Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર B.Sc. Botany Sem.-1 to 4 ના રીવાઈઝ કરેલ અભ્યાસક્રમ સંદર્ભે વનસ્પતિશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૦૪/૦૪/૨૦૨૫ ની સભાના ઠરાવ ક્રમાંકઃ૦૬ થી નીચે મુજબ કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૪ થી કરેલ ભલામણસ્વીકારી એકેડેમિક કાઉન્સિલની તા.૫/૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૧ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

.બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/સિલેબસ/૧૧૮૮૯/૨૦૨૫
તા.૦૨–૦૬–૨૦૨૫

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-I

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	----- ---
I	3+3	1+1	2	2	4/(2+2)	2	2/2/ (1+1)	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester I [Major (MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-101	PHYCOLOGY	3	3
BOTP-MJ-102	PRACTICAL	2	1
BOT-MJ-103	PLANT MORPHOLOGY	3	3
BOTP-MJ-104	PRACTICAL	2	1
TOTAL CREDITS			8

Semester I [Minor (ME)] DOMAIN SPECIFIC/ ELECTIVE

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-ME-101	PHYCOLOGY AND PLANT MORPHOLOGY	2	2
BOTP-ME-102	PRACTICAL	4	2
TOTAL CREDITS			4

Semester I [Multidisciplinary (MDC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MDC-101	FUNDAMENTAL OF PLANT MICROBIOLOGY	2	2
BOTP-MDC-102	PRACTICAL	4	2
TOTAL CREDITS			4

Semester I [Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-101	NATURAL RESOURCES AND CONSERVATION	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-II

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

(Effective from December 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-II

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	-----
II	3+3	1+1	2	2	4/(2+2)	2	2/2/ (1+1)	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester II[Major (MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-201	FUNGI, LICHEN AND PLANT PATHOLOGY	3	3
BOTP-MJ-202	PRACTICAL	2	1
BOT-MJ-203	PLANT MORPHOLOGY AND PLANT TAXONOMY	3	3
BOTP-MJ-204	PRACTICAL	2	1
TOTAL CREDITS			8

Semester II[Minor (ME)] DOMAIN SPECIFIC/ ELECTIVE

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-ME-201	FUNGI, LICHEN AND BRYOPHYTA	2	2
BOTP-ME-202	PRACTICAL	4	2
TOTAL CREDITS			4

Semester II[Multidisciplinary (MDC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MDC-201	ORGANIC FARMING	2	2
BOTP-MDC-202	PRACTICAL	4	2
TOTAL CREDITS			4

Semester II[Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-201	BIODIVERSITY	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-101 (PHYCOLOGY)

BOTANY (Major) PAPER – 101

Course Objectives :	
❖	The objective of the Algology course is to provide students with comprehensive knowledge of the biology, diversity, classification, structure, reproduction, and ecological significance of algae.
Course Outcomes :	
➢	CO1: Understand the general characteristics, classification, and ecological significance of algae. CO2: Identify various groups of algae based on their morphology, pigmentation, reproduction, and habitat. CO3: Explain the economic importance of algae in industries like food, pharmaceuticals, biofuel, and environmental management. CO4: Demonstrate knowledge of algal reproduction, life cycles, and evolutionary trends among different algal groups. CO5: Apply algal techniques in laboratory and field studies, including culture methods, sampling, and microscopic identification.

BOT-MJ-101	**PHYCOLOGY**	**(3 Credits) 45 hours**
UNIT I	**Introduction to Phycology** ➢ Important characteristics of algae ➢ Thallus organization of algae (unicellular, multicellular, colonial forms) ➢ Habitat of algae ➢ Economic importance of algae ➢ Classification of algae (G.M. Smith, 1950) ➢ Characteristic of major algal division- Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta	15 Hours

UNIT II	➢ Life history of the following types with classification, occurrence, thallus structure, cell structure and reproduction (excluding development) – ❖ *Nostoc* ❖ *Oscillatoria* ❖ *Spirogyra* ❖ *Chara*	15 Hours
UNIT III	➢ Life history of the following types with classification, occurrence, thallus structure, cell structure and reproduction (excluding development) ❖ *Ectocarpus* ❖ *Sargassum* ❖ *Batrachospermum*	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

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BOTP-MJ-102 (**PHYCOLOGY**)

BOTANY (Major) Practical – 102

Course Outcomes :

- CO1: Demonstrate proficiency in using microscopes and preparing slides for algal observation.
- CO2: Identify major algal genera through morphological characteristics and reproductive features.
- CO3: Distinguish between different classes of algae based on thallus structure and pigmentation.
- CO4: Understand the basic techniques of algal culturing and its significance.
- CO5: Develop skills in field collection, preservation, and documentation of algal specimens.

BOTP-MJ-102	**PHYCOLOGY**	**(1 Credits) 30 hours**
1.	To study the thallus structure of *Nostoc*,	
2.	To study the thallus structure of *Oscillatoria*	
3.	To study the thallus structure of *Rivularia*	
4.	To study the thallus structure of *Spirogyra*	
5.	To study the lateral and sclariform conjugation in *Spirogyra*	
6.	To study thallus structure and daughter colonies in *Volvox*	
7.	To study vegetative and reproductive structures in *Chara*	
8.	To study thallus structure in *Ectocarpus*	
9.	To study unilocular and plurilocular sporangia in *Ectocarpus*	
10.	To study thallus structure and t.s. of leaf blade of *Sargassum*	
11.	To study air bladder, male conceptacle and female conceptacle of *Sargassum*	
12.	To study thallus structure in *Batrachospermum*	
13.	To study cystocarp in *Batrachospermum*	
14.	To study the thallus structure and cystocarp of *Polysiphonia*	
15.	Collection and submission of various algae	
16.	Culture of algae using relevant media	
17.	Isolation and qualitative analysis of secondary metabolites/ pigments from algae	

REFERENCES:

1. Algae by Linda E. Graham, James M. Graham, and Lee W. Wilcox
2. Algae: An Introduction to Phycology by G. R. South and C. Van den Hoek
3. Introduction to the Algae: Structure and Reproduction by Harold C. Bold and Michael J. Wynne
4. Freshwater Algae: Identification and Use as Bioindicators by Edward G. Bellinger and David C. Sigee
5. Algal Culturing Techniques by Robert A. Andersen
6. Algae: Form and Function by F. E. Fritsch and G. Subramanian
7. Textbook of Algae by O. P. Sharma
8. Phycology: Principles, Practices and Applications by B. N. Pandey and R. N. Pandey
9. Algae: Biology, Ecology, and Cultivation by R. C. Gupta
10. Applied Phycology by M. S. Kumar and V. S. Venkataraman
11. A Text Book of Botany by Singh, Pande & Jain
12. A Text Book of Practical Botany Vol. I by Dr. Ashok Bendre Dr. Ashok Kumar

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-103 (PLANT MORPHOLOGY)

BOTANY (Major) PAPER – 103

Course Outcomes :

- CO1: Understand and describe the basic concepts and principles of plant morphology, including vegetative and reproductive structures.
- CO2: Identify and differentiate various types of roots, stems, leaves, inflorescences, flowers based on their morphological characteristics.
- CO3: Analyze the adaptive significance of different morphological modifications in relation to habitat and environment.
- CO4: Demonstrate the ability to classify and compare plant parts based on standard morphological terminology.

BOT-MJ--103	PLANT MORPHOLOGY	(3 Credits) 45 hours
UNIT I	➢ Introduction to Plant Morphology ➢ Distinguishing characters of Seed plants **ROOT MORPHOLOGY** **1. Introduction to Root System** ➢ Definition and significance of roots ➢ Characteristics of the root system ➢ Differences between root and shoot **2. Types of Root Systems** ➢ Taproot system (e.g., dicots) ➢ Fibrous root system (e.g., monocots) ➢ Adventitious roots **3. Root Regions and Structure** ➢ Root cap: Functions and structure ➢ Meristematic zone	15 Hours

	➢ Zone of elongation ➢ Zone of maturation (root hairs and lateral roots) **4. Modifications of Roots** ➢ Storage roots ➢ Prop roots ➢ Stilt roots ➢ Pneumatophores ➢ Haustorial roots ➢ Nodulated roots ➢ Epiphytic roots **STEM MORPHOLOGY** **1. Introduction to Stem** ➢ Definition and significance of stems ➢ Primary functions of the stem (support, conduction, storage, photosynthesis) **2. Types of Stems** ➢ Herbaceous vs. Woody Stems ➢ Aerial Stems (Erect, Creeping, Twining, Climbing) ➢ Underground Stems (Rhizome, Tuber, Corm, Bulb) ➢ Subaerial Stems (Runner, Stolon, Offset, Sucker) **3. Regions of the Stem** ➢ Node and Internode ➢ Axillary and Terminal Buds **4. Modifications of Stem** ➢ Storage Stems ➢ Supportive Stems ➢ Protective Stems ➢ Photosynthetic Stems ➢ Reproductive Stems	
UNIT II	**LEAF MORPHOLOGY** **1. Introduction to Leaves** ➢ Definition and functions of leaves **2. Leaf Structure** ➢ Leaf parts: Lamina, petiole, stipules, veins	15 Hours

	3. Types of Leaves ➢ Based on attachment: Petiolate vs. Sessile ➢ Simple leaves ➢ Compound leaves (Pinnate and Palmate with their types) ➢ Based on venation : Reticulate (dicots) vs. Parallel (monocots) **4. Leaf Arrangement (Phyllotaxy)** ➢ Alternate ➢ Opposite ➢ Whorled **5. Types of stipules** ➢ Free-lateral ➢ Adnate ➢ Interpetiolar ➢ Intrapetiolar ➢ Ochreate ➢ Foliaceous ➢ Bud Scales ➢ Tendrillar ➢ Spinous	
UNIT III	**1. Inflorescence** ➢ Racemose –Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum ➢ Cymose-Solitary, Monochasial-Helicoid and Scorpoid; Dichasial and Polychasial ➢ Special types - Verticillaster, Cyathium and Hypanthodium **2. Flower:** ➢ Parts of a typical flower: Bract, Pedicel, Thalamus-forms, Perianth-Calyx and Corolla, Androecium & Gynoecium ➢ Symmetry: Actinomorphic and Zygomorphic, Sexuality-Unisexual and Bisexual, Insertion of Floral whorls on thalamus-Hypogyny, Epigyny and Perigyny, Merous Condition-Trimerous, tetramerous and Pentamerous. **3. Aestivation :** Types with examples **4. Placentation:** Types with examples.	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MJ-104 (PLANT MORPHOLOGY)

BOTANY (Major) PRACTICAL – 104

Course Outcomes :

- CO1: Develop practical skills in observing, dissecting, and recording morphological features of different plant species.
- CO2: Identify and differentiate various root, stem, and leaf types along with their modifications.
- CO3: Recognize different types of inflorescences and floral structures in angiosperms.
- CO4: Develop observational and dissection skills for identifying plant parts and interpreting morphological adaptations.

BOTP-MJ-104	PLANT MORPHOLOGY	(1 Credits) 30 hours
	1. To study different types of roots: a. types of roots: ➢ Tap roots (*Vinca*), Fibrous Roots (Grass), Adventitious (Sugarcane), b. Modified roots: ➢ Prop roots (Banyan tree), Stilt root (Maize), Pneumatophores (Avicennia), Storage roots (Carrot, Sweet Potato). 2. To study different types of stem: a. Aerial Stems- Caudex-Palms, Clums (Bamboo), Scape (Canna and Onions), Excurrent (*Polyalthia longifolia, Casuarina*), Deliquescent (Mango), Weak Stem (*Ipomoea* b. Underground Stems: ➢ Rhizome-(Ginger, turmeric), Tuber (Potato), Bulb (Onion), Corm (*Amorphophallus*). c. Specialized Stem: ➢ Phylloclade (*Opuntia*), Cladode (*Asparagus*).	

3. To study different types of leaf: (any of the plant as per availability)
   a. Simple (Mango & Banana),
   b. Pinnate Compound Leaf-
      - Unipinnate (Cassia, Rose),
      - Bipinnate –*Mimosa, Caesalpinia*
      - Tripinnate *(Moringa)*
      - Decompound (*Coriander*)
   c. Palmately Compound Leaf-
      - Unifoliate (*Citrus*),
      - Bifoliate (Balanites, Bauhinia),
      - Trifoliate (*Crotalaria, Oxalis*),
      - Quadrifoliate (*Marsilea*), Mutlifoliate (*Bombax*)
4. To study phyllotaxy of the following type:
   - Alternate: *Hibiscus*
   - Opposite Superpose: *Quisqualis indica*
   - Opposite Decussate: *Calotropis*
   - Verticillate or Whorled: *Ocimum*
5. To study Flower: (any of the type as per availability)
   - Regular Flower-*Ipomoea*
   - Irregular Flower-*Clitoria, Caesalpinia*
   - Unisexual Flower-*Coccinia*
   - Bisexual Flower-*Hibiscus*
6. To study Racemose type of inflorescence :
   a. *Raceme: Caesalpinia pulcherrima, Brassica juncea*
   b. Spike: *Achyranthes aspera, Polianthes tuberosa*
   c. Spadix: *Colocasia*
   d. Catkin: *Acalphya hispida*
   e. Corymb: *Cassia, Ixora*
   f. Umbel: *Coriandrum*
   g. Capitate: *Acacia, Albizzia*
   h. Capitulum: *Helianthus, Tridax*
7. To study Racemose type of inflorescence :
   - Unbranched
     a. Solitary Terminal: *Datura*
     b. Solitary Axillary: *Hibiscus*
   - Branched
     a. Helicoid: *Hemellia patens*
     b. Scorpoid: *Heliotropium*

	c. Dichasial or Biparous: *Clerodendrum, Nyctanthes, Jasminum* d. Polychasial or Multipaorus: *Nerium, Calotropis*	

REFERENCES:

1. Pandey, B.P. (2009). A Text Book of Botany- Angiosperms. S. Chand and Co. Ltd. New Delhi.
2. Saxena, A.K. and Sarabhai, R.P. (1968). A Text Book of Botany. Vol. III. Ratan Prakashan mandir, Agra.
3. Singh V. & Jain - Taxonomy of Angiosperms - Rastogi Publications, Meerut.
4. Sharma, O.P. (1993). Plant Taxonomy. 2 nd Edition, McGraw Hill Education, New Delhi.
5. Singh, Gurucharan (2005). Systematics- Theory and Practice. Oxford IBH.
6. Sutaria, R.N.A. Text Book of Systematic Botany.
7. Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
8. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
9. Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
10. Lawrence - Taxonomy of Vascular Plants - Oxford & I B H, New Delhi.
11. Naik V.N., Taxonomy of Angiosperms, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
12. Pandey, S. N, and S.P. Misra (2008)-Taxonomy of Angiosperms- Ane Books India, New Delhi.
13. Sivarajan V. V - Introduction to Principles of taxonomy - Oxford &I B H New Delhi.
14. Any local/state/regional flora published by BSI or any other agency.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-ME-101 (PHYCOLOGY AND PLANT MORPHOLOGY)

BOTANY (Minor) PAPER – 101

Course Outcomes :

- CO1: Understand the general characteristics, classification, and ecological significance of algae.
- CO2: Identify various groups of algae based on their morphology, pigmentation, reproduction, and habitat.
- CO3: Explain the economic importance of algae in industries like food, pharmaceuticals, biofuel, and environmental management.
- CO4: Demonstrate knowledge of algal reproduction, life cycles, and evolutionary trends among different algal groups.
- CO5: Identify and differentiate various types of roots, stems, leaves, inflorescences, flowers based on their morphological characteristics.

BOT-ME-101	PHYCOLOGY AND PLANT MORPHOLOGY	(2 Credits) 30 hours
UNIT I	**ALGAE** ➢ Introduction to Algology : ➢ Important characteristics of Algae ➢ Classification of Algae by G.M. Smith ➢ Distinguishing Characteristics of following groups ❖ Cyanophyta (blue-green algae) ❖ Chlorophyta (green algae) ❖ Phaeophyta (brown algae) ❖ Rhodophyta (red algae) ➢ Classification, Occurrence, Thallus & Cell structure, and reproduction of *Spirogyra* and *Chara*	15 Hours
UNIT II	➢ Introduction to Plant Morphology ➢ Distinguishing characters of Seed plants	15 Hours

ROOT MORPHOLOGY

1. Types of Root Systems
   - Taproot system (e.g., dicots)
   - Fibrous root system (e.g., monocots)
   - Adventitious roots

2. Root Regions and Structure
   - Root cap: Functions and structure
   - Meristematic zone
   - Zone of elongation
   - Zone of maturation (root hairs and lateral roots)

3. Modifications of Roots
   - Storage roots
   - Prop roots
   - Stilt roots
   - Pneumatophores
   - Epiphytic roots

STEM MORPHOLOGY

1. Types of Stems
   - Herbaceous vs. Woody Stems
   - Aerial Stems (Erect, Creeping, Twining, Climbing)
   - Underground Stems (Rhizome, Tuber, Corm, Bulb)
   - Subaerial Stems (Runner, Stolon, Offset, Sucker)

2. Regions of the Stem
   - Node and Internode
   - Axillary and Terminal Buds

3. Modifications of Stem
   - Storage Stems
   - Supportive Stems
   - Protective Stems
   - Photosynthetic Stems
   - Reproductive Stems

LEAF MORPHOLOGY

1. Leaf Structure

- Leaf parts: Lamina, petiole, stipules, veins

2. Types of Leaves

- Based on attachment: Petiolate vs. Sessile
- Simple leaves
- Compound leaves (Pinnate and Palmate with their types)
- Based on venation : Reticulate (dicots) vs. Parallel (monocots)

3. Leaf Arrangement (Phyllotaxy)

- Alternate
- Opposite
- Whorled

INFLORESCENCE

- Racemose –Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum
- Cymose-Solitary, Monochasial-Helicoid and Scorpoid; Dichasial and Polychasial

FLOWER

- Parts of a typical flower: Bract, Pedicel, Thalamus-forms, Perianth-Calyx and Corolla, Androecium & Gynoecium
- Symmetry: Actinomorphic and Zygomorphic, Sexuality-Unisexual and Bisexual, Insertion of Floral whorls on thalamus-Hypogyny, Epigyny and Perigyny, Merous Condition-Trimerous, tetramerous and Pentamerous.
- Aestivation : Types with examples
- Placentation: Types with examples.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-ME-102 (PHYCOLOGY AND PLANT MORPHOLOGY)

BOTANY (Minor) Practical – 102

Course Outcomes :

- CO1: Demonstrate proficiency in using microscopes and preparing slides for algal observation.
  CO2: Identify major algal genera through morphological characteristics and reproductive features.
  CO3: Distinguish between different classes of algae based on thallus structure and pigmentation.
  CO4: Develop skills in field collection, preservation, and documentation of algal specimens.
- CO5: Develop practical skills in observing, dissecting, and recording morphological features of different plant species.
  CO6: Identify and differentiate various root, stem, and leaf types along with their modifications.
  CO7: Recognize different types of inflorescences and floral structures in angiosperms.
  CO8: Develop observational and dissection skills for identifying plant parts and interpreting morphological adaptations.

BOTP-ME-102	PHYCOLOGY AND PLANT MORPHOLOGY	(2 Credits) 60 hours
1	To study the thallus structure of *Nostoc*,	
2	To study the thallus structure of *Oscillatoria*	
3	To study the thallus structure of *Spirogyra*	
4	To study the lateral and sclariform conjugation in *Spirogyra*	
5	To study vegetative and reproductive structures in *Chara*	
6	To study thallus structure in *Ectocarpus*	
7	To study unilocular and plurilocular sporangia in *Ectocarpus*	
8	To study thallus structure in *Batrachospermum*	
9	To study cystocarp in *Batrachospermum*	
10	To study different types of roots: A) types of roots: ➢ Tap roots (*Vinca*), Fibrous Roots (Grass), Adventitious (Sugarcane), B) Modified roots: ➢ Prop roots (Banyan tree), Stilt root (Maize),	

	Pneumatophores (Avicennia), Storage roots (Carrot, Sweet Potato).	
11	To study different types of stem: A) Aerial Stems- Caudex-Palms, Clums (Bamboo), Scape (Canna and Onions), Excurrent (*Polyalthia longifolia, Casuarina*), Deliquescent (Mango), Weak Stem (*Ipomoea* B) Underground Stems: ➢ Rhizome-(Ginger, turmeric), Tuber (Potato), Bulb (Onion), Corm (*Amorphophallus*). C) Specialized Stem: ➢ Phylloclade (*Opuntia*), Cladode (*Asparagus*).	
12	To study different types of leaf: (any of the plant as per availability) A) Simple (Mango & Banana), B) Pinnate Compound Leaf- ➢ Unipinnate (Cassia, Rose), ➢ Bipinnate –*Mimosa, Caesalpinia* ➢ Tripinnate *(Moringa)* ➢ Decompound (*Coriander*) C) Palmately Compound Leaf- ➢ Unifoliate (*Citrus*), ➢ Bifoliate (Balanites, Bauhinia), ➢ Trifoliate (*Crotalaria, Oxalis*), ➢ Quadrifoliate (*Marsilea*), Mutlifoliate (*Bombax*)	
13	To study phyllotaxy of the following type: A) Alternate: *Hibiscus* B) Opposite Superpose: *Quisqualis indica* C) Opposite Decussate: *Calotropis* D) Verticillate or Whorled: *Ocimum*	
14	To study stipules of the following type : A) Free lateral : *Hibiscus* B) Adnate : *Rosa* C) Interpetiolar : *Ixora* D) Intrapetiolar : *Gardenia* E) Ochreate : *Polygonum* F) Foliaceous : *Pisum sativum*	

	G) Tendrillar : *Smilax* H) Spiny: *Acacia nilotica, Zizyphus*	
15	To study Flower: (any of the type as per availability) A) Regular Flower-*Ipomoea* B) Irregular Flower-*Clitoria, Caesalpinia* C) Unisexual Flower-*Coccinia* D) Bisexual Flower-*Hibiscus* E) Perianth : *Canna, Pancratium*	
16	To study Racemose type of inflorescence : A) Raceme: Caesalpinia pulcherrima, Brassica juncea B) Spike: Achyranthes aspera, Polianthes tuberosa C) Spadix: Colocasia D) Catkin: Acalphya hispida E) Corymb: Cassia, Ixora F) Umbel: Coriandrum G) Capitate: Acacia, Albizzia H) Capitulum: Helianthus, Tridax	
17	To study Racemose type of inflorescence : A) Unbranched ➢ Solitary Terminal: *Datura* ➢ Solitary Axillary: *Hibiscus* B) Branched ➢ Helicoid: *Hemellia patens* ➢ Scorpoid: *Heliotropium* ➢ Dichasial or Biparous: *Clerodendrum, Nyctanthes, Jasminum* ➢ Polychasial or Multipaorus: *Nerium, Calotropis*	
18	To study types of Aestivation in Flower.	
19	To study types of Placentation in Ovary.	
20	Study of morphological and floral characteristics of family Malvaceae.	
21	Study of morphological and floral characteristics of family Fabaceae.	
22	Study of morphological and floral characteristics of family Apocynaceae.	
23	Study of morphological and floral characteristics of family Nyctaginaceae.	
24	Study of morphological and floral characteristics of family Amaryllidaceae.	

REFERENCES:

1. Algae by Linda E. Graham, James M. Graham, and Lee W. Wilcox
2. Algae: An Introduction to Phycology by G. R. South and C. Van den Hoek
3. Textbook of Algae by O. P. Sharma
4. Phycology: Principles, Practices and Applications by B. N. Pandey and R. N. Pandey
5. Algae: Biology, Ecology, and Cultivation by R. C. Gupta
6. Applied Phycology by M. S. Kumar and V. S. Venkataraman
7. A Text Book of Botany by Singh, Pande & Jain
8. A Text Book of Practical Botany Vol. I by Dr. Ashok Bendre Dr. Ashok Kumar
9. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
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12. Sharma, O.P. (1993). Plant Taxonomy. 2 nd Edition, McGraw Hill Education, New Delhi.
13. Singh, Gurucharan (2005). Systematics- Theory and Practice. Oxford IBH.
14. Sutaria, R.N.A. Text Book of Systematic Botany.
15. Singh V. & Jain - Taxonomy of Angiosperms - Rastogi Publications, Meerut.
16. Sivarajan V. V - Introduction to Principles of taxonomy - Oxford &I B H New Delhi.
17. Any local/state/regional flora published by BSI or any other agency.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MDC-101 (FUNDAMENTAL OF PLANT MICROBIOLOGY)

BOTANY (MDC) PAPER – 101

Course Objectives :

- This undergraduate course introduces the core principles of microbiology with a focus on plant-microbe interactions. Students will explore the historical development of microbiology, microbial classification, and the three domains of life. The curriculum emphasizes applied aspects such as rhizosphere dynamics, microbial nutrient cycling, and their role in sustainable agriculture. Laboratory sessions will cover essential techniques including staining methods and pure culture isolation. By the end of the course, students will understand the significance of microbes in plant health, soil fertility, and ecosystem functioning, equipping them with foundational knowledge for advanced studies in microbiology, agriculture, or environmental science.

Course Outcomes :

- **CO1:** Explain the historical developments and contributions of key scientists in microbiology.
- **CO2:** Classify microorganisms based on cellular organization, staining, oxygen requirement, and molecular techniques.
- **CO3:** Compare the three domains of life (Bacteria, Archaea, Eukarya) and their evolutionary significance.
- **CO4:** Describe the structure and function of bacterial cell walls and general properties of viruses.
- **CO5:** Analyze the role of rhizosphere microbes in nutrient cycling and soil health.
- **CO6:** Demonstrate staining techniques and pure culture methods in microbiological studies.

BOT-MDC-101	FUNDAMENTAL OF PLANT MICROBIOLOGY	(2 Credits) 30 hours
UNIT I	**History and Key Discoveries in Microbiology** Pioneers and their contributions: o 1.Robert Koch (Germ Theory, Koch's Postulates) o 2.Louis Pasteur (Fermentation, Pasteurization)	15 Hours

	○ 3.Antony Van Leeuwenhoek (Microscope, Discovery of Microbes) ○ 4.Joseph Lister (Aseptic Techniques) ○ 5.Edward Jenner (Vaccination) ○ 6.Alexander Fleming (Penicillin) • **Classification of Microorganisms based on** ○ Cellular organization (Prokaryotes vs. Eukaryotes) ○ Staining (Gram +ve, Gram -ve, Acid-fast) ○ Oxygen requirement (Aerobic, Anaerobic, Facultative) ○ Shape (Cocci, Bacilli, Spirilla) ○ Pathogenicity (Pathogenic vs. Non-pathogenic) ○ Molecular techniques (16S rRNA, PCR-based) • **Three Domains of Life & Their Comparison** ○ Comparison table (Bacteria, Archaea, Eukarya) ○ Key differences (Cell wall, Membrane lipids, Genetic machinery) ○ Evolutionary relationships (Universal Ancestor) ○ Importance of the three domains ○ Introduction to Bacterial Cell Wall (Gram +ve vs. Gram -ve) ○ General Properties of Viruses (Structure)	
UNIT II	• **Plant Rhizosphere Basics** ○ Definition, structure, and importance. ○ Differences between rhizosphere, rhizoplane, and endosphere. ○ Root exudates (sugars, organic acids, amino acids) and microbial attraction. • **Plant Nutrient Cycling & Soil Health** ○ Role of microbes in: ▪ Nitrogen fixation (Rhizobium, Azotobacter) ▪ Phosphate solubilization (Pseudomonas, Bacillus) ▪ Siderophore production (Iron chelation) ▪ Carbon cycling & rhizodeposition ○ Impact on soil fertility & sustainable agriculture • **Dyes, Stains, and Staining**	15 Hours

	○ Basic concepts of dyes and stains ○ Types of stains (Simple, Differential, Special) ○ Applications in microbiology (Indicator & Inhibitor dyes) ○ Fixatives, mordant, decolorizer & intensifier ○ Mechanism of staining (Simple & Negative staining) • **Pure Culture Techniques** (Streak plate, Pour plate, Spread plate)	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MDC-102 ((FUNDAMENTAL OF PLANT MICROBIOLOGY)

BOTANY (MDC) Practical – 102

Course Outcomes :

- CO1: Demonstrate the use of basic microbiological tools and aseptic techniques in the lab.
- CO2: Perform staining methods and use microscopy for identification of bacteria and fungi.
- CO3: Prepare culture media and isolate microorganisms from soil and plant materials.
- CO4: Identify beneficial and harmful microorganisms associated with plants.

BOTP-MDC-102	FUNDAMENTAL OF PLANT MICROBIOLOGY	(2 Credits) 60 hours

1. Contribution of scientists with the help of chart/Photographs: Robert Koch, Louis Pasteur, Antony Van Leeuwenhoek,Joseph Lister, Edward Jenner, Alexander Fleming.
2. Introduction to common instruments/ equipment in microbiology laboratory: Autoclave, Incubator, Hot air oven, Laminar air flow, Centrifuge, Bacteriological Filter, pH meter, Colorimeter, Anaerobic jar, Colony counter.
3. Microscopic examination of living microorganisms:
   a. Observation of hay infusion by Wet Mount Technique.
   b. Observation of bacterial Motility by Hanging Drop technique.
4. Study of antiseptics & disinfectants.
5. pH measurement and adjustment
6. Preparation of buffer solutions, Citrate Buffer, Phosphate Buffer,Acetate Buffer.
7. Preparation of molar solution
8. Preparation of molal solution
9. Preparation of normal solution.
10. Preparation of ppm solution.

	11. Preparation of Gram staining solutions. 12. Gram Staining of Rhizosphere Bacteria. 13. Monochrome staining by basic dye. (Positive staining) 14. Monochrome staining by acidic dye. (Negative staining) 15. Preparation of bacteriological and mycological broth / agar medium 16. Observation of bacteria from curd. 17. Grading the quality of milk by MBRT test. 18. Direct microscopic observation of Microorganisms in polluted water (Hanging Dropmethod).	

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3. Modi, H. A. (2019). Elementary microbiology (Vol. II). Ekta Prakashan.
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - I

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-SEC-101 (NATURAL RESOURCES AND CONSERVATION)

BOTANY (SEC) PAPER – 101

Course Outcomes :

- Understand the basic types of natural resources (renewable vs. non-renewable).
- Explore the role of natural resources in global and local economies.
- Examine environmental impacts related to the extraction, use, and depletion of resources.
- Learn about sustainable management practices and policies.
- Analyze case studies related to resource use and management from around the world.

BOT-SEC-101	(NATURAL RESOURCES AND CONSERVATION)	(2 Credits) 30 hours
UNIT I	**Introduction to Natural Resources** ➢ Definition and Classification of natural resources ➢ Importance and role of natural resources ➢ Resources depletion and its consequences ➢ Impact of climate change on natural resources ➢ Strategies to mitigate climate change effects on resources ➢ Principle and Objective of Sustainability development ➢ National Policies and law related Natural Resources	15 Hours
UNIT II	**Types Natural Resources** ➢ Types Natural Resources **1. Renewable Resources:** **Water Resources:** Distribution, Conservation and Pollution **Forest Resources:** Types, Deforestation, Afforestation and conservation **Wildlife Resources:** Biodiversity and Conservation strategies **Agricultural Resources:** Soil conservation and Sustainable farming	15 Hours

	practices **2. Non-Renewable Resources:** **Mineral Resources:** Extraction, mining impacts and sustainable use **Fossil fuels:** Coal, oil, natural gas and their environmental effects **Nuclear energy:** Sources, Advantages and Challenges ➢ **Urbanization:** Definition, Characteristics and Problems	

REFERENCES:

1. "Natural Resources Conservation and Management" by C. H. S. S. Prasad
2. "Prakritik Sansadhan" (પ્રાકૃતિક સંસાધન) by Dr. K. B. Kothari
3. "Vigyanik Parivar ane Prakritik Sansadhan" (વિજ્ઞાનિક પરિવાર અને પ્રાકૃતિક સંસાધન) by Dr. B. B. Pandya
4. "Principles of Environmental Science: Inquiry and Applications" by William P. Cunningham and Mary Ann Cunningham
5. "Natural Resource Conservation: Management for a Sustainable Future" by Daniel D. Chiras
6. "Prakritik Sansadhan Ane Paristhitiki" (પ્રાકૃતિક સંસાધન અને પરિસ્થિતિકી) by Dr. T. B. S. Khatri

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-II

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

(Effective from December 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-II

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	-----
II	3+3	1+1	2	2	4/(2+2)	2	2/2/ (1+1)	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester II[Major (MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-201	FUNGI, LICHEN AND PLANT PATHOLOGY	3	3
BOTP-MJ-202	PRACTICAL	2	1
BOT-MJ-203	PLANT MORPHOLOGY AND PLANT TAXONOMY	3	3
BOTP-MJ-204	PRACTICAL	2	1
TOTAL CREDITS			8

Semester II[Minor (ME)] DOMAIN SPECIFIC/ ELECTIVE

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-ME-201	FUNGI, LICHEN AND BRYOPHYTA	2	2
BOTP-ME-202	PRACTICAL	4	2
TOTAL CREDITS			4

Semester II[Multidisciplinary (MDC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MDC-201	ORGANIC FARMING	2	2
BOTP-MDC-202	PRACTICAL	4	2
TOTAL CREDITS			4

Semester II[Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-201	BIODIVERSITY	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-201 (FUNGI, LICHEN AND PLANT PATHOLOGY)

BOTANY (Major) PAPER – 201

Course Outcomes :	
➢	CO1: Understand and describe the general characteristics, structure, and classification of fungi. CO2: Explain the reproductive strategies and life cycles of major fungal groups. CO3: Identify ecologically and economically important fungi and their roles in various industries.
➢	CO4: Understand the symbiotic nature, structure, and classification of lichens. CO5: Differentiate between major morphological types of lichens and their structural organization. CO6: Explain the reproductive strategies and life cycle of lichens. CO70: Assess the economic and biotechnological applications of lichens in various industries.
➢	CO8: Understand the fundamental concepts of plant pathology, including types of plant diseases, causal organisms, and modes of infection. CO9: Identify major groups of plant pathogens—fungi, bacteria, viruses, nematodes—and describe their structural features and disease mechanisms. CO10: Explain the disease cycle, host-pathogen interactions, and factors affecting disease development (disease triangle). CO11: Diagnose common plant diseases based on symptoms and causal agents, and suggest appropriate control measures.

