain the different types of plants' traditional uses and pharmacognosy.		X	X			
3. Students will be able to cultivate crop plants and medicinal plants and make an ethno medicine.		X	X	X		
4. Students will be able to use minor and major products of plants.	X	X	X	X		

F.Y. BSc. (BOTANY) SEMESTER II

Skill Enhanced Course (Practical)

COURSE TITLE: Basics of crude herbal drugs

COURSE CODE: BOTSEC-S2PR1-2CR25 [CREDIT- 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:
1. Students develop their practical skills for knowledge of crude herbal drugs.
2. Students will be able to collect medicinal plants and make crud drugs.
3. Students will be able to use different types of methods for crud drugs and herbal cosmetics preparation.

PRACTICAL Module – I

1	Collection of different plant parts for their medicinal use.
2	Drying, Grading and Storage of collected plant parts.
3	Perform the maceration method on *Clerodendrum inerme.*
4	Study of extractive value of plant sample.
5	Study stomatal index in *Calotropis porcera.*
6	Biochemical test of Protein and Amino acid from plant sample.
7	Biochemical test of Carbohydrates and Steroids from plant sample.

PRACTICAL Module – II

1	Preparation of Herbal lotion.
2	Preparation of Churan mixture.
3	Preparation of Herbal face pack.
4	Preparation of Hair oil.
5	Preparation of Herbal shampoo.
6	To prepare Herbarium of Medicinal plant. **[Minimum 5 Plants]**
7	Submit the field visit report of Herbal plants.

- Every candidate shall complete laboratory courses by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce a certified journal during the practical examination.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
5. Understand about pharmacognosy and crud drugs.	X	X	X			
6. Explain the different types of plants' traditional uses and pharmacognosy.		X	X			
7. Students will be able to cultivate medicinal plants and make crud drugs.		X	X	X		
8. Students will be able to use different types of extraction methods for crud drug preparation.		X	X	X		