



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, ઉદ્ધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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## **-:પરિપત્ર:-**

યુનિવર્સિટીના વિજ્ઞાન વિદ્યાશાખા હેઠળના તમામ શૈક્ષણિક વિભાગોના વડાશ્રીઓ અને યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૬-૨૭ થી અમલમાં આવનાર B.Sc. Botany Sem.-7 & 8 Honours (with OJT / without OJT) અને Honours with Research નો વનસ્પતિશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૨૬/૧૧/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૦૨ અંતર્ગત પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ વનસ્પતિશાસ્ત્ર વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિવતી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૦૪/૬/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૧૮ થી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૧૮/૦૬/૨૦૨૬ની સભાના ઠરાવ ક્રમાંક:૧૭ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણ: ઉપર મુજબ)

ક્રમાંક:ઓથો./પરિપત્ર/૧૩૬૪૫/૨૦૨૬  
તા.૧૮/૦૬/૨૦૨૬

*Widya*  
કુલસચિવ

પ્રતિ,

- (૧) યુનિવર્સિટીના વિજ્ઞાન વિદ્યાશાખા હેઠળના તમામ શૈક્ષણિક વિભાગોના વડાશ્રીઓ.
- (૨) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.  
... આપશ્રીના વિભાગ/કોલેજના સંબંધિત શિક્ષકો/વિદ્યાર્થીઓને જાણ કરી અમલ કરવા સારું.
- (૩) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
- (૪) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારું.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT



B.Sc. HONOURS PROGRAM  
IN  
BOTANY

Semester- VII  
**With OJT/ RP**

Effective from-2026-27

**Veer Narmad South Gujarat University, Surat**  
**Effective from-2026-27**  
**B.Sc. Honours Semester-7 (Botany)**  
**With OJT/ RP**

Course Category	Course Code	Course Title	Mark Sheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
					TH	PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	BOT-MJ-701	Advance Phycology and Mycology	Advance Phycology and Mycology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-702	Practical In Advance Phycology and Mycology	Practical In Advance Phycology and Mycology	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOT-MJ-703	Fundamentals of Microbiology and Plant pathology	Fundamentals of Microbiology and Plant pathology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-704	Practical In Fundamentals of Microbiology and Plant pathology	Practical In Fundamentals of Microbiology and Plant pathology	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOT-MJ-705	Analytical Techniques and Biostatistics	Analytical Techniques and Biostatistics	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-706	Practical In Analytical Techniques and Biostatistics	Practical In Analytical Techniques and Biostatistics	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
MINOR ELECTIVE	ME-	Fundamentals of Cyber Security	Fundamentals of Cyber Security	400-499	04	-	02	-	04	-	50	-	50	-	100	-
RP/OJT	BOT-RP/OJT-707	Research Project/ On Job Training	Research Project/ On Job Training	400-499	12	-	-	-	06	-	75	-	75	-	150	-

\*Fundamentals of Cyber Security Syllabus and course code will prepare by Computer Faculty of VNSGU, Surat.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**PROGRAM TITLE**

<b>Name of Program</b>	Bachelor of Science (Honours) Botany							
<b>Program Abbreviation</b>	<b>BOT-Botany, MJ-Major, BOTP-Botany Practical, ME-Minor Elective</b>							
<b>Duration</b>	One Year							
<b>Eligibility Criteria</b>	As per university rules.							
<b>Pre-requisite</b>	<input type="checkbox"/> Strong knowledge of fundamental subjects of Botany <input type="checkbox"/> Practical skills (microscopy, slide preparation, field work) <input type="checkbox"/> Basic knowledge of research methodology							
<b>Medium of Instruction</b>	English/ Gujarati							
<b>Objective of Program</b>	<p>The objective of this semester is to provide students with practical, research-oriented, and professional experience:</p> <ul style="list-style-type: none"> <li>• To gain real-world work experience through On Job Training (OJT)</li> <li>• To develop a scientific approach through research projects</li> <li>• To improve skills in data collection, analysis, and report writing</li> <li>• To prepare students for higher studies (M.Sc., Ph.D.) and careers in industry</li> <li>• To enhance understanding of environmental awareness and plant-based applications</li> </ul>							
<b>Program Outcome (PO)</b>	<p><b>PO1:</b> Gain in-depth knowledge of plant sciences including algae, fungi, microbes, and plant health.</p> <p><b>PO2:</b> Understand plant diversity, classification, and ecological significance.</p> <p><b>PO3:</b> Apply microbiological and pathological concepts in agriculture and environment.</p> <p><b>PO4:</b> Use analytical techniques and statistical tools for biological data interpretation.</p> <p><b>PO5:</b> Understand principles of organic farming and sustainable agriculture practices.</p> <p><b>PO6:</b> Develop critical thinking and problem-solving skills in biological sciences.</p> <p><b>PO7:</b> Apply ethical and environmentally sustainable approaches in plant sciences.</p>							
<b>Program Specific Outcomes (PSO)</b>	<p><b>PSO1:</b> Demonstrate knowledge of plant diversity, especially algae and fungi, and apply taxonomic principles for their identification and classification.</p> <p><b>PSO2:</b> Understand fundamentals of microbiology and plant pathology to identify plant diseases and apply appropriate management strategies.</p> <p><b>PSO3:</b> Apply analytical techniques and biostatistical tools for collection, analysis, and interpretation of biological data.</p> <p><b>PSO4:</b> Understand and implement principles of organic farming and sustainable agriculture for eco-friendly practices.</p> <p><b>PSO5:</b> Demonstrate understanding of research methodology, hypothesis formulation, and statistical applications in biological sciences.</p> <p><b>PSO6:</b> Apply botanical knowledge in agriculture, environmental management, and allied fields.</p> <p><b>PSO7:</b> Develop environmental awareness and adopt ethical practices for biodiversity conservation and sustainable development.</p>							
<b>Mapping between Pos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	PO1	√	√	√	√	√	√	√
	PO2	√	√		√		√	√
	PO3	√	√	√	√	√	√	√
	PO4	√	√	√	√	√		
	PO5		√	√	√	√	√	√
	PO6	√	√	√	√	√	√	√
	PO7	√	√	√	√	√	√	√

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>7</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Entrepreneurship/ Employability / Skill Development							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-701</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Advance Phycology and Mycology</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO.1:</b> Understand diversity, classification, and life cycles of algae and fungi.  <b>CO.2:</b> Analyze structural and reproductive adaptations in different groups.  <b>CO.3:</b> Identify economically and ecologically important algae and fungi.  <b>CO.4:</b> Understand role of fungi in industry, medicine, and agriculture.  <b>CO.5:</b> Apply knowledge for identification and classification of specimens.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√						
	CO2	√					√	
	CO3	√	√		√		√	√
	CO4	√	√	√		√	√	
	CO5	√	√					√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>  General characters and Classification of algae (Fritsch 1945, and Smith, 1955)  Life cycle types in algae  Salient features of Cyanophyta, Chlorophyta, Bacillariophyta, Xanthophyta, Pyrrophyta, Phaeophyta and Rhodophyta with special reference to <i>Rivularia</i>, <i>Tolypothrix</i>, <i>Hydrodictyon</i>, <i>Nitella</i>, <i>Ulva</i>, <i>Fucus</i> and <i>Polysiphonia</i>  Algal biofuels (algal biodiesel, bio-ethanol and biological hydrogen production)  Industrial applications of algae.</p> <p><b><u>Unit – 2</u></b>  General characters and Classification of fungi (Alexoplous and Mims, 1979; Ainsworth, 1973)  Heterothallism and Parasexuality in fungi  General account of mastigomycotina, zygomycotina, ascomycotina, basidiomycotina and deuteromycotina with special reference to <i>Phytophthora</i>, <i>Penicillium</i>, <i>Erysiphae</i>, <i>Ustilago</i>, <i>Alternaria</i>, <i>Cercospra</i>  Economic importance of fungi (as food, in medicine, in industry, in agriculture), harmful actions of fungi, Mycorrhiza, Mushroom cultivation.</p>							
<b>Course Code</b>	<b>BOTP-MJ-702</b>							
<b>Course Title</b>	<b>Practical In Advanced Phycology and Mycology</b>							
<b>Course Practical content</b>	1. Study of the following algae through microscopic preparations, permanent slides and charts-							