BOT-MJ-201	**FUNGI, LICHENS AND PLANT PATHOLOGY**	**(3 Credits) 45 hours**
UNIT I	**Introduction to Mycology** ➢ Important characteristics of fungi ➢ Economic importance of fungi ➢ Classification of fungi (Alexopolus and Mims, 1979) ➢ Characteristic of major fungal classes- Phycomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes	15 Hours

UNIT II	➢ Life history of the following types with classification, occurrence, thallus structure, cell structure and reproduction (excluding development) ❖ *Mucor* ❖ *Aspergillus* ❖ *Agaricus* ❖ *Peziza* ❖ *Puccinia*	15 Hours
UNIT III	**Lichen** ➢ Introduction, Type of lichens, Reproduction, Economic importance of Lichen ➢ Classification, morphology, anatomy and reproduction of *Usnea* **Plant diseases** ➢ Study of following plant diseases (causal organism, symptoms and prevention) ❖ Bacterial diseases -Citrus Canker ❖ Viral diseases - Tobacco mosaic virus, Leaf curl of papaya ❖ Fungal diseases- White rust of crucifers, Red rot of sugarcane, Tikka disease of groundnut ❖ Phytoplasma diseases: Little leaf of brinjal	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

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BOTP-MJ-202 (FUNGI, LICHEN AND PLANT PATHOLOGY)

BOTANY (Major) Practical – 202

Course Outcomes :

- CO1: Describe the general characteristics, classification, morphology, and reproduction of fungi, including economically important species.
- CO2: Analyze the ecological and industrial roles of fungi in decomposition, fermentation, antibiotics, and as pathogens.
- CO3: Understand the symbiotic relationship in lichens, their types, structure, reproduction, and ecological significance.
- CO4: Explain the role of lichens as bioindicators and their economic uses in dyes, medicines, and pollution monitoring.
- CO5: Recognize and differentiate major plant diseases caused by fungi, bacteria, and viruses based on symptoms and causative agents.
- CO6: Explain disease development in plants through concepts like the disease triangle, infection process, and pathogen-host interactions.
- CO7: Evaluate and suggest suitable disease control strategies including cultural, chemical, biological, and integrated plant disease management.
- CO8: Develop basic practical skills in identifying fungal and lichen specimens and diagnosing plant diseases from field and laboratory observations.

BOTP-MJ-201	**FUNGI, LICHENS AND PLANT PATHOLOGY**	**(1 Credits) 30 hours**
1.	To study vegetative and reproductive structure of *Mucor*	
2.	To study vegetative thallus of *Pythium*	
3.	To study vegetative thallus and asexual reproductive structure of *Albugo* (*Cystopus candidus*)	
4.	To study vegetative thallus and asexual reproductive structure of *Aspergillus*	
5.	To study external morphology of basidiocarp of *Agaricus*	

6.	To study TS of stipe, pileus and gills of *Agaricus*	
7.	To study LS of apothecium of *Peziza*	
8.	To study symptoms of rust disease caused by *Puccinia*	
9.	To study uredospore, telutospore, pycnidiospore and aeciospore of *Puccina*	
10.	To study external features and internal structures of *Usnea* (Permanent slides of Lichen thallus T.S., Lichen apothecium V.S., Lichen soridia)	
11.	To study bacterial disease - Citrus Canker	
12.	To study viral diseases - Tobacco mosaic virus, Leaf curl of papaya	
13.	To study fungal diseases - White rust of crucifers, Red rot of sugarcane, Tikka disease of groundnut	
14.	To study phytoplasma diseases - Little leaf of brinjal	
15.	Collection of local fungi and/or plant disease	
16.	Fungal culture using PDA	
17.	Extraction and qualitative analysis of fungal metabolites	

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7. Mehrotra, R.S. and Aneja, R.S. An Introduction to Mycology, New Age Intermediate Press.
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-203 (**PLANT MORPHOLOGY AND PLANT TAXONOMY**)

BOTANY (Major) PAPER – 203

Course Outcomes :	
➢	CO 1 : Students will learn to identify and differentiate key parts of plants, including roots, stems, leaves, flowers, bracts, and inflorescences.
➢	CO 2: They will gain hands-on experience in observing plant anatomy and understanding its functions in growth, reproduction, and adaptation.
➢	CO 3: They will learn about binomial nomenclature and various classification systems, including the Bentham and Hooker system, and gain the ability to identify and classify plant families based on morphological features.

BOT-MJ-203	**PLANT MORPHOLOGY AND PLANT TAXONOMY**	**(3 Credits) 45 hours**
UNIT I	➢ Types of Bracts ➢ Fruits classification and types with examples ➢ Dicot and Monocot Seed ➢ Germination of seed : Epigeal germination, Hypogeal germination, Vivipary ➢ Defensive devices of plants	15 Hours
UNIT II	**Introduction to taxonomy** ➢ Principles of taxonomy ➢ Types of classification systems ➢ International Code for Botanical Nomenclature (ICBN) ➢ Nomenclature types ➢ Binomial nomenclature ➢ Botanical Garden ➢ Herbarium ➢ Bentham Hooker Classification (up to series)	15 Hours

	➢ Botanical Survey of India	
UNIT III	**Selected Plant Families** ➢ Selected angiosperm families their classification as per Bentham & hooker system, Distinguishing characters, general characteristics, floral formula and floral diagram: 1. Malvaceae 2. Apocynaceae 3. Nyctaginaceae 4. Amaryllidaceae	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MJ-204 (PLANT MORPHOLOGY AND PLANT TAXONOMY)

BOTANY (Major) Practical – 204

Course Outcomes :	
➢	CO 1 : Through practical sessions, students will acquire skills in observing plant structures, understanding their adaptive significance, and applying classification principles.
➢	CO 2 : Students will develop an understanding of plant morphology and taxonomy, including the structure and functions of fruits, seeds, and defensive adaptations in plants.

BOTP-MJ-204	PLANT MORPHOLOGY AND PLANT TAXONOMY	(1 Credits) 30 hours
1.	To study simple dry fruits using specimen/ charts	
2.	To study simple fleshy fruits using specimen/ charts	
3.	To study aggregate fruits using specimen/ charts	
4.	To study composite fruits using specimen/ charts	
5.	To study dicot and monocot seed.	
6.	To study defensive devices of plants. 1. Thorns – *Carissa, Bougainvillea* 2. Spines – *Zizyphus, Acacia, Opuntia* 3. Prickles- *Rose, Smilax* 4. Stinging hair- *Urtica* 5. Glandular hairs – *Jatropha* 6. Sticky latex – *Euphorbia, Calotropis*	
7.	Study of morphological and floral characteristics of family Malvaceae.	
8.	Study of morphological and floral characteristics of family Fabaceae.	
9.	Study of morphological and floral characteristics of family Apocynaceae.	
10.	Study of morphological and floral characteristics of family Solanaceae	
11.	Study of morphological and floral characteristics of family Nyctaginaceae.	
12.	Study of morphological and floral characteristics of family Amaryllidaceae.	

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-ME-201 (FUNGI, LICHEN AND BRYOPHYTA)

BOTANY (Minor) PAPER – 201

Course Outcomes :	
➢	CO 1: Students will gain knowledge of Bryophyta, their unique characteristics, and their significance in the plant kingdom.
➢	CO 2: They will learn about species like Riccia, Anthoceros, and Funaria, focusing on their structure, reproduction, and ecological roles.

BOT-ME-201	(FUNGI, LICHEN AND BRYOPHYTA)	(2 Credits) 30 hours
UNIT I	**FUNGI** 1. Introduction to Mycology : ➢ Important characteristics of Fungi ➢ Classification of Fungi by Alexopoulos and Mims (1979) 2. Major groups of Fungi : ➢ Distinguishing Characteristics of following groups ❖ Phycomycetes ❖ Ascomycetes ❖ Basidiomycetes ❖ Deuteromycetes 3. Classification, Occurrence, Vegetative structure and reproduction of *Mucor* **LICHEN** ➢ Introduction, Type of lichens, Reproduction, Economic importance of Lichen ➢ Classification, morphology, anatomy and reproduction of *Usnea*	15 Hours

UNIT II	**BRYOPHYTA**	15 Hours

- Important Characteristics of Bryophyta
- Characteristics of class Hepaticopsida, Anthocertopsida, Bryopsida,
- Economic importance of bryophytes
- Life history of the following with classification, occurrence, gametophyte & sporophyte structure and reproduction (excluding development)
  - *Riccia*
  - *Anthoceros*
  - *Funaria*

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-ME-202 (FUNGI, LICHEN AND BRYOPHYTA)

BOTANY (Minor) Practical – 202

Course Outcomes :	
➢	CO 1: Through practical observations and experiments, students will develop skills in identifying fungal and lichen specimens, analyzing plant-fungal interactions, and understanding their applications in agriculture, ecology, and industry.
➢	CO 2 : This knowledge will foster a broader appreciation for the importance of fungi and lichens in ecosystems and human life.
➢	CO 3 : Through practical sessions, students will develop skills in identifying bryophytes, observing their lifecycle stages, and understanding their adaptations to terrestrial and aquatic environments.

BOTP-ME-202	FUNGI, LICHEN AND BRYOPHYTA	(2 Credits) 60 hours
1	To study vegetative and reproductive structure of *Mucor*	
2	To study vegetative thallus of *Pythium*	
3	To study vegetative thallus and asexual reproductive structure of *Albugo* (*Cystopus candidus*)	
4	To study vegetative thallus and asexual reproductive structure of *Aspergillus*	
5	To study external morphology of basidiocarp of *Agaricus*	
6	To study TS of stipe, pileus and gills of *Agaricus*	
7	To study LS of apothecium of *Peziza*	
8	To study symptoms of rust disease caused by *Puccinia*	
9	To study uredospore, telutospore, pycnidiospore and aeciospore of *Puccina*	
10	To study external features and internal structures of *Usnea* (Permanent slides of Lichen thallus T.S , Lichen apothecium V.S., Lichen soridia)	
11	Study of morphology and anatomy of *Riccia:* external features of	

	gametophytes, anatomy of thallus and sporophytes of Riccia. (Permanent slides of Riccia gametophyte and sporophyte).	
12	Study of morphology and anatomy of *Marchantia:* external features of gametophytes, anatomy of thallus and sporophytes of *Marchantia.* (Permanent slides of *Marchantia* gametophyte, gemma cup and sporophyte)	
13	Study of morphology and anatomy of *Porella:* external features of gametophytes, anatomy of thallus and sporophytes of *Porella.* (Permanent slides of *Porella* gametophyte and sporophyte)	
14	Study of morphology and anatomy of *Anthoceros:* external features of gametophytes, anatomy of thallus and sporophytes of *Anthoceros.* (Permanent slides of *Anthoceros* gametophyte and sporophyte)	
15	Study of morphology and anatomy of *Funaria:* external features of gametophyte, anatomy of thallus and sporophytes of *Funaria.* (Permanent slides of *Funaria* gametophyte and sporophyte)	
16	Study of morphology and anatomy of *Sphagnum*: external features of c, anatomy of thallus and sporophytes of *Sphagnum.* (Permanent slides of *Sphagnum* gametophyte and sporophyte)	

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1. Pandey, S.N., Trivedi, P.S. and Misra, S.P. 2005. A Textbook of Botany Vol. I and II, Vikas Publishing House Pvt. Ltd.
2. Gangulee , H.C , Das, K. S. & Dutta ,C.. College Botany Vol. I , New Central book Agency.
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9. Satish Kumar (2014) "Diversity of Pteridophytes,Gymnosperms and Elementary Palaeobotany". Publisher: Pragati Prakashan
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MDC-201(ORGANIC FARMING)

BOTANY (MDC) PAPER – 201

Course Outcomes :

➢ **Course Objectives**

CO1: Explain the principles, history, and regulatory standards of organic farming.

CO2: Compare conventional and organic farming systems in terms of sustainability.

CO3: Design an organic farm plan integrating crop rotation and biodiversity.

CO4: Evaluate the economic viability and certification process of organic farming.

BOT-MDC--201	ORGANIC FARMING	(2 Credits) 30 hours
UNIT I	**Foundations of Organic Farming** **1. Introduction to Organic Farming** • Definition, principles, and scope • Comparison with conventional farming • Historical development and global trends **2. Organic Farming Standards & Certification** • National (e.g., NPOP, Organic) and international standards (IFOAM) • Certification process, labelling, and accreditation **3. Soil Health & Fertility Management** • Soil organic matter, microbial activity, and biofertilizers • Composting, vermicomposting, and green manuring • Crop rotation and cover cropping **4. Pest & Disease Management in Organic Systems** • Integrated Pest Management (IPM) • Biopesticides, botanical extracts, and biocontrol agents • Cultural and mechanical pest control methods	15 Hours

UNIT II	**Unit 2: Advanced Practices & Sustainability** **2.1 Organic Crop Production Techniques** • Selection of crops/varieties for organic farming • Seed treatment, sowing methods, and nutrient scheduling • Case studies of organic cereals, vegetables, and fruits **2.2 Livestock & Organic Farming Integration** • Role of livestock in nutrient cycling • Organic feed, pasture management, and animal welfare **2.3 Marketing & Economics of Organic Products** • Supply chains, export potential, and domestic markets • Cost-benefit analysis and government schemes **2.4 Sustainability & Future Challenges** • Climate resilience and carbon sequestration	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MDC-202 (ORGANIC FARMING)

BOTANY (MDC) Practical – 202

Course Outcomes :

- **CO1:** Apply organic techniques for soil fertility management (composting, green manure, etc.).
- **CO2:** Analyze pest and disease management strategies using organic inputs.

BOTP-MDC-202	ORGANIC FARMING	(2 Credits) 60 hours
	1. Testing pH of different types of soil. 2. Prepapring dry flower based fertilizer. 3. Preparing aerobic compost pits (using farm waste, cow dung, etc.). 4. Demonstrating vermicomposting (with Earthworms like Eisenia fetida). 5. Sowing and incorporating green manure crops (e.g., sunn hemp, dhaincha). 6. Culturing rhizobia/azotobacter for legume/non-legume crops. 7. Preparing neem-based pesticides (neem seed kernel extract). 8. Making garlic-chili-ginger spray for pest repellency. 9. Planting marigold as a trap crop for nematodes. 10. Installing pheromone traps/sticky traps. 11. Cow urine/panchagavya treatment for seed priming. 12. Designing polycultures (e.g., maize + beans + pumpkin). 13. Formulating livestock feed using farm-grown fodder. 14. Measure morphology of panchagavya treated seedlings. 15. Making Organic Herbal Cough Syrup (Homemade Remedy).	

	16. Making organic Dhoop Stick from dry flower powder. 17. Making Cowdung, Neem and aromatic herb mix mosquito repellent sticks. 18. Mock audit for organic certification (documentation review).	

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1. Altieri, M. A., & Nicholls, C. I. (2004). Biodiversity and pest management in agroecosystems (2nd ed.). CRC Press.
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16. Singh, A., & Singh, M. (2017). Utilization of Waste Flowers for Vermicomposting and Value-Added Products. Journal of Environmental Biology, 38(5), 1029-1034.
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - II

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

Skill Enhancement Courses

BOT-SEC-201 :BIODIVERSITY

Course Outcomes :

1. Understand the basic concepts of biodiversity, including the different levels (genetic, species, ecosystem).
2. Appreciate the significance of biodiversity for ecosystems, economies, and human wellbeing.
3. Gain insight into the main threats to biodiversity (climate change, habitat destruction, over-exploitation, etc.).
4. Learn about the methods used in biodiversity conservation and sustainable use.
5. Develop a critical understanding of conservation policy, laws, and ethical considerations.
6. Appreciate the global efforts toward biodiversity conservation.

BOT-SEC-201	BIODIVERSITY	(2 Credits) 30 hours
UNIT I	**Introduction to Biodiversity** ➢ Biodiversity basic concept and definition. ➢ Types of Biodiversity 1. Genetic Biodiversity 2. Species Biodiversity 3. Ecosystem Biodiversity ➢ Value of Biodiversity ➢ Importance of Biodiversity ➢ Factor affecting to Biodiversity ➢ Biodiversity Hotspots and Biodiversity Index ➢ Mangrove, Aquatic and Medicinal Plants of Gujarat	15 Hours
UNIT II	Conservation of Biodiversity ➢ In –situ conservation: Protected area, National Parks, Wildlife	15 Hours

	sanctuaries and Biosphere reserves ➢ Ex-situ conservation: Zoos, Botanical Garden, Gene banks, Seed Banks etc. ➢ Major National Park and Wildlife sanctuaries of Gujarat and India ➢ IUCN and Red data book ➢ Threatened species, Endemic species and Rare species (With Example) ➢ Biological Diversity Act (2002) ➢ The Environment Protection Act (1980) ➢ The Forest conservation Act (1980) ➢ The wild life protection Act (1972)	

REFERENCES:

1. "Jeev Vividhta" (જીવ વિવિધતા) by Dr. M. G. Zala
2. "Biodiversity" by Edward O. Wilson
3. "Principles of Conservation Biology" by Gary K. Meffe and C.R. Carroll
4. "Biodiversity and Conservation" by Kevin J. Gaston
5. Paryavaran Adhyayan (Gujarati) Erach Bharucha

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-III

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

(Effective from JUNE 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-III

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	-----
II	2+2+4	2+2	-	-	2+2	2	2	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester III[Major (BO-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-301	BRYOPHYTA	2	2
BOT-MJ-303	PLANT ANATOMY	2	2
BOT-MJ-305	CELL BIOLOGY	4	4
TOTAL CREDITS			8

Semester III[Major (BOTP-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOTP-MJ-302	PRACTICAL	4	2
BOTP-MJ-304	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[Multidisciplinary (MDC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MDC-301	NURSERY MANAGEMENT	2	2
BOTP-MDC-302	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-301	HEALTH, HYGIENE AND FIRST AID	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-IV

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

(Effective from JUNE 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-IV

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	-----
II	2+2+4	2+2	2	2	-	2	2	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester III[Major (BOT-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-401	PTERIDOPHYTA	2	2
BOT-MJ-403	GYMNOSPERM	2	2
BOT-MJ-405	PLANT EMBRYOLOGY AND SYSTEMATICS	4	4
TOTAL CREDITS			8

Semester III[Major (BOTP-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOTP-MJ-402	PRACTICAL	4	2
BOTP-MJ-404	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[MINOR (BOT-ME)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-ME-401	PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS	2	2
BOTP-ME-402	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-401	DISASTER MANAGEMENT	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-301 (BRYOPHYTA)

BOTANY (Major) PAPER – 301

Course Outcomes :	
➢	Students will gain knowledge of Bryophyta, their unique characteristics, and their significance in the plant kingdom.
➢	They will learn about species like Riccia, Marchantia, Anthoceros, and Funaria, focusing on their structure, reproduction, and ecological roles.
➢	This course emphasizes the importance of bryophytes in ecological balance and their use in studies of plant evolution and environment conservation.

BOT-MJ-301	**BRYOPHYTA**	**(2 Credits) 30 hours**
UNIT I	➢ Important Characteristics of Bryophyta ➢ Affinities of bryophytes ➢ Alternation of generation (life cycle) in bryophytes ➢ Classification of bryophytes by Proskaur (1957) ➢ Characteristics of class Hepaticopsida, Anthocertopsida, Bryopsida, ➢ Economic importance of bryophytes	15 Hours
UNIT II	➢ Life history of the following with classification, occurrence, gametophyte & sporophyte structure and reproduction (excluding development) ❖ *Riccia* ❖ *Marchantia*	15 Hours
UNIT III	➢ Life history of the following with classification, occurrence, structure and reproduction (excluding development) ❖ *Anthoceros* ❖ *Funaria*	15 Hours

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SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

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BOTP-MJ-302 (**BRYOPHYTA, CELL BIOLOGY AND FLOWERING PLANTS**)

BOTANY (Major) Practical – 302

Course Outcomes :	
➢	They will learn about species like Riccia, Marchantia, Porella, Anthoceros, Sphagnum and Funaria, focusing on their structure, reproduction, and ecological roles.
➢	Through practical sessions, students will develop skills in identifying bryophytes, observing their lifecycle stages, and understanding their adaptations to terrestrial and aquatic environments.

BOTP-MJ-302	**BRYOPHYTA, CELL BIOLOGY AND FLOWERING PLANTS**	(2 Credits) 60 hours
1.	Study of morphology and anatomy of *Riccia:* external features of gametophytes, anatomy of thallus and sporophytes of *Riccia*. (Permanent slides of *Riccia* gametophyte and sporophyte).	
2.	Study of morphology and anatomy of *Marchantia:* external features of gametophytes, anatomy of thallus and sporophytes of *Marchantia*. (Permanent slides of *Marchantia* gametophyte, gemma cup and sporophyte)	
3.	Study of morphology and anatomy of *Porella:* external features of gametophytes, anatomy of thallus and sporophytes of *Porella*. (Permanent slides of *Porella* gametophyte and sporophyte)	
4.	Study of morphology and anatomy of *Anthoceros:* external features of gametophytes, anatomy of thallus and sporophytes of *Anthoceros*. (Permanent slides of *Anthoceros* gametophyte and sporophyte)	
5.	Study of morphology and anatomy of *Funaria:* external features of gametophyte, anatomy of thallus and sporophytes of *Funaria*. (Permanent slides of *Funaria* gametophyte and sporophyte)	
6.	Study of morphology and anatomy of *Sphagnum*: external features of c, anatomy of thallus and sporophytes of *Sphagnum*.	

	(Permanent slides of *Sphagnum* gametophyte and sporophyte)	
7.	Gram Staining of Bacterial Cells	
8.	Study of Mitosis from any growing tip.	
9.	Study of Meiosis from any young bud.	
10.	Isolation and characterization by spectroscopic method of DNA, RNA.	
11.	Fluorescence Microscopy for Organelle Visualization using DAPI (nuclei) and MitoTracker dyes for Mitochondria, RNA.	
12.	Study Cell-viability assay using Trypan Blue exclusion Test.	
13.	Study of morphological and floral characteristics of family Nymphaceae.	
14.	Study of morphological and floral characteristics of family Cucurbitaceae.	
15.	Study of morphological and floral characteristics of family Myrtaceae.	
16.	Study of morphological and floral characteristics of family Convolvulaceae	
17.	Study of morphological and floral characteristics of family Loranthaceae	
18.	Study of morphological and floral characteristics of family Palmaceae.	

REFERENCES:

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SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

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BOT-MJ-303 (PLANT ANATOMY)

BOTANY (Major) PAPER – 303

Course Outcomes :	
➢	Students will develop a clear understanding of plant anatomy, including the structure and function of tissues involved in primary and secondary growth.
➢	They will learn about nodal anatomy and its role in the transport of nutrients and water.
➢	This course encourages critical thinking by connecting anatomical features to plant adaptations and survival.

BOT-MJ-303	**PLANT ANATOMY**	**(2 Credits) 30 hours**
UNIT I	**Tissue and tissue system** ➢ Meristematic Tissues-Characteristics of meristematic tissue, Types of meristematic tissues, Function and modification of meristematic tissues ➢ Permanent Tissue (Simple and Complex): Introduction, Types and Its function & Significance ➢ Epidermal tissue system - stomata and its types, hairs and trichome ➢ Secretory tissue system ➢ Vascular Bundle and Stele - Definition and Types ➢ Cell inclusions (Cystolith, Raphides, Spaheraphides)	15 Hours
UNIT II	**Anatomy and Secondary growth** ➢ Anatomy of dicot and monocot root ➢ Anatomy of dicot and monocot stem ➢ Anatomy of Dorsiventral and isobilateral leaf ➢ Normal secondary growth in dicot and monocot root ➢ Normal secondary growth in dicot and monocot stem ➢ Anomalous secondary growth in stem of Boerrhavia, Bignonia, Nyctanthes, Dracaena	15 Hours

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BOTP-MJ-304 (**PLANT ANATOMY**)

BOTANY (Major) Practical – 304

Course Outcomes :

- Through hands-on activities, students will gain skills in observing and analyzing plant tissues under the microscope, identifying growth patterns, and understanding the differences between primary and secondary growth.

BOTP-MJ-304	**PLANT ANATOMY**	**(2 Credits) 60 hours**
1.	**To study various tissue types** ➢ Root apical meristem ➢ Shoot apical meristem ➢ Parenchyma ➢ Aerenchyma ➢ Chlorenchyma ➢ Collenchyma ➢ Sclerenchyma ➢ Xylem elements ➢ Phloem elements	
2.	**To study different types of vascular bundles** ➢ Radial ➢ Conjoint collateral open ➢ Conjoint collateral closed ➢ Conjoint bicollateral ➢ Amphicribral (Hadrocentric)	
3.	**To study various types of steles** ➢ Protostele (Actinostele, Plectostele) ➢ Amphiphloic siphonostele ➢ Eustele	

	➢ Atactostele	
4.	**To study cell inclusions** ➢ Raphides: Pothos, Colocasia petiole ➢ Sphaeraphides: Opuntia, Nerium leaf ➢ Cystolith: Ficus bengalensis	
5.	To study anatomy of dicot (sunflower) root and stem with permanent slide.	
6.	To study anatomy of monocot (maize) root and stem with permanent slide.	
7.	To study anatomy of dorsiventral (sunflower) and isobilateral (maize) leaf with permanent slide	
8.	To study anomalous secondary growth in *Bignonia*.	
9.	To study anomalous secondary growth in *Boerrhavia*.	
10.	To study anomalous secondary growth in *Nyctanthes*.	
11.	To study anomalous secondary growth in *Dracaena*.	
12.	To study anomalous secondary growth in *Bougainvillea*	
13.	To study anomalous secondary growth in *Mirabilis*	
14.	To study anomalous secondary growth in Beet, Radish and Carrot	
15.	To study unilacunar and trilacunar nodal anatomy	
16.	To study following permanent slides: • Lenticel, Periderm, Sunken stomata, Multicellular epidermis	
17.	To study mitotic cell division in onion root tip	

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3. "Textbook of Plant Anatomy" by A.R. Bhatnagar and B.K. Bhatnagar
4. "Plant Anatomy and Embryology" by S. S. Shukla and V. S. Pandey
5. "Plant Anatomy: Structure and Function" by P. K. Gupta
6. "Plant Anatomy: A Textbook" by S.K. Gupta
7. "Anatomy of Seed Plants" by S.S. Khanna
8. "Plant Anatomy: Development and Structure" by V.S. Raghavan
9. "Plant Anatomy" by A. V. S. S. K. Sharma
10. "Plant Anatomy and Physiology" by D.K. Verma
11. "Plant Anatomy and Embryology" by M. P. Purohit

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER -

FRAMED ACCORDING TO

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BOT-MJ-305 (CELL BIOLOGY)

BOTANY (Major) PAPER – 305

Course Outcomes :

- CO1 : Understanding the cell cycle is key to grasping how cells grow, divide, and maintain genetic continuity. This knowledge forms the backbone of many biological concepts, from development and tissue regeneration to aging and disease.

  CO2 : Many diseases, notably cancer, are directly linked to disruptions in the cell cycle and regulatory mechanisms. Learning these processes helps students understand how mutations and dysregulation can lead to uncontrolled cell proliferation and the development of therapeutic interventions.

  CO3 : This topic bridges the gap between molecular genetics and cellular physiology, enabling students to see how genetic information is faithfully transmitted and expressed. It highlights the importance of checkpoints, repair mechanisms, and regulatory proteins in maintaining cellular integrity.

  CO4 : Studying the cell cycle encourages analytical thinking, as students learn to connect biochemical events with physiological outcomes. It also lays a foundation for advanced research in cell biology, biotechnology, and medicine.

BOT-MJ- 305	CELL BIOLOGY	(4 Credits) 60 hours
Unit-1	**Fundamentals of Cell Biology**	10 hours
	Introduction to Cell Biology ➢ Significance of cell biology with reference to major historical events. ➢ The cell theory and its importance in research. **Comparative Cell Structure** ➢ Prokaryotic cell, Eukaryotic cell, and the difference between the two. ➢ Basic structural components: cell membrane, cytoplasm, and cell	

	wall (in plants, animals, fungi, and bacteria)	
Unit-II	**Cellular Structure and Function**	20 hours
	Organelle Structure and Function ➢ Nucleus, nucleolus, endoplasmic reticulum (rough and smooth), and Golgi apparatus, Mitochondria and chloroplasts: structure, function, and energy conversion processes. ➢ Lysosomes, peroxisomes, and vacuoles ➢ Structure and function of the cell wall and plasma membrane ➢ Cytoskeletal elements: microtubules, actin filaments, and intermediate filaments ➢ Nucleic acid and its type (DNA & RNA).	
Unit-III	**Intracellular Communication and Cell Division**	15 hours
	Vesicular Transport ➢ Mechanisms of endocytosis and exocytosis **Organelle Communication** ➢ ER-Golgi Network ➢ Mitochondrial and Peroxisomal Interactions **Mitosis and Meiosis** ➢ Detailed steps of mitosis and meiosis ➢ Comparative analysis: somatic cell division vs. gametogenesis	
Unit-IV	**Cell Cycle and Regulation**	15 hours
	➢ Phases of the cell cycle (G1, S, G2 and M phases) ➢ Checkpoints and regulation mechanisms ➢ Mechanisms and significance of programmed cell death (apoptosis) ➢ Lytic and Lysogenic Cycle	

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14. "Principles of Cell Biology" by George Plopper
15. "Cell Biology and Genetics" by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter
16. "Cell Biology: A Laboratory Handbook" by Robert D. Goldman et al.
17. "Cell Biology of Disease: A Textbook of Mechanisms of Disease" by Michael J. Keating

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MDC-301 (NURSERY MANAGEMENT)

BOTANY (Major) PAPER – 301

Course Outcomes :

- CO1: Understand the basic principles and importance of nursery management in horticultural crop production.
- CO2: Identify and propagate various plant species using different propagation methods (sexual and asexual).
- CO3: Develop skills in the selection, preparation, and maintenance of nursery beds and containers.
- CO4: Manage inputs such as soil, water, fertilizers, and pest control in nursery settings.
- CO5: Plan and establish a commercial nursery with knowledge of layout, infrastructure, and marketing strategies.
- CO6: Apply entrepreneurship and business management skills in running a successful nursery venture.

BOT-MDC--301	NURSERY MANAGEMENT	(2 Credits) 30 hours
UNIT I	**Basics of Nursery** ➢ Nursery: definition, types ➢ Management strategies - planning, layout, budgeting - production unit, sales unit ➢ Design and layout of nursery facilities ➢ Greenhouse and shade structure management ➢ Nursery equipment operation	15 Hours
UNIT II	**Nursery Management Techniques** ➢ Principles of plant nursery management ➢ Propagation methods in plant nurseries	15 Hours

	➢ Soil preparation and potting techniques ➢ Irrigation and fertilization practices ➢ Pest and disease control measures in the nursery ➢ Greenhouse technology ➢ Cultivation of Rose and Gerbera in greenhouse.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MDC-302 (NURSERY MANAGEMENT)

BOTANY (MDC) Practical – 302

Course Outcomes :

- CO1: Demonstrate practical skills in preparing nursery beds, seed trays, and polybags for plant propagation.
- CO2: Apply various plant propagation techniques such as seed sowing, grafting, budding, layering, and cutting.
- CO3: Identify and manage common nursery tools, equipment, and materials effectively.
- CO4: Practice methods of irrigation, fertilization, pest and disease control in a nursery setup.
- CO5: Maintain nursery records including inventory, plant growth tracking, and input usage.
- CO6: Design and organize layout for a small-scale commercial nursery with cost-effective planning.
- CO7: Demonstrate entrepreneurship and marketing strategies for nursery plants and products.

BOTP-MDC-302	NURSERY MANAGEMENT	(2 Credits) 60 hours
	1. Visit to a garden/orchard/vegetable farm 2. Preparation of potting mixture of known combination and potting in earthen pots/poly bags. 3. Preparation of nursery beds. 4. Preparation of compost/vermin-compost using different substrates. 5. Working knowledge and identification of garden tools and implements. 6. Practical knowledge in different plant propagation techniques. 7. Propagation through asexual methods-cuttings, layering, runners, suckers, grafting, and budding. 8. Propagation of horticultural crops through seeds. 9. Identification of different fertilizers-NPK 10. Identification of organic manures-FYM, vermicompost, cakes, bonemeal.	

	11. To identify various cut flower crops based on primary morphological characters. (Locally available any three flowers) 12. To identify various loose flower crops based on primary morphological characters. (Locally available any three flowers) 13. To identify various ornamental trees for avenues based on primary morphological characters. (Locally available any three plants) 14. To identify various ornamental shrubs for avenues based on primary morphological characters. (Locally available any three plants) 15. To identify various foliage/ house plants based on primary morphological characters. (Locally available any three plants) 16. To prepare a report on a visit to any three nursery from local area.	

REFERENCES:

1. Manibhushan Rao K, 1991. Text Book of Horticulture. Macmillan India Ltd.
2. Barton West R, 1999. Practical Gardening in India. Discovery Pub. House, New Delhi.
3. Edmond J B, Senn T L, Andrews F S, Halfacre P G, 1975. Fundamentals of Horticulture (IV Edn). TMH, New Delhi.
4. John Weathers, 1993. Encyclopaedia of Horticulture. Discovery Pub. House. New Delhi
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - III

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-SEC-301 (HEALTH, HYGIENE AND FIRST AID)

BOTANY (SEC) PAPER – 301

Course Outcomes :

- CO1: Define key concepts of health, hygiene, and first aid, including WHO's definition of health, types of hygiene, and first aid principles.

CO:2 Explain the relationship between hygiene practices and disease prevention, and the physiological basis of first aid techniques.

CO:3 Demonstrate first aid procedures (e.g., CPR, wound care) and design a personal/community hygiene plan.

CO:4 Differentiate between effective and ineffective hygiene/first aid practices in case studies or real-world scenarios.

CO:5 Assess the impact of environmental and occupational hazards on health and propose mitigation strategies.

BOT-SEC--301	HEALTH, HYGIENE AND FIRST AID	(2 Credits) 30 hours
UNIT I	**Foundations of Health, Hygiene & First Aid** **1.1 Introduction to Public Health & Hygiene** • Definition of health (WHO) and determinants of health • Personal, food, and environmental hygiene practices • Safe water, sanitation, and waste management **1.2 First Aid Basics** • Aims and principles of first aid • CPR, choking management (Heimlich maneuver), wound care • Handling fractures, burns, and snake/insect bites	15 Hours

	1.3 Common Communicable Diseases • Transmission and prevention of diseases: o Waterborne (cholera, typhoid) o Vector-borne (malaria, dengue) Airborne (TB, COVID-19)	
UNIT II	**Occupational Health & Advanced Disease Management** **Occupational Health in Farming/Rural Settings** • Chemical (pesticide) exposure and PPE use • Zoonotic diseases (anthrax, leptospirosis) • Heat stress, dehydration, and ergonomic injuries **Nutrition and Immunity** • Balanced diets for vulnerable groups (children, pregnant women) • Micronutrient deficiencies (vitamin A, iron) **Disaster Preparedness** • First aid in natural disasters (floods, earthquakes) Psychological first aid (PFA) basics	15 Hours

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REFERENCES:

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2. Uganda Ministry of Health. (2019). National Hygiene and Sanitation Strategy.
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4. Practical Guide: WHO Guidelines for Drinking-Water Quality (2022). WHO Water
5. First Aid Manual (10th Ed.) – Uganda Red Cross Society.
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7. MoH Uganda. (2021). National Malaria Control Guidelines. Malaria Consortium Uganda

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-IV

FRAMED ACCORDING TO NATIONAL EDUCATION POLICY (NEP) 2020

(Effective from JUNE 2025)

FOR

BOTANY

Course Coding Pattern for Three/Four Years UG Degree (Honours) Semester-IV

Semester	Major(MJ)		Minor(ME)		Multi disciplinary (MDC)	AEC	SEC	VAC	Internship	Total Credits
	Theory	Practical	Theory	Practical	T/(T+P)	-----	T/P/ (T+P)	-----	--------	-----
II	2+2+4	2+2	2	2	-	2	2	2	--------	22

[**AEC:** Ability Enhancement Course; **SEC:** Skill Enhancement Course; **VAC:** Value Added Course]

Semester III[Major (BOT-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-MJ-401	PTERIDOPHYTA	2	2
BOT-MJ-403	GYMNOSPERM	2	2
BOT-MJ-405	PLANT EMBRYOLOGY AND SYSTEMATICS	4	4
TOTAL CREDITS			8

Semester III[Major (BOTP-MJ)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOTP-MJ-402	PRACTICAL	4	2
BOTP-MJ-404	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[MINOR (BOT-ME)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-ME-401	PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS	2	2
BOTP-ME-402	PRACTICAL	4	2
TOTAL CREDITS			4

Semester III[Skill Enhancement Course(SEC)]

Course Code	Course Title	Teaching Schedule Hours /Week	Credits
BOT-SEC-401	DISASTER MANAGEMENT	2	2
TOTAL CREDITS			2

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-401 (PTERIDOPHYTA)

BOTANY (Major) PAPER – 401

Course Outcomes :	
➢	CO1 :Describe the structure, function, and life cycle of pteridophytes.
➢	CO2 :Identify common pteridophyte species and understand their ecological roles.
➢	CO3 :Explain the evolution and phylogeny of pteridophytes and their significance in plant history.
➢	CO4 :Recognize the conservation challenges faced by pteridophytes and suggest mitigation strategies.
➢	CO5 :Apply research methods to study the diversity, ecology, and distribution of pteridophytes.
➢	CO6 :Communicate scientific findings related to pteridophyte biology effectively.
➢	CO7 :Interpret fossilized pteridophytes to reconstruct the environments of past geological periods.

BOT-MJ-401	**PTERIDOPHYTA**	**(2 Credits) 30 hours**
UNIT I	➢ Important Characteristics of pteridophyta ➢ Affinities of pteridophytes ➢ Alternation of generation (life cycle) in Pteridophytes ➢ Classification of pteridophytes (Riemers 1954) ➢ Characteristics of division : Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida. ➢ Geological Time Scale ➢ Fossilization and types of fossils (Compression, Petrification, Incrustation, Impression)	15 Hours
UNIT II	➢ Life history of the following with classification, occurrence, gametophyte & sporophyte structure and reproduction (excluding development) : ❖ Sellaginella	15 Hours

	❖ Equisetum ❖ Nephrolepis ❖ Marsilea ➢ Structure and anatomy of following fossil pteridophytes: ❖ Rhynia ❖ Lepidodendron ❖ Calamites	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MJ-402 (PTERIDOPHYTA)

BOTANY (Major) Practical – 402

Course Outcomes :

- CO 1: Identify and describe external morphology of representative pteridophytes such as Lycopodium, Selaginella, Equisetum, and Pteris through observation and dissection.

  CO 2 :Analyze internal anatomy by preparing temporary and permanent slides of stems, roots, and leaves of pteridophytes.

  CO 3 :Examine reproductive structures such as sporangia, sporophylls, and strobili to understand spore development and dispersal mechanisms.

  CO 4 :Understand alternation of generations by studying the gametophyte and sporophyte stages through specimens and slides.

  CO 5 :Differentiate between homospory and heterospory in pteridophytes using comparative morphological and anatomical studies.

  CO 6 :Interpret the ecological and evolutionary significance of pteridophytes through hands-on examination and practical demonstration.

  CO 7 :Develop technical skills in microscopy, slide preparation, staining techniques, and proper lab reporting.

BOTP-MJ-402	**PTERIDOPHYTA**	**(2 Credits) 60 hours**
1.	Study of external features of *Sellaginella* using fresh/ preserved specimen and whole mount	
2.	Study of T.S. of stem of *Sellaginella* using fresh/ preserved specimen and permanent slide	
3.	Study of L.S. of strobilus of *Sellaginella* using fresh/ preserved specimen and permanent slide	
4.	Study of external features of *Equisetum* using fresh/ preserved specimen	
5.	Study of T.S. of stem of *Equisetum* using fresh/ preserved specimen and	

	permanent slide	
6.	Study of L.S. of cone of *Equisetum* using fresh/ preserved specimen or permanent slide	
7.	Study of T.S. of stolon of *Nephrolepis* using fresh/ preserved specimen and permanent slide	
8.	Study of T.S. of rachis of *Nephrolepis* fresh/ preserved specimen and permanent slide	
9.	Study of T.S. of sporophyll of *Nephrolepis* using fresh/ preserved specimen and permanent slide	
10.	Study of T.S. of rhizome of *Marsilea* using fresh/ preserved specimen and permanent slide	
11.	Study of T.S. of petiole of *Marsilea* using fresh/ preserved specimen and permanent slide	
12.	Study of various sections (V.T.S., V.L.S. and H.L.S.) of sporocarp of *Marsilea* using fresh/ preserved specimen and permanent slide	
13.	To study the structure and anatomy of fossil pteridophytes (*Rhynia*, *Lepidodendron*, *Calamites*) using fossil stone/slides/charts	

REFERENCES:

1. A text book of Botany vol. II (Bryophyta, Pteridophyta, Gymnosperms & Paleo Botany) Pandey etal. - Vikash publishing House pvt. Ltd., New Delhi.
2. "Pteridophytes of India" by K. S. Rajesh & C. R. B. Sastry
3. "Pteridophytes of the Western Ghats" by V. S. R. Murthy
4. "Indian Pteridophytes" by N. I. S. Babu & K. K. Nayar
5. "Pteridophytes of India: A Review" by S. S. Kaur & H. S. Sood
6. "Pteridophytes of North-East India" by K. S. Rajesh & B. K. Datta
7. "Pteridophytes of India and Nepal" by M. D. S. Rao
8. "Handbook of Indian Ferns" by C. D. K. Raju & V. B. Rao
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-403 (GYMNOSPERM)

BOTANY (Major) PAPER – 403

Course Outcomes :	
➢	CO 1 :Identify and classify gymnosperm species and explain their key morphological and reproductive features.
➢	CO 2 :Understand the reproductive strategies of gymnosperms, including the role of cones, pollen, and seed development.
➢	CO 3 :Investigate the ecological and economic importance of gymnosperms in modern and ancient ecosystems.
➢	CO 4 :Conduct field and laboratory work to identify and study gymnosperm species, as well as analyze fossil gymnosperms for paleoecological insights.

BOT-MJ-403	**GYMNOSPERM**	**(2 Credits) 30 hours**
UNIT I	➢ Important Characteristics of gymnosperms ➢ Affinities of gymnosperm with pteridophytes and angiosperm, ➢ Classification of gymnosperms ➢ Important characteristics of various orders of gymnosperms : Cycadofilicales, Bennettitales, Cycadales, Cordaitales, Coniferales, Ginkgoales, Gnetales	15 Hours
UNIT II	➢ Life history of the following with classification, occurrence, structure and reproduction (excluding development) – Cycas, Pinus, Ephedra ➢ Structure and anatomy of fossil gymnosperms – Lyginopteris (Cycadofilicales), Cycadeoidea (Cycadeoidales), Cordaites (Corditales)	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-MJ-404 (**GYMNOSPERM AND ANGIOSPERMS**)

BOTANY (Major) Practical – 404

Course Outcomes :

- CO1: Identify and describe the external morphology and internal anatomy of representative gymnosperm taxa through hands-on examination and microscopy.
- CO2: Demonstrate skills in preparing temporary slides of gymnosperm plant parts, including leaves, stems, and reproductive organs.
- CO3: Develop the ability to record observations, draw labeled diagrams, and write accurate descriptions of gymnosperm specimens.
- CO4: Identify and classify major angiosperm families based on morphological, anatomical, and reproductive features.
- CO5: Explain the distinguishing characteristics of selected dicot and monocot families with reference to representative species.
- CO6: Interpret floral diagrams and floral formulae to understand the floral structure and taxonomy of angiosperms.

BOTP –MJ-404	**GYMNOSPERM AND ANGIOSPERMS**	**(2 Credits) 60 hours**
1.	To study the anatomy of coralloid root, stem, rachis and leaflet of *Cycas* using fresh/preserved material and permanent slides	
2.	To study the male cone and megasporophyll of *Cycas* using preserved specimen	
3.	To study the internal structure of root, stem and needle of *Pinus* using fresh/preserved material and permanent slides	
4.	To study the male and female cone of *Pinus* using preserved specimen	
5.	To study the internal structure of stem of *Ephedra* using fresh/preserved material and permanent slides	
6.	To study the male and female strobilus of *Ephedra* using preserved	

	specimen	
7.	To study the structure and anatomy of fossil gymnosperms (*Lyginopteris* and *Cycadeoidea*) using fossil stone/slides/charts	
8.	To study the following permanent slides a. T.S. of anther b. Pollinia c. Globular embryo d. Heart shaped embryo e. Mature embryo	
9.	To calculate the size of pollen grain by calibration and standardization of microscope using stage micrometer and ocular micrometer	
10.	Demonstration of pollen germination using cavity slides	
11.	To study the pollen germination using triphenyl tetrazolium chloride (TTC)	
12.	To study the type of ovules using permanent slide or chart	
13.	Dissection of embryo -*Tridax* and *Crotalaria*	
14.	Embryo mounting in any available dicot plant	
15.	Study of morphological and floral characteristics of family Caesalpinaceae.	
16.	Study of morphological and floral characteristics of family Rosaceae.	
17	Study of morphological and floral characteristics of family Asclepiadaceae.	
18	Study of morphological and floral characteristics of family Acanthaceae.	
19	Study of morphological and floral characteristics of family Euphorbiaceae.	
20	Study of morphological and floral characteristics of family Cannaceae.	

REFERENCES:

1. "Taxonomy of Gymnosperms" by G. K. S. Kharwar
2. A text book of Botany vol. II (Bryophyta, Pteridophyta, Gymnosperms & Paleo Botany) Pandey etal. - Vikash publishing House pvt. Ltd., New Delhi
3. Botany for Degree Student- P.C. Vashishta 1st Edi.
4. "Gymnosperms of India" by R. S. Tiwari
5. "The Gymnosperms of India" by B. N. Pandey
6. "The Gymnosperms of Western Himalayas" by P. K. Dhyani & M. S. Mehta
7. "Gymnosperms: A Textbook" by P. K. Sharma
8. "Gymnosperms: Morphology and Anatomy" by S. K. Jain and V. V. Awasthi
9. "Gymnosperms of Eastern Himalayas" by R. D. Singh

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-MJ-405 (**PLANT EMBRYOLOGY AND SYSTEMATICS**)

BOTANY (Major) PAPER – 405

Course Outcomes :

- CO1: Understand the structure and development of reproductive organs in flowering plants.
- CO2: Describe the processes of microsporogenesis and megasporogenesis, and the development of male and female gametophytes.
- CO3: Explain the mechanisms of pollination, fertilization, and barriers to hybridization.
- CO4: Analyze the development of embryo, endosperm, and seed formation in angiosperms.
- CO5: Identify and describe major plant families using morphological and reproductive characteristics.

BOT-MJ-405	**PLANT EMBRYOLOGY AND SYSTEMATICS**	**(4 Credits) 60 hours**
UNIT I	➢ Structure of typical flower ➢ Structure of anther ➢ Microsporogenesis ➢ Types of pollen tetrad ➢ Structure of pollen grain ➢ Development of male gametophyte. ➢ Structure and types of ovules ➢ Megasporogenesis ➢ Development of embryo sac ➢ Structure of typical embryo sac (monosporic embryo sac - polygonum type)	15 Hours
UNIT II	➢ Types of embryo sac (monosporic, bisporic and tetrasporic) ➢ Pollination (self-pollination and cross pollination), agents of pollination (wind, water, insects, birds, bats, snails), pollination in	15 Hours

	Salvia, Ficus, Vallisnaria and Orchids ➢ Types of fertilization, double fertilization and triple fusion, endosperm and its type, embryogeny in monocot and dicot	
UNIT III	➢ Major phylogenetic system of classification and their merits and demerits ➢ Engler and Prantl ➢ John Hutchinson ➢ Charles Edwin Bessey	15 Hours
UNIT IV	➢ Selected angiosperm families their morphological characteristics, floral characteristics, floral formula, floral diagram and economic importance: 1. Caesalpinaceae 2. Rosaceae 3. Asclepiadaceae 4. Acanthaceae 5. Euphorbiaceae 6. Cannaceae	15 Hours

REFERENCES:

1. Taxonomy of Angiosperms V. Singh 1st Edi. 1981 Rastogi pub.
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3. "Plant Systematics: A Phylogenetic Approach" by Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and M. J. Donoghue
4. "Taxonomy of Angiosperms" by B.P. Pandey
5. "An Introduction to the Study of Indian Plants" by R.N. Chopra and M.N. Verma
6. "A Textbook of Plant Taxonomy" by S.K. Jain
7. Plant Embryology" by S. S. Bhojwani & M. K. Bhatnagar
8. "Taxonomy of Angiosperms" B.P. Pandey's
9. "Plant Systematics" by P. D. Sharma
10. "Indian Flora and Fauna" by P. N. Kaushal
11. "Botany for Degree Students" by A.C. Dutta
12. "Taxonomy of Angiosperms" B.P. Pandey's

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-ME-401 (PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS)

BOTANY (Minor) PAPER – 401

Course Outcomes :	
➢	CO1 :Describe the structure, function, and life cycle of pteridophytes.
➢	CO2 :Identify common pteridophyte species and understand their ecological roles.
➢	CO3 :Explain the evolution and phylogeny of pteridophytes and their significance in plant history.
➢	CO4 :Recognize the conservation challenges faced by pteridophytes and suggest mitigation strategies.
➢	CO 5 :Identify and classify gymnosperm species and explain their key morphological and reproductive features.
➢	CO 6 :Understand the reproductive strategies of gymnosperms, including the role of cones, pollen, and seed development.
➢	CO 7 :Investigate the ecological and economic importance of gymnosperms in modern and ancient ecosystems.
➢	CO 8 :Conduct field and laboratory work to identify and study gymnosperm species, as well as analyze fossil gymnosperms for paleoecological insights.
➢	CO 9 : Identify and classify major angiosperm families based on morphological, anatomical, and reproductive features. CO 10: Explain the distinguishing characteristics of selected dicot and monocot families with reference to representative species. CO 11: Interpret floral diagrams and floral formulae to understand the floral structure and taxonomy of angiosperms.

BOT-ME--401	**PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS**	**(2 Credits) 30 hours**
UNIT I	**PTERIDOPHYTA** ➢ Important Characteristics of pteridophyta ➢ Classification of pteridophytes (Riemers 1954)	15 Hours

	➢ Characteristics of division : Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida. ➢ Fossilization and types of fossils (Compression, Petrification, Incrustation, Impression) ➢ Life history of the following with classification, occurrence, gametophyte & sporophyte structure and reproduction (excluding development) : ❖ Equisetum ❖ Nephrolepis	
UNIT II	**GYMNOSPERMS** ➢ Important Characteristics of gymnosperms ➢ Classification of gymnosperms ➢ Important characteristics of various orders of gymnosperms : Cycadofilicales, Bennettitales, Cycadales, Cordaitales, Coniferales, Ginkgoales, Gnetales ➢ Life history of the following with classification, occurrence, structure and reproduction (excluding development) – Cycas **ANGIOSPERMS** ➢ Types of classification systems ➢ International Code for Botanical Nomenclature (ICBN) ➢ Bentham Hooker Classification (up to series) ➢ Selected angiosperm families their classification as per Bentham & hooker system, Distinguishing characters, general characteristics, floral formula and floral diagram: 1. Malvaceae 2. Apocynaceae 3. Nyctaginaceae ➢ Amaryllidaceae	15 Hours

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR B.Sc. SEMESTER - IV

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOTP-ME-402 (PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS)

BOTANY (Major) Practical – 402

Course Outcomes :	
➢	CO1:Describe the structure, function, and life cycle of pteridophytes. CO 2 : Identify common pteridophyte species and understand their ecological roles. CO 3: Describe the structure, function, and life cycle of pteridophytes.
➢	CO4: Identify and describe the external morphology and internal anatomy of representative gymnosperm taxa through hands-on examination and microscopy. CO5: Demonstrate skills in preparing temporary slides of gymnosperm plant parts, including leaves, stems, and reproductive organs. CO6: Develop the ability to record observations, draw labeled diagrams, and write accurate descriptions of gymnosperm specimens.

BOTP-ME-402	PTERIDOPHYTA, GYMNOSPERMS AND ANGIOSPERMS	**(2 Credits) 60 hours**
1.	Study of external features of *Sellaginella* using fresh/ preserved specimen and whole mount	
2.	Study of T.S. of stem of *Sellaginella* using fresh/ preserved specimen and permanent slide	
3.	Study of L.S. of strobilus of *Sellaginella* using fresh/ preserved specimen and permanent slide	
4.	Study of external features of *Equisetum* using fresh/ preserved specimen	
5.	Study of T.S. of stem of *Equisetum* using fresh/ preserved specimen and permanent slide	
6.	Study of L.S. of cone of *Equisetum* using fresh/ preserved specimen or permanent slide	
7.	Study of T.S. of stolon of *Nephrolepis* using fresh/ preserved specimen and permanent slide	
8.	Study of T.S. of rachis of *Nephrolepis* fresh/ preserved specimen and	

	permanent slide	
9.	Study of T.S. of sporophyll of *Nephrolepis* using fresh/ preserved specimen and permanent slide	
10.	Study of T.S. of rhizome of *Marsilea* using fresh/ preserved specimen and permanent slide	
11.	Study of T.S. of petiole of *Marsilea* using fresh/ preserved specimen and permanent slide	
12.	Study of various sections (V.T.S., V.L.S. and H.L.S.) of sporocarp of *Marsilea* using fresh/ preserved specimen and permanent slide	
13.	To study the anatomy of coralloid root, stem, rachis and leaflet of *Cycas* using fresh/preserved material and permanent slides	
14.	To study the male cone and megasporophyll of *Cycas* using preserved specimen	
15.	To study the internal structure of root, stem and needle of *Pinus* using fresh/preserved material and permanent slides	
16.	To study the male and female cone of *Pinus* using preserved specimen	
17.	Study of morphological and floral characteristics of family Malvaceae.	
18.	Study of morphological and floral characteristics of family Fabaceae.	
19.	Study of morphological and floral characteristics of family Apocynaceae.	
20.	Study of morphological and floral characteristics of family Solanaceae	
21.	Study of morphological and floral characteristics of family Nyctaginaceae.	
22.	Study of morphological and floral characteristics of family Amaryllidaceae.	

REFERENCES:

1. A text book of Botany vol. II (Bryophyta, Pteridophyta, Gymnosperms & Paleo Botany) Pandey etal. - Vikash publishing House pvt. Ltd., New Delhi.
2. "Pteridophytes of India" by K. S. Rajesh & C. R. B. Sastry
3. "Pteridophytes of the Western Ghats" by V. S. R. Murthy
4. "Indian Pteridophytes" by N. I. S. Babu & K. K. Nayar
5. "Pteridophytes of India: A Review" by S. S. Kaur & H. S. Sood
6. "Pteridophytes of North-East India" by K. S. Rajesh & B. K. Datta
7. "Pteridophytes of India and Nepal" by M. D. S. Rao
8. "Handbook of Indian Ferns" by C. D. K. Raju & V. B. Rao

9. A text book of Botany vol. II (Bryophyta, Pteridophyta, Gymnosperms & Paleo Botany) Pandey etal. - Vikash publishing House pvt. Ltd., New Delhi
10. Botany for Degree Student- P.C. Vashishta 1st Edi.
11. "Gymnosperms of India" by R. S. Tiwari
12. "The Gymnosperms of India" by B. N. Pandey
13. "The Gymnosperms of Western Himalayas" by P. K. Dhyani & M. S. Mehta
14. "Gymnosperms: A Textbook" by P. K. Sharma
15. "Gymnosperms: Morphology and Anatomy" by S. K. Jain and V. V. Awasthi
16. "Gymnosperms of Eastern Himalayas" by R. D. Singh
17. "Indian Gymnosperms: A Guide to Their Identification" by M. K. Thakur
18. Modern Practical Botany Vol. II B.P. Pandey 1995 S. Chand & Company, New delhi.
19. Taxonomy of Angiosperms V. Singh 1st Edi. 1981 Rastogi pub.

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SYLLABUS FOR B.Sc. SEMESTER - 0000

FRAMED ACCORDING TO

NATIONAL EDUCATION POLICY (NEP) 2020 (Effective from June 2025)

BOT-SEC-401 (DISASTER MANAGEMENT)

BOTANY (SEC) PAPER – 401

Course Outcomes :

- **Understanding Disasters**: Learn about the types, causes, and impacts of disasters, including natural, human-induced, and hybrid.
- **Disaster Response Skills**: Develop skills to effectively respond to disasters, such as rescue, relief, rehabilitation, and recovery, with the help of advanced tools like GIS and satellite imaging.
- **Environmental Awareness**: Understand the ecological aftermath of disasters and the role of climate change in increasing disaster frequency.
- **Ethical and Sustainable Management**: Recognize ethical responsibilities in disaster management and integrate strategies with sustainable development goals.

BOT-SEC--401	DISASTER MANAGEMENT	(2 Credits) 30 hours
UNIT I	**Fundamentals of Disasters and Disaster Management** ➢ Definition and types of disasters: natural, human-induced, and hybrid. ➢ Causes and effects of disasters on the environment, economy, and human life. ➢ Scientific principles behind common natural disasters: earthquakes, floods, cyclones, etc. ➢ Role of government agencies, NGOs, and community participation. ➢ Phases of disaster response: rescue, relief, rehabilitation, and recovery. ➢ Scientific and technical tools for effective disaster response: Drones, GIS, satellite imaging.	15 Hours
UNIT II	**Environmental and Ethical Considerations in Disaster Management** ➢ The ecological aftermath of disasters: restoration and mitigation techniques.	15 Hours

	➢ Climate change and its relationship with disaster frequency and intensity. ➢ Ethical responsibilities in disaster management: equity, transparency, and inclusivity. ➢ Integrating disaster management strategies into sustainable development goal ➢ Historical analysis of major disaster in India: 1. Tsunami-2004 2. Earthquake (Gujarat)- 2001 3. Machhu Dam fail-1979 4. Bhopal Gas disaster-1984	

REFERENCES:

1. Disaster Management by Rajib Shaw: A comprehensive guide covering disaster preparedness and response, with a focus on Indian scenarios.
2. Natural Hazards and Disaster Management by Shailesh Sharma: Provides practical insights into disaster management techniques in the Indian context.
3. Environmental Studies and Disaster Management by Singh and Sharma: Focused on the interrelation between environmental factors and disaster management.
4. Disaster Management in India by Anu Kapoor: Analyzes government policies and frameworks related to disasters in India.
5. Disaster Risk Reduction: Cases from Urban Africa by Mark Pelling: Offers insights into disaster management practices in urban settings, suitable for global comparison.
6. Disaster Management: International Lessons by J.C. Gaillard: Focuses on international approaches to disaster risk reduction.
7. Natural Disaster Management edited by Jon Coaffee: A detailed compilation of global experiences and management strategies.
8. At Risk: Natural Hazards, People's Vulnerability, and Disasters by Ben Wisner et al.: A globally respected book addressing vulnerability and resilience.
9. કુદરતી આફતો અને સંકટ વાપરાશ (Natural Disasters and Crisis Management) by Dr. R. Patel.
10. પર્યાવરણ અભ્યાસ અને આફત વ્યવસ્થાપન (Environmental Studies and Disaster Management) by D.R. Vaghela.
11. Look for Gujarati translations of major works like Disaster Management by Rajib Shaw.