	<ol style="list-style-type: none"> <li>a. <i>Rivularia</i></li> <li>b. <i>Tolypothrix</i></li> <li>c. <i>Coleochaete</i></li> <li>d. <i>Hydrodictyon</i></li> <li>e. <i>Nitella</i></li> <li>f. <i>Ulva</i></li> <li>g. <i>Fucus</i></li> <li>h. <i>Polysiphonia</i></li> </ol> <ol style="list-style-type: none"> <li>2. Study of the following fungi through microscopic preparations, permanent slides and charts- <ol style="list-style-type: none"> <li>a. <i>Phytophthora</i></li> <li>b. <i>Penicillium</i></li> <li>c. <i>Erysiphae</i></li> <li>d. <i>Phyllactinia</i></li> <li>e. <i>Ustilago</i></li> <li>f. <i>Alternaria</i></li> <li>g. <i>Cercospra</i></li> </ol> </li> <li>3. Isolation and establishment of axenic algal culture using BG11 media.(Demonstration or Hands on)</li> </ol>
<b>Reference Books</b>	<ul style="list-style-type: none"> <li>• The Structure and Reproduction of the Algae by F.E. Fritsch</li> <li>• Cryptogamic Botany, Volume I: Algae and Fungi by G.M. Smith</li> <li>• Manual of Phycology by G.M. Smith</li> <li>• Phycology by Robert Edward Lee</li> <li>• Algae by V.D. Chopra</li> <li>• Botany for Degree Students: Algae by B.R. Vashishta</li> <li>• Algal Culturing Techniques by Elsevier Academic Press</li> <li>• Algae and Human Affairs by C.A. Prescott</li> <li>• Introductory Mycology by C.J. Alexopoulos and C.W. Mims</li> <li>• Dictionary of the Fungi by G.C. Ainsworth</li> <li>• Textbook of Fungi by B.P. Pandey</li> <li>• Fungi by B.R. Vashishta</li> <li>• Botany for Degree Students: Fungi by B.R. Vashishta</li> <li>• Introductory Mycology by H.C. Dube</li> <li>• The Fungi by Ainsworth</li> <li>• Mushrooms: Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact by Philip G. Miles and Shu-Ting Chang</li> <li>• Mushroom Cultivation in India by M.C. Nair</li> <li>• University Botany I: Algae, Fungi, Bryophyta and Pteridophyta by S.M. Reddy</li> </ul>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2603000507024001]

[Subject code for Practical-2603000507024002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS								
Program Name	B.Sc. Botany (Honours)							
Semester	7							
NCrF Credit Level	6.0							
Course Type	Major							
Course Subtype	Nil							
Subject Type	Discipline Specific							
Course Code	BOT-MJ-703							
Course Level	400-499							
Course Title	Fundamentals of Microbiology and Plant pathology							
Credit	Theory:	02	Practical:	02	Total:	04		
Effective From	Academic Year : 2026-27							
Course Outcomes	<p><b>CO1:</b> Understand structure, classification, and functions of microorganisms.  <b>CO2:</b> Explain microbial growth, reproduction, and metabolism.  <b>CO3:</b> Identify plant diseases and their causal organisms.  <b>CO4:</b> Understand host-pathogen interaction and disease cycles.  <b>CO5:</b> Apply disease management strategies in agriculture.</p>							
Mapping between COs and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√		√	√	√
	CO2	√	√	√		√	√	√
	CO3	√	√	√		√	√	√
	CO4	√	√	√	√	√	√	√
	CO5	√	√	√	√	√	√	√
Course Content	<p><b><u>Unit - 1</u></b>            General symptoms of plant disease            Classification of plant disease            Genetics of plant disease (vir, avr and R genes)            Host pathogen interaction            Enzymes and Toxin in Plant Disease            Defense response of plants to pathogenic attack            Control of plant disease            Biological control of insects and pests            Study of etiology and management of following important plant diseases:-  <b>Fungal diseases:</b> Wheat - Karnal bunt, Rust of Linseed  <b>Bacterial diseases:</b> Leaf blight of rice, Red stripe of sugarcane  <b>Viral diseases:</b> Cadang-Cadang disease of Coconut, Sandal spike  <b>Nematode disease:</b> Root Knot of Brinjal, Ear Cockle of Wheat  <b><u>Unit – 2</u></b>  <b>Phytoplasma</b>  <b>Bacteria:</b> General characters, ultra-structure of bacterial cell, multiplication and methods of genetic recombination (Conjugation, transformation and transduction), Economic importance of bacteria.  <b>Virus:</b> Nomenclature and general characteristics of plant viruses, ultra structure of</p>							

	TMV and Bacteriophage, Lytic and Lysogenic life cycle, Economic importance of viruses. <b>Viroids and Prions</b>
<b>Course Code</b>	<b>BOTP-MJ-704</b>
<b>Course Title</b>	<b>Practical In Fundamentals of Microbiology and Plant pathology</b>
<b>Course Practical content</b>	<ol style="list-style-type: none"> <li>1. Study of morphology and symptomology of causal organisms (TMV, Mycoplasma, Bacteria, Nematode) using photographs/3D models.</li> <li>2. Study of important plant diseases mentioned in the syllabus.</li> <li>3. Study of spores of <i>Alternaria</i> from Early Blight of Potato.</li> <li>4. Study of histopathology using temporary slide preparation of the Leaf gall of <i>Pongamia</i>.</li> <li>5. Study of phylloplane mycoflora using cellotape method.</li> <li>6. To understand the comparative biochemical and molecular profile in diseased v/s normal plants.</li> <li>7. Demonstration and application of basic control techniques such as soil solarization and roguing in the field.</li> <li>8. Collection of herbarium specimens and study of pathological characteristics.</li> <li>9. To study ultra structure of bacterial cell using charts/ diagrams/ electron micrographs.</li> <li>10. Study of root nodule bacterium (<i>Rhizobium</i>) and curd (<i>Lactobacillus</i>) by gram staining.</li> <li>11. To demonstrate the preparation of media for culturing microbes (nutrient agar, potato dextrose agar).</li> <li>12. To determine the number of viable microorganisms (CFU) using the standard plate count method.</li> <li>13. To study virus life cycles using charts/ diagrams (Lytic and Lysogenic).</li> <li>14. To study (theoretically and/or practically) the streak plate and pour plate methods for isolation, cultivation, and observation of bacterial colonies.</li> <li>15. To understand the key concept and principle of the disc diffusion method to assess the effectiveness of antibiotics on bacterial growth.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Plant Pathology — by George N. Agrios</li> <li>2. Fundamentals of Plant Pathology — by R. S. Mehrotra and Ashok Aggarwal</li> <li>3. Microbiology and Plant Pathology — by R. S. Mehrotra</li> <li>4. Diseases of Crop Plants in India — by G. Rangaswami</li> <li>5. Crop Diseases and Their Management — by R. S. Shukla</li> <li>6. Field Crop Diseases Handbook — by James B. Sinclair</li> <li>7. Pathological Problems of Economic Crop Plants and Their Management — by B. P. Pandey</li> <li>8. Recent Advances in the Diagnosis and Management of Plant Diseases — edited by P. C. Trivedi</li> <li>9. Plant Diseases: Epidemics and Control — by J. E. Vanderplank</li> <li>10. Disease Resistance in Plants — by J. E. Vanderplank</li> <li>11. Phytoplasmas: Plant Pathogenic Bacteria - I — edited by P. Narayanasamy</li> <li>12. Encyclopedia of Plant Viruses and Viroids — edited by P. Narayanasamy</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2603000507034001]

[Subject code for Practical-2603000507034002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS								
<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>7</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-705</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Analytical Techniques and Biostatistics</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO 1:</b> Understand principles of analytical instruments used in biology.</p> <p><b>CO 2:</b> Apply techniques like chromatography, spectroscopy, and microscopy.</p> <p><b>CO 3:</b> Understand basic statistical concepts (mean, median, variance, correlation).</p> <p><b>CO 4:</b> Analyze biological data using statistical tools.</p> <p><b>CO 5:</b> Interpret experimental results and present data scientifically.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√		√	√	√
	CO2	√	√	√		√	√	√
	CO3	√	√	√		√	√	√
	CO4	√	√	√		√	√	√
	CO5	√	√	√		√	√	√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>  <b>Microscopy</b> (Optical, phase contrast, Fluorescence microscopy, Confocal microscopy).  <b>Centrifugation:</b> Principle; types, application. Ultra-centrifugation.  <b>Radioisotopes</b> in biological research and <b>autoradiography</b>.  <b>Spectrophotometry</b>-Principle, and applications, Colorimeter, UV-Vis Spectrophotometry, AAS, NMR spectroscopy.  <b>Blotting techniques</b> (Western, Southern and Northern blotting),  <b>Electrophoresis</b> (AGE, PAGE), Principle of PCR and its applications.  <b>Chromatography:</b> Principle and methodology of chromatographic techniques: Paper, Thin Layer, Column chromatography and types (size exclusion, ion exchange, affinity, HPLC, GCMS, LCMS).</p> <p><b><u>Unit – 2</u></b>            Sampling methods; Data types (Primary and secondary data; Qualitative and quantitative data; Discrete and continuous data)            Measures of Central tendency (Mean, Median and Mode)            Measures of dispersion (Coefficient of Variance, Standard Deviation and Standard Error)            Testing of Hypothesis (Null and Alternative hypotheses)            T-test, ANOVA and Chi-square test.</p>							

<b>Course Code</b>	<b>BOTP-MJ-706</b>
<b>Course Title</b>	<b>Practical in Analytical Techniques and Biostatistics</b>
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>1. Subcellular Fractionation by Differential &amp; Density Gradient Centrifugation</li> <li>2. Optical &amp; Phase Contrast Microscopy, Observe living vs. stained cells, compare brightfield and phase contrast. (demonstration or hands-on).</li> <li>3. Fluorescence Microscopy, Visualize specific cellular components using fluorescent dyes. (demonstration or hands-on).</li> <li>4. Colorimeter – Quantification of Protein (Bradford Assay) ,Determine unknown protein concentration.</li> <li>5. Spectroscopy, Simultaneous estimation of a binary mixture (e.g., Paracetamol and Ibuprofen) by UV spectrophotometry.</li> <li>6. Western Blotting, Detect a specific protein (e.g., <math>\beta</math>-actin) from cell lysate, Southern Blotting ,Detect specific DNA fragment after restriction digest, Northern Blotting Detect mRNA expression of a gene. (demonstration or hands-on).</li> <li>7. AGE (Agarose Gel Electrophoresis), Separate DNA fragments (PCR products). (demonstration or hands-on).</li> <li>8. PAGE (SDS-PAGE), Separate proteins by molecular weight. (demonstration or hands-on).</li> <li>9. Chromatography, Separation and identification of amino acids/sugars by TLC/HPTLC.</li> <li>10. Estimation of drugs in tablet formulation using HPLC (demonstration or hands-on).</li> <li>11. To test the significance of association or difference between variables using the Chi-square test to determine whether observed differences or relationships are statistically significant.</li> <li>12. To test the significance of association or difference between variables using the T-test, and to determine whether observed differences or relationships are statistically significant.</li> <li>13. To calculate and interpret various measures of dispersion such as standard deviation, coefficient of variation, and standard error to assess the extent of variability in a given dataset.</li> <li>14. To study the relationship between two quantitative variables and compute the coefficient of correlation..</li> <li>15. To analyze the variance among group means using one-way ANOVA and determine whether there are statistically significant differences between the means of three or more independent groups.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Techniques in Microscopy and Cell Biology — by V. K. Sharma</li> <li>2. Introductory Practical Biochemistry — by S. K. Sawhney and Randhir Singh</li> <li>3. Basics of Analytical Biochemistry — by P. Asokan</li> <li>4. Biological Instrumentation and Methodology — by P. K. Bajpai</li> <li>5. Bioinstrumentation — by L. Veerakumari</li> <li>6. Analytical Biochemistry and Separation Techniques — by P. Palanivelu</li> <li>7. Biotechniques: Theory and Practice — by S. V. S. Rana</li> <li>8. Biostatistical Analysis — by Jerrold H. Zar</li> <li>9. Introduction to Biostatistics and Research Methods — by P. S. S. Sundar Rao and J. Richard</li> <li>10. Analytical Techniques in Plant Sciences — by B. P. Pandey</li> <li>11. Plant Microtechnique and Microscopy — by Steven E. Ruzin</li> </ol>

	<p>12. An Introduction to Practical Biochemistry — by D. T. Plummer</p> <p>13. Short Protocols in Molecular Biology — by Frederick M. Ausubel et al.</p> <p>14. Modern Spectroscopy — by J. Michael Hollas</p> <p>15. Electrophoresis in Practice — by Reiner Westermeier</p>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT



B.Sc. HONOURS PROGRAM  
IN  
BOTANY

Semester- VII  
**Without OJT/ RP**

Effective from-2026-27

**Veer Narmad South Gujarat University, Surat**  
**Effective from-2026-27**  
**B.Sc. Honours Semester-7 (Botany)**  
**Without OJT/ RP**

Course Category	Course Code	Course Title	Mark Sheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
					TH	PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	BOT-MJ-701	Advance Phycology and Mycology	Advance Phycology and Mycology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-702	Practical In Advance Phycology and Mycology	Practical In Advance Phycology and Mycology	400-499	-	04	-	04	-	02	-	25	-	25	-	50
	BOT-MJ-703	Fundamentals of Microbiology and Plant pathology	Fundamentals of Microbiology and Plant pathology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-704	Practical In Fundamentals of Microbiology and Plant pathology	Practical In Fundamentals of Microbiology and Plant pathology	400-499	-	04	-	04	-	02	-	25	-	25	-	50
	BOT-MJ-705	Analytical Techniques and Biostatistics	Analytical Techniques and Biostatistics	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-706	Practical In Analytical Techniques and Biostatistics	Practical In Analytical Techniques and Biostatistics	400-499	-	04	-	04	-	02	-	25	-	25	-	50
	BOT-MJ-707	Bhartiya Gyan Parampara in Agriculture: Foundations and Applications	Bhartiya Gyan Parampara in Agriculture: Foundations and Applications	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-708	Practical In Bhartiya Gyan Parampara in Agriculture: Foundations and Applications	Practical In Bhartiya Gyan Parampara in Agriculture: Foundations and Applications	400-499	-	04	-	04	-	02	-	25	-	25	-	50
	MJ	*Research Methodology	Research Methodology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
MINOR ELECTIVE	ME	*Fundamentals of Cyber Security	Fundamentals of Cyber Security	400-499	04	-	02	-	04	-	50	-	50	-	100	-

\*Research Methodology Syllabus and Course Code will prepare by Adhoc Board of Research Methodology of VNSGU, Surat.

\*Fundamentals of Cyber Security Syllabus and Course Code will prepare by Computer Faculty of VNSGU, Surat

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**PROGRAM TITLE**

<b>Name of Program</b>	Bachelor of Science (Honours) Botany							
<b>Program Abbreviation</b>	<b>BOT-Botany, MJ-Major, BOTP-Botany Practical, ME-Minor Elective</b>							
<b>Duration</b>	One Year							
<b>Eligibility Criteria</b>	As per university rules.							
<b>Pre-requisite</b>	<input type="checkbox"/> Strong knowledge of fundamental subjects of Botany <input type="checkbox"/> Practical skills (microscopy, slide preparation, field work) <input type="checkbox"/> Basic knowledge of research methodology							
<b>Medium of Instruction</b>	English/ Gujarati							
<b>Objective of Program</b>	<p>The objective of this semester is to provide students with practical, research-oriented, and professional experience:</p> <ul style="list-style-type: none"> <li>• To gain real-world work experience through On Job Training (OJT)</li> <li>• To develop a scientific approach through research projects</li> <li>• To improve skills in data collection, analysis, and report writing</li> <li>• To prepare students for higher studies (M.Sc., Ph.D.) and careers in industry</li> <li>• To enhance understanding of environmental awareness and plant-based applications</li> </ul>							
<b>Program Outcome (PO)</b>	<p><b>PO1:</b> Gain in-depth knowledge of plant sciences including algae, fungi, microbes, and plant health.</p> <p><b>PO2:</b> Understand plant diversity, classification, and ecological significance.</p> <p><b>PO3:</b> Apply microbiological and pathological concepts in agriculture and environment.</p> <p><b>PO4:</b> Use analytical techniques and statistical tools for biological data interpretation.</p> <p><b>PO5:</b> Understand principles of organic farming and sustainable agriculture practices.</p> <p><b>PO6:</b> Develop critical thinking and problem-solving skills in biological sciences.</p> <p><b>PO7:</b> Apply ethical and environmentally sustainable approaches in plant sciences.</p>							
<b>Program Specific Outcomes (PSO)</b>	<p><b>PSO1:</b> Demonstrate knowledge of plant diversity, especially algae and fungi, and apply taxonomic principles for their identification and classification.</p> <p><b>PSO2:</b> Understand fundamentals of microbiology and plant pathology to identify plant diseases and apply appropriate management strategies.</p> <p><b>PSO3:</b> Apply analytical techniques and biostatistical tools for collection, analysis, and interpretation of biological data.</p> <p><b>PSO4:</b> Understand and implement principles of organic farming and sustainable agriculture for eco-friendly practices.</p> <p><b>PSO5:</b> Demonstrate understanding of research methodology, hypothesis formulation, and statistical applications in biological sciences.</p> <p><b>PSO6:</b> Apply botanical knowledge in agriculture, environmental management, and allied fields.</p> <p><b>PSO7:</b> Develop environmental awareness and adopt ethical practices for biodiversity conservation and sustainable development.</p>							
<b>Mapping between Pos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	PO1	√	√	√	√	√	√	√
	PO2	√	√		√		√	√
	PO3	√	√	√	√	√	√	√
	PO4	√	√	√	√	√		
	PO5		√	√	√	√	√	√
	PO6	√	√	√	√	√	√	√
	PO7	√	√	√	√	√	√	√

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
 SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>7</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Entrepreneurship/ Employability / Skill Development							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-701</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Advance Phycology and Mycology</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO.1:</b> Understand diversity, classification, and life cycles of algae and fungi.  <b>CO.2:</b> Analyze structural and reproductive adaptations in different groups.  <b>CO.3:</b> Identify economically and ecologically important algae and fungi.  <b>CO.4:</b> Understand role of fungi in industry, medicine, and agriculture.  <b>CO.5:</b> Apply knowledge for identification and classification of specimens.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√						
	CO2	√					√	
	CO3	√	√		√		√	√
	CO4	√	√	√		√	√	
	CO5	√	√					√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>                      General characters and Classification of algae (Fritsch 1945, and Smith, 1955)                      Life cycle types in algae                      Salient features of Cyanophyta, Chlorophyta, Bacillariophyta, Xanthophyta, Pyrrophyta, Phaeophyta and Rhodophyta with special reference to <i>Rivularia</i>, <i>Tolypothrix</i>, <i>Hydrodictyon</i>, <i>Nitella</i>, <i>Ulva</i>, <i>Fucus</i> and <i>Polysiphonia</i>                      Algal biofuels (algal biodiesel, bio-ethanol and biological hydrogen production)                      Industrial applications of algae.</p> <p><b><u>Unit – 2</u></b>                      General characters and Classification of fungi (Alexoplous and Mims, 1979; Ainsworth, 1973)                      Heterothallism and Parasexuality in fungi                      General account of mastigomycotina, zygomycotina, ascomycotina, basidiomycotina and deuteromycotina with special reference to <i>Phytophthora</i>, <i>Penicillium</i>, <i>Erysiphae</i>, <i>Ustilago</i>, <i>Alternaria</i>, <i>Cercospra</i>                      Economic importance of fungi (as food, in medicine, in industry, in agriculture), harmful actions of fungi, Mycorrhiza, Mushroom cultivation.</p>							
<b>Course Code</b>	BOTP-MJ-702							
<b>Course Title</b>	<b>Practical In Advanced Phycology and Mycology</b>							
<b>Course Practical content</b>	1. Study of the following algae through microscopic preparations, permanent slides and charts-							

	<ol style="list-style-type: none"> <li>a. <i>Rivularia</i></li> <li>b. <i>Tolypothrix</i></li> <li>c. <i>Coleochaete</i></li> <li>d. <i>Hydrodictyon</i></li> <li>e. <i>Nitella</i></li> <li>f. <i>Ulva</i></li> <li>g. <i>Fucus</i></li> <li>h. <i>Polysiphonia</i></li> </ol> <ol style="list-style-type: none"> <li>2. Study of the following fungi through microscopic preparations, permanent slides and charts- <ol style="list-style-type: none"> <li>a. <i>Phytophthora</i></li> <li>b. <i>Penicillium</i></li> <li>c. <i>Erysiphae</i></li> <li>d. <i>Phyllactinia</i></li> <li>e. <i>Ustilago</i></li> <li>f. <i>Alternaria</i></li> <li>g. <i>Cercospra</i></li> </ol> </li> <li>3. Isolation and establishment of axenic algal culture using BG11 media.(Demonstration or Hands on)</li> </ol>
<b>Reference Books</b>	<ul style="list-style-type: none"> <li>• The Structure and Reproduction of the Algae by F.E. Fritsch</li> <li>• Cryptogamic Botany, Volume I: Algae and Fungi by G.M. Smith</li> <li>• Manual of Phycology by G.M. Smith</li> <li>• Phycology by Robert Edward Lee</li> <li>• Algae by V.D. Chopra</li> <li>• Botany for Degree Students: Algae by B.R. Vashishta</li> <li>• Algal Culturing Techniques by Elsevier Academic Press</li> <li>• Algae and Human Affairs by C.A. Prescott</li> <li>• Introductory Mycology by C.J. Alexopoulos and C.W. Mims</li> <li>• Dictionary of the Fungi by G.C. Ainsworth</li> <li>• Textbook of Fungi by B.P. Pandey</li> <li>• Fungi by B.R. Vashishta</li> <li>• Botany for Degree Students: Fungi by B.R. Vashishta</li> <li>• Introductory Mycology by H.C. Dube</li> <li>• The Fungi by Ainsworth</li> <li>• Mushrooms: Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact by Philip G. Miles and Shu-Ting Chang</li> <li>• Mushroom Cultivation in India by M.C. Nair</li> <li>• University Botany I: Algae, Fungi, Bryophyta and Pteridophyta by S.M. Reddy</li> </ul>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2603000507024001]

[Subject code for Practical-2603000507024002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS								
<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	7							
<b>NCrF Credit Level</b>	6.0							
<b>Course Type</b>	Major							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-703</b>							
<b>Course Level</b>	400-499							
<b>Course Title</b>	<b>Fundamentals of Microbiology and Plant pathology</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<b>CO1:</b> Understand structure, classification, and functions of microorganisms. <b>CO2:</b> Explain microbial growth, reproduction, and metabolism. <b>CO3:</b> Identify plant diseases and their causal organisms. <b>CO4:</b> Understand host-pathogen interaction and disease cycles. <b>CO5:</b> Apply disease management strategies in agriculture.							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√		√	√	√
	CO2	√	√	√		√	√	√
	CO3	√	√	√		√	√	√
	CO4	√	√	√	√	√	√	√
	CO5	√	√	√	√	√	√	√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>            General symptoms of plant disease            Classification of plant disease            Genetics of plant disease (vir, avr and R genes)            Host pathogen interaction            Enzymes and Toxin in Plant Disease            Defense response of plants to pathogenic attack            Control of plant disease            Biological control of insects and pests            Study of etiology and management of following important plant diseases:-  <b>Fungal diseases:</b> Wheat - Karnal bunt, Rust of Linseed  <b>Bacterial diseases:</b> Leaf blight of rice, Red stripe of sugarcane  <b>Viral diseases:</b> Cadang-Cadang disease of Coconut, Sandal spike  <b>Nematode disease:</b> Root Knot of Brinjal, Ear Cockle of Wheat</p> <p><b><u>Unit – 2</u></b>  <b>Phytoplasma</b>  <b>Bacteria:</b> General characters, ultra-structure of bacterial cell, multiplication and methods of genetic recombination (Conjugation, transformation and transduction), Economic importance of bacteria.  <b>Virus:</b> Nomenclature and general characteristics of plant viruses, ultra structure of</p>							

	TMV and Bacteriophage, Lytic and Lysogenic life cycle, Economic importance of viruses. <b>Viroids and Prions</b>
<b>Course Code</b>	BOTP-MJ-704
<b>Course Title</b>	<b>Practical In Fundamentals of Microbiology and Plant pathology</b>
<b>Course Practical content</b>	<ol style="list-style-type: none"> <li>1. Study of morphology and symptomology of causal organisms (TMV, Mycoplasma, Bacteria, Nematode) using photographs/3D models.</li> <li>2. Study of important plant diseases mentioned in the syllabus.</li> <li>3. Study of spores of <i>Alternaria</i> from Early Blight of Potato.</li> <li>4. Study of histopathology using temporary slide preparation of the Leaf gall of <i>Pongamia</i>.</li> <li>5. Study of phylloplane mycoflora using cellotape method.</li> <li>6. To understand the comparative biochemical and molecular profile in diseased v/s normal plants.</li> <li>7. Demonstration and application of basic control techniques such as soil solarization and roging in the field.</li> <li>8. Collection of herbarium specimens and study of pathological characteristics.</li> <li>9. To study ultra structure of bacterial cell using charts/ diagrams/ electron micrographs.</li> <li>10. Study of root nodule bacterium (<i>Rhizobium</i>) and curd (<i>Lactobacillus</i>) by gram staining.</li> <li>11. To demonstrate the preparation of media for culturing microbes (nutrient agar, potato dextrose agar).</li> <li>12. To determine the number of viable microorganisms (CFU) using the standard plate count method.</li> <li>13. To study virus life cycles using charts/ diagrams (Lytic and Lysogenic).</li> <li>14. To study (theoretically and/or practically) the streak plate and pour plate methods for isolation, cultivation, and observation of bacterial colonies.</li> <li>15. To understand the key concept and principle of the disc diffusion method to assess the effectiveness of antibiotics on bacterial growth.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Plant Pathology — by George N. Agrios</li> <li>2. Fundamentals of Plant Pathology — by R. S. Mehrotra and Ashok Aggarwal</li> <li>3. Microbiology and Plant Pathology — by R. S. Mehrotra</li> <li>4. Diseases of Crop Plants in India — by G. Rangaswami</li> <li>5. Crop Diseases and Their Management — by R. S. Shukla</li> <li>6. Field Crop Diseases Handbook — by James B. Sinclair</li> <li>7. Pathological Problems of Economic Crop Plants and Their Management — by B. P. Pandey</li> <li>8. Recent Advances in the Diagnosis and Management of Plant Diseases — edited by P. C. Trivedi</li> <li>9. Plant Diseases: Epidemics and Control — by J. E. Vanderplank</li> <li>10. Disease Resistance in Plants — by J. E. Vanderplank</li> <li>11. Phytoplasmas: Plant Pathogenic Bacteria - I — edited by P. Narayanasamy</li> <li>12. Encyclopedia of Plant Viruses and Viroids — edited by P. Narayanasamy</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2603000507034001]

[Subject code for Practical-2603000507034002]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>7</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-705</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Analytical Techniques and Biostatistics</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO 1:</b> Understand principles of analytical instruments used in biology.  <b>CO 2:</b> Apply techniques like chromatography, spectroscopy, and microscopy.  <b>CO 3:</b> Understand basic statistical concepts (mean, median, variance, correlation).  <b>CO 4:</b> Analyze biological data using statistical tools.  <b>CO 5:</b> Interpret experimental results and present data scientifically.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√		√	√	√
	CO2	√	√	√		√	√	√
	CO3	√	√	√		√	√	√
	CO4	√	√	√		√	√	√
	CO5	√	√	√		√	√	√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>  <b>Microscopy</b> (Optical, phase contrast, Fluorescence microscopy, Confocal microscopy).  <b>Centrifugation:</b> Principle; types, application. Ultra-centrifugation.  <b>Radioisotopes</b> in biological research and <b>autoradiography</b>.  <b>Spectrophotometry</b>-Principle, and applications, Colorimeter, UV-Vis Spectrophotometry, AAS, NMR spectroscopy.  <b>Blotting techniques</b> (Western, Southern and Northern blotting),  <b>Electrophoresis</b> (AGE, PAGE), Principle of PCR and its applications.  <b>Chromatography:</b> Principle and methodology of chromatographic techniques: Paper, Thin Layer, Column chromatography and types (size exclusion, ion exchange, affinity, HPLC, GCMS, LCMS).</p> <p><b><u>Unit – 2</u></b>  Sampling methods; Data types (Primary and secondary data; Qualitative and quantitative data; Discrete and continuous data)  Measures of Central tendency (Mean, Median and Mode)  Measures of dispersion (Coefficient of Variance, Standard Deviation and Standard Error)  Testing of Hypothesis (Null and Alternative hypotheses)  T-test, ANOVA and Chi-square test.</p>							

<b>Course Code</b>	<b>BOTP-MJ-706</b>
<b>Course Title</b>	<b>Practical in Analytical Techniques and Biostatistics</b>
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>1. Subcellular Fractionation by Differential &amp; Density Gradient Centrifugation</li> <li>2. Optical &amp; Phase Contrast Microscopy, Observe living vs. stained cells, compare brightfield and phase contrast. (demonstration or hands-on).</li> <li>3. Fluorescence Microscopy, Visualize specific cellular components using fluorescent dyes. (demonstration or hands-on).</li> <li>4. Colorimeter – Quantification of Protein (Bradford Assay) ,Determine unknown protein concentration.</li> <li>5. Spectroscopy, Simultaneous estimation of a binary mixture (e.g., Paracetamol and Ibuprofen) by UV spectrophotometry.</li> <li>6. Western Blotting, Detect a specific protein (e.g., <math>\beta</math>-actin) from cell lysate, Southern Blotting ,Detect specific DNA fragment after restriction digest, Northern Blotting Detect mRNA expression of a gene. (demonstration or hands-on).</li> <li>7. AGE (Agarose Gel Electrophoresis), Separate DNA fragments (PCR products). (demonstration or hands-on).</li> <li>8. PAGE (SDS-PAGE), Separate proteins by molecular weight. (demonstration or hands-on).</li> <li>9. Chromatography, Separation and identification of amino acids/sugars by TLC/HPTLC.</li> <li>10. Estimation of drugs in tablet formulation using HPLC (demonstration or hands-on).</li> <li>11. To test the significance of association or difference between variables using the Chi-square test to determine whether observed differences or relationships are statistically significant.</li> <li>12. To test the significance of association or difference between variables using the T-test, and to determine whether observed differences or relationships are statistically significant.</li> <li>13. To calculate and interpret various measures of dispersion such as standard deviation, coefficient of variation, and standard error to assess the extent of variability in a given dataset.</li> <li>14. To study the relationship between two quantitative variables and compute the coefficient of correlation..</li> <li>15. To analyze the variance among group means using one-way ANOVA and determine whether there are statistically significant differences between the means of three or more independent groups.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Techniques in Microscopy and Cell Biology — by V. K. Sharma</li> <li>2. Introductory Practical Biochemistry — by S. K. Sawhney and Randhir Singh</li> <li>3. Basics of Analytical Biochemistry — by P. Asokan</li> <li>4. Biological Instrumentation and Methodology — by P. K. Bajpai</li> <li>5. Bioinstrumentation — by L. Veerakumari</li> <li>6. Analytical Biochemistry and Separation Techniques — by P. Palanivelu</li> <li>7. Biotechniques: Theory and Practice — by S. V. S. Rana</li> <li>8. Biostatistical Analysis — by Jerrold H. Zar</li> <li>9. Introduction to Biostatistics and Research Methods — by P. S. S. Sundar Rao and J. Richard</li> <li>10. Analytical Techniques in Plant Sciences — by B. P. Pandey</li> <li>11. Plant Microtechnique and Microscopy — by Steven E. Ruzin</li> </ol>

	<p>12. An Introduction to Practical Biochemistry — by D. T. Plummer</p> <p>13. Short Protocols in Molecular Biology — by Frederick M. Ausubel et al.</p> <p>14. Modern Spectroscopy — by J. Michael Hollas</p> <p>15. Electrophoresis in Practice — by Reiner Westermeier</p>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2603000507054001]

[Subject code for Practical-2603000507054002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS								
<b>Program Name</b>	<b>Master of Science in Botany (M.Sc. Botany)</b>							
<b>Semester</b>	7							
<b>NCrF Credit Level</b>	6.0							
<b>Course Type</b>	Major							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	BOT-MJ-707							
<b>Course Level</b>	400-499							
<b>Course Title</b>	<b>Bhartiya Gyan Parampara in Agriculture: Foundations and Applications</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO1:</b> Explain the foundations of Indian agricultural heritage through ancient texts, historical evolution, and traditional knowledge systems.</p> <p><b>CO2:</b> Analyze Indigenous Technical Knowledge (ITK) in crop production including seed sovereignty, organic inputs, pest management, and cropping systems.</p> <p><b>CO3:</b> Describe traditional water harvesting techniques and animal husbandry practices including Pashu Ayurveda and indigenous breeds.</p> <p><b>CO4:</b> Evaluate the contemporary relevance of traditional agriculture in terms of sustainability, biodiversity, socio-economic conditions, and policy frameworks.</p> <p><b>CO5:</b> Integrate traditional agricultural knowledge with modern scientific tools for sustainable agriculture and future development.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√			√		√	√
	CO2	√	√		√		√	√
	CO3		√		√		√	√
	CO4		√	√	√	√	√	√
	CO5			√	√	√	√	√
<b>Course Content</b>	<p><b><u>Unit 1: Foundations of Indian Agricultural Heritage</u></b></p> <ul style="list-style-type: none"> <li>• Ancient Texts &amp; Literature: Study of Krishi-Parashara (400 BCE), Kautilya's Arthashastra, Vrikshayurveda, and Sangam Tamil literature .</li> <li>• Historical Evolution: Agricultural practices in the Indus Valley, Vedic, and Post-Vedic periods.</li> <li>• Astronomy &amp; Monsoon Prediction: Traditional methods of weather forecasting using Panchanga and observations by scholars like Varahamihira .</li> <li>• Concept of Bhumi: Traditional classification of soils and their productivity maintenance.</li> </ul> <p><b>Crop Production and Indigenous Technical Knowledge (ITK).</b></p>							

	<ul style="list-style-type: none"> <li>• Seed Sovereignty: Traditional techniques of seed selection, treatment (e.g., Beejamruta), storage, and exchange systems .</li> <li>• Manures &amp; Fertilizers: Preparation and application of Jeevamruta, Ghanajeevamruta, Panchagavya, and composting techniques .</li> <li>• Pest Management (ITK): Preparation of natural decoctions (Dashparni, Neemastra, Agniastra, Brahmastra) .</li> <li>• Cropping Systems: Mixed cropping, intercropping, and crop rotation patterns unique to various bio-regions of India.</li> </ul> <p><b><u>Unit 2: Water Harvesting and Animal Husbandry</u></b></p> <ul style="list-style-type: none"> <li>• Traditional Water Management: Kunds, Baolis (stepwells), Ahar-Pyne, Kere (tanks), and Khadin (runoff farming) systems .</li> <li>• Pashu Ayurveda: Traditional remedies for common livestock diseases using local flora (e.g., babool, jamun bark) .</li> <li>• Indigenous Breeds: Study of native cattle, poultry, and goat breeds and their role in agrarian economy and draught power.</li> <li>• Vrikshayurveda: The science of plant life and soil rejuvenation using tree-based interventions.</li> </ul> <p><b>Contemporary Relevance &amp; Socio-Economic Dimensions and Policy</b></p> <ul style="list-style-type: none"> <li>• Traditional vs. Modern: Comparative study of input costs, soil health impact, nutritional quality, and water efficiency .</li> <li>• <b>Role of National Programme for Organic Production (NPOP) , Agricultural and Processed Food Products Export Development Authority (APEDA).</b></li> <li>• Organic farming Certification in Gujarat: Role of GOPCA.</li> <li>• Gujarat Organic Farming :The Dang Model (2021)</li> <li>• Status of Farmers: Historical social status (as described in Ramayana, Mahabharata) vs. current agrarian distress .</li> <li>• Local Biodiversity: Folk varieties of Rice (e.g., Pokkali, Kalanamak), Millets, and Cotton.</li> <li>• Policy Framework: Role of the National Mission on Natural Farming (NMNF) and the Indian Knowledge Systems (IKS) division .Future Roadmap: Integrating traditional systems with modern technology (GIS mapping of heritage sites, digital seed banks).</li> </ul>
<b>Course Code</b>	<b>BOTP-MJ-708</b>
<b>Course Title</b>	<b>Practical In Bhartiya Gyan Parampara in Agriculture: Foundations and Applications</b>
<b>Course practical content</b>	<p><b>1. Preparation &amp; Efficacy Testing of Beejamruta</b>  <b>Objective:</b> Prepare Beejamruta as per traditional method; test its effect on seed germination rate, root length, and seedling vigor index compared to chemical fungicide treatment and control.  <b>Methods:</b> Cow dung, cow urine, lime, soil, water – ferment overnight. Treat seeds (e.g., wheat, chickpea). Conduct blotter paper test and pot trial.</p> <p><b>2. Formulation &amp; Field Application of Jeevamruta &amp; Ghanajeevamruta</b>  <b>Objective:</b> Prepare both liquid and solid microbial cultures; apply to a 10m × 10m plot; measure soil dehydrogenase activity and available NPK before and after (15 &amp; 30 days).  <b>Methods:</b> Fermentation monitoring (pH, smell, foam test), soil sampling, basic biochemistry.</p> <p><b>3. Extraction &amp; Efficacy of Dashparni, Neemastra, Agniastra, Brahmastra</b></p>

**Objective:** Collect 10 local leaves (Dashparni); prepare decoctions; test against Plant leaf-dip bioassay; calculate LC50.

**Comparison:** Synthetic insecticide (e.g., Cypermethrin) vs. ITKs vs. control.

#### **4. Survey & Documentation of Traditional Cropping Systems**

**Objective:** Visit 3-5 farms in a bio-region (e.g., Gujarat, Eastern Ghats, Western Ghats). Document existing mixed/inter/multi-tier cropping patterns (e.g., millet + pigeonpea + sesame). Calculate Land Equivalent Ratio (LER).

**Output:** Prepare a “Cropping System Atlas” for the district.

#### **5. Traditional Seed Storage Structures & Seed Health**

**Objective:** Compare traditional storage (earthen pots, mud-coated bins, ash mixing, neem leaf layered) vs. modern gunny bags + pesticide. Monitor moisture content, insect infestation (%), and germination% at 0, 30, 60 days.

#### **6. Vrikshayurveda – Soil Rejuvenation Using Tree-Based Interventions**

**Objective:** Select degraded plot. Apply Vrikshayurveda treatments: (a) Panchavalkala (bark of 5 Ficus species), (b) Bhallataka (Semecarpus) leaf mulch, (c) Control. Measure soil organic carbon, aggregate stability, and earthworm count after 60 days.

#### **7. Comparative Analysis: Traditional vs. Modern for One Crop**

**Objective:** For a single crop (e.g., rice/groundnut), collect real or secondary data on input cost (seed, fertilizer, pesticide, water), yield, grain protein/FE/Zn content (lab analysis), and water efficiency (kg grain/m<sup>3</sup>). Calculate benefit-cost ratio and sustainability index.

#### **8. Organic Certification Documentation – Role Play / Mock Audit**

**Objective:** Understand NPOP and APEDA standards. Prepare a mock Group Certification file for a 5-member farmer group. Complete: Farm history declaration, input list, buffer zone map, internal inspection report. Role play as GOPCA (Gujarat Organic Products Certification Agency) inspector.

#### **9. Case Study – The Dang Model (Gujarat, 2021)**

**Objective:** Obtain secondary data (papers/reports) on Dang’s 100% organic tribal farming model. Compare pre (2018) and post (2022) metrics: % chemical-free area, income/farmer, biodiversity index, women’s participation. Present SWOT analysis.

#### **10. Folk Variety Collection of plants**

**Objective:** Collect 5 folk rice varieties (e.g., Pokkali, Kalanamak, Tulaipanji), 3 millets (Kodo, Little, Foxtail), 1 native cotton. Document morphological traits.

#### **11. Analyze amylose of traditional plant Compare with high-yielding variety.**

**Objective :**To estimate and compare the amylose content (a key determinant of starch quality and digestibility) in a traditional plant variety versus a modern high-yielding variety.

#### **12. Protein estimation any of folk variety plant compare with hybrid plant.**

**Objective :** To quantitatively estimate the crude protein content in a selected folk (traditional) plant variety using a standard Lowry method.

#### **13. Qualitative analysis of inorganic components from traditional plant ash.**

**Objective :** To identify the presence of essential inorganic elements (e.g. calcium, magnesium, phosphorus, iron) in the ash obtained from a traditional plant.

#### **14. Collection of traditional verity of plants.**

**Objective :** To prepare a herbarium or digital record of the collected specimens, creating a reference resource for conservation.

#### **15. Collection of seeds of indigenous plants.**

**Objective:** To collect and document seeds of diverse indigenous plant species from local ecosystems.

#### **16. Designing a NMNF (National Mission on Natural Farming) – IKS Integration Plan**

**Objective:** Based on field survey of 20 farmers, prepare a 5-year roadmap for a village/cluster. Integrate: Panchanga-based sowing, local breed draught power,

	Vrikshayurveda bund planting, digital seed bank link, and APEDA export readiness for millets/rice.
<b>Reference Books</b>	<ul style="list-style-type: none"> <li>➤ Krishi-Parashara (400 BCE) : "Krishi-Parashara" (Translated by A.Y. Nene &amp; N. Sadhale) Plant Protection: "Crop Disease Management Practices in Ancient, Medieval, and Pre-modern India" by Y.L. Nene (Asian Agri-History, 2003).</li> <li>➤ General ITK: "Indigenous Technical Knowledge in Agriculture" by P. Venkatesan . Venkatesan is an ICAR scientist specializing in ITK documentation and Participatory Technology Development.</li> <li>➤ Seed Systems: "Reclaiming the Commons" by Vandana Shiva.</li> <li>➤ Kunds &amp; Baolis: "Baolis of Bundi: The Ancient Stepwells" by INTACH.</li> <li>➤ Regional Systems: "Tanks of South India" by D. Ludden (For <i>Kere/Tanks</i>) and Ahar-Pyne System" in <i>Gazetteer of Bihar</i> (Historical records).</li> <li>➤ Ethnoveterinary Science: "Indian Traditional Animal Husbandry and Ethnoveterinary Science" (New India Publishing Agency, 2026.)</li> <li>➤ The Dang Model: "Organic Farming in the Dangs: Tribal Farmers' Insights" by Neeta Kalasariya (Scholars' Press, 2024).</li> <li>➤ Certification: Official publications from APEDA (Agricultural and Processed Food Products Export Development Authority) and NPOP (National Programme for Organic Production)</li> <li>➤ "Folk Varieties of Rice in India" by Debal Deb . Essential for understanding <i>Pokkali</i>, <i>Kalanamak</i>, and other native rice varieties.</li> <li>➤ Introductory Agroforestry by K. T. Parthiban, R. Seenivasan</li> <li>➤ Laboratory Manual for the Analysis of Soil, Plant, and Water" by D. R. Gautam</li> <li>➤ Plant Physiology: Fundamentals and Applications" by S. Mukherji and A. K. Ghosh:</li> <li>➤ Research Methods in Plant Sciences: Volume I: Soil &amp; Agronomy" by S. R. Reddy:</li> <li>➤ The Organic Farming" by P. L. Maliwal and S. L. Mundra (Agrotech Publishing Academy.</li> <li>➤ Vrikshayurveda: The Science of Plant Life" by Surapala (Translated by Nalini Sadhale.</li> <li>➤ Handbook of Natural Farming" by Bihar Government (ITK Section).</li> <li>➤ Zero Budget Natural Farming (ZBNF)" by Subhash Palekar: Specifically for the preparation standards of Beejamruta, Jeevamruta, and Agniastra (mentioned in search results for Neemastra/Brahmastra).</li> <li>➤ Statistical Methods for Agricultural Workers" by V. G. Panse and P. V. Sukhatme: Required for calculating the significance of LER (Land Equivalent Ratio) data.</li> <li>➤ Methods in Food Analysis" by R. S. K. Buys and G. G. Nair: Contains the specific protocols for Amylose estimation in grains (Standard AACC method).</li> <li>➤ Biochemistry Laboratory Manual" by S. S. Jadhav and S. B. Sullia: For the Lowry method of protein estimation (Experiment 12) and the specific gravity methods for inorganic component identification.</li> <li>➤ Handbook of Analytical Techniques" by S. Williams: For qualitative analysis of ash (Potassium, Calcium, Magnesium via Flame photometer/Colorimetric).</li> </ul>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Filed Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT



B.Sc. HONOURS PROGRAM  
IN  
BOTANY

Semester- VIII  
**With OJT/ RP**

Effective from-2026-27

**Veer Narmad South Gujarat University, Surat**  
**B.Sc. Honours Semester-8 (Botany)**  
**Effective from-2026-27**  
**With OJT/ Research**

Course Category	Course Code	Course Title	Mark Sheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
					TH	PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	BOT- MJ-801	Bryophyta and Pteridophyta	Bryophyta and Pteridophyta	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-802	Practical In Bryophyta and Pteridophyta	Practical In Bryophyta and Pteridophyta	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOP-MJ-803	Phanerogams and Paleobotany	Phanerogams and Paleobotany	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-804	Practical In Phanerogams and Paleobotany	Practical In Phanerogams and Paleobotany	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOT-MJ-805	Plant Molecular Biology & Genetics	Plant Molecular Biology & Genetics	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-806	Practical In Plant Molecular Biology & Genetics	Practical In Plant Molecular Biology & Genetics	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
MINOR ELECTIVE	ME-	*Entrepreneurship	Entrepreneurship	400-499	04	-	02	-	04	-	50	-	50	-	100	-
OJT/RP	BOT-OJT/RP-707	Research Project/ On Job Training	Research Project/ On Job Training	400-499	12	-	-	-	06	-	75	-	75	-	150	-

\* Entrepreneurship Syllabus and course code will prepare by Commerce including B.A. Board of studies of VN SGU, Surat

<b>VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT</b>																																																																									
<b>PROGRAM TITLE</b>																																																																									
<b>Name of Program</b>	Bachelor of Science (Honours) Botany																																																																								
<b>Program Abbreviation</b>	<b>BOT-Botany, MJ-Major, BOTP-Botany Practical, ME-Minor Elective</b>																																																																								
<b>Duration</b>	One Year																																																																								
<b>Eligibility Criteria</b>	As per university norms.																																																																								
<b>Pre-requisite</b>	B.Sc. in Botany																																																																								
<b>Medium of Instruction</b>	English / Gujarati																																																																								
<b>Objective of Program</b>	<p>The objective of this semester is to provide students with practical, research-oriented, and professional experience:</p> <ul style="list-style-type: none"> <li>• To develop a scientific approach through research projects</li> <li>• To improve skills in data collection, analysis, and report writing</li> <li>• To prepare students for higher studies (Ph.D.) and careers in industry</li> <li>• To enhance understanding of environmental awareness and plant-based applications</li> </ul>																																																																								
<b>Program Outcome (PO)</b>	<p><b>PO1:</b> Understand fundamental and advanced concepts of plant sciences including taxonomy, physiology, genetics, ecology, and evolution.</p> <p><b>PO2:</b> Develop scientific thinking and analytical skills for studying plant diversity and processes.</p> <p><b>PO3:</b> Apply biological knowledge in agriculture, horticulture, and environmental management.</p> <p><b>PO4:</b> Demonstrate laboratory skills and use of modern tools and techniques in plant sciences.</p> <p><b>PO5:</b> Analyze environmental issues and propose sustainable solutions.</p> <p><b>PO6:</b> Communicate scientific information effectively in oral and written forms.</p> <p><b>PO7:</b> Use ICT tools and statistical methods for data analysis and presentation.</p> <p><b>PO8:</b> Develop ethical awareness and responsibility toward biodiversity conservation.</p>																																																																								
<b>Program Specific Outcomes (PSO)</b>	<p><b>PSO1:</b> Identify and classify plants from lower groups (Bryophyta, Pteridophyta) to higher groups (Phanerogams).</p> <p><b>PSO2:</b> Understand plant evolution through fossil records and paleobotanical evidence.</p> <p><b>PSO3:</b> Explain molecular mechanisms of gene expression, inheritance, and variation in plants.</p> <p><b>PSO4:</b> Apply genetic principles in plant improvement and breeding practices.</p> <p><b>PSO5:</b> Demonstrate knowledge of horticultural practices for crop production and management.</p> <p><b>PSO6:</b> Use modern molecular and ICT tools in plant science studies.</p> <p><b>PSO7:</b> Analyze research data using statistical and computational methods.</p>																																																																								
<b>Mapping between Pos and PSOs</b>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>PSO1</th> <th>PSO2</th> <th>PSO3</th> <th>PSO4</th> <th>PSO5</th> <th>PSO6</th> <th>PSO7</th> </tr> </thead> <tbody> <tr> <td>PO1</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO2</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>PO3</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>PO4</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>PO5</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>PO6</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO7</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO8</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> </tbody> </table>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	√	√	√			√	√	PO2	√	√	√	√	√		√	PO3			√	√	√			PO4	√	√			√	√	√	PO5	√	√	√		√	√	√	PO6	√	√				√	√	PO7	√	√	√	√		√	√	PO8		√	√	√	√		
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PO7	√	√	√	√		√	√																																																																		
PO8		√	√	√	√																																																																				

[Subject code for Theory-2703000508014001]

[Subject code for Practical-2703000508014002]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>8</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Entrepreneurship/ Skill development							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-801</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Bryophyta and Pteridophyta</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO1:</b> Understand classification, morphology, and life cycles of Bryophytes and Pteridophytes.</p> <p><b>CO2:</b> Explain evolutionary significance of these lower vascular and non-vascular plants.</p> <p><b>CO3:</b> Identify economically and ecologically important species.</p> <p><b>CO4:</b> Study alternation of generations and reproductive strategies.</p>							
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√			√	√
	CO2	√		√	√	√	√	
	CO3	√		√	√	√		
	CO4	√	√	√				
<b>Course Content</b>	<p><b>Unit - 1</b>            Characteristic features and classification of Bryophyta            Evolution of sporophyte in Bryophyta            Affinities of bryophytes with algae and pteridophytes            Comparative account of Hepaticopsida, Anthocertopsida and Bryopsida            Economic and ecological importance of Bryophyta</p> <p><b>Unit – 2</b>            Characteristic features and classification of pteridophyta            Characteristics feature of following sub divisions (Psiliophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida)            Affinities of pteridophytes with bryophytes and gymnosperm            Heterospory and Seed Habit in Pteridophyta            Telome theory            Stellar system and evolution of stele in pteridophyta</p>							
<b>Course Code</b>	<b>BOTP-MJ-802</b>							
<b>Course Title</b>	<b>Practical In Bryophyta and Pteridophyta</b>							
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>To study external morphology, internal structure and reproductive features of bryophyte <i>Plagiochasma</i> through microscopic preparations, permanent slides and charts.</li> <li>To study external morphology, internal structure and reproductive features of bryophyte <i>Pelia</i> through microscopic preparations, permanent slides and</li> </ol>							

	<p>charts.</p> <ol style="list-style-type: none"> <li>3. To study external morphology, internal structure and reproductive features of bryophyte <i>Notothyllus</i> through microscopic preparations, permanent slides and charts.</li> <li>4. To study external morphology, internal structure and reproductive features of bryophyte <i>Polytrichum</i> through microscopic preparations, permanent slides and charts.</li> <li>5. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Lycopodium</i> through microscopic preparations, permanent slides and charts.</li> <li>6. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Adiantum</i> through microscopic preparations, permanent slides and charts.</li> <li>7. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Pteris</i> through microscopic preparations, permanent slides and charts.</li> <li>8. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Azolla</i> through microscopic preparations, permanent slides and charts.</li> <li>9. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Salvinia</i> through microscopic preparations, permanent slides and charts.</li> <li>10. To study the morphology and evolutionary significance of fossil pteridophyte <i>Rhynia</i> using charts, models, and diagrams.</li> <li>11. To study the morphology and evolutionary significance of fossil pteridophyte <i>Horneophyton</i> using charts, models, and diagrams.</li> <li>12. To study stelar organization in pteridophytes (protostele, siphonostele, etc.) using charts and slides.</li> <li>13. To prepare an herbarium of locally available bryophytes and pteridophytes with proper labeling.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Bryophyta — by P. C. Vashishta</li> <li>2. Bryophytes — by B. R. Vashishta</li> <li>3. An Introduction to Bryophyta — by A. C. Rashid</li> <li>4. Morphology of Pteridophytes — by K. R. Sporne</li> <li>5. Pteridophyta — by P. C. Vashishta</li> <li>6. Pteridophyta — by R. K. Sinha</li> <li>7. Morphology of Vascular Plants — by D. W. Bierhorst</li> <li>8. The Biology of Bryophytes — by Bernard Goffinet and A. Jonathan Shaw</li> <li>9. Pteridophyta — by B. P. Pandey</li> <li>10. Plant Morphology — by N. S. Parihar</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2703000508024001]

[Subject code for Practical-2703000508024002]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>								
<b>Semester</b>	<b>8</b>								
<b>NCrF Credit Level</b>	<b>6.0</b>								
<b>Course Type</b>	<b>Major</b>								
<b>Course Subtype</b>	Nil								
<b>Subject Type</b>	Discipline Specific								
<b>Course Code</b>	<b>BOT-MJ-803</b>								
<b>Course Level</b>	<b>400-499</b>								
<b>Course Title</b>	<b>Phanerogams and Paleobotany</b>								
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>			<b>04</b>	
<b>Effective From</b>	<b>Academic Year : 2026-27</b>								
<b>Course Outcomes</b>	CO1: Understand classification and diversity of gymnosperms and angiosperms. CO2: Analyze evolutionary trends in seed plants. CO3: Study fossil plants and their role in plant evolution. CO4: Interpret paleobotanical data for understanding past vegetation.								
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1	√	√		√	√			
	CO2	√	√	√	√	√		√	
	CO3	√	√						
	CO4	√	√	√					
<b>Course Content</b>	<p><b><u>Unit-1</u></b> General characters and Classification of Gymnosperms (Sporne 1965, Bierhorst 1971) Affinities with Pteridophytes and Angiosperms Characteristic features of following gymnosperm orders (Cycadofilicales, Bennettitales, Cycadales, Cordaitales, Coniferales, Ginkgoales, and Gnetales) Economic importance. Geological Time Scale, Types of Fossils</p> <p><b><u>Unit-2</u></b> <b>Taxonomic evidences:</b> Morphology, Anatomy, Palynology, Embryology, Cytology, and Phytochemistry Palynology (NPC system of classification of pollen) Brief overview of Angiosperm Phylogeny Group (APG IV) classification <b>Numerical Taxonomy</b> (Principles, concepts, operational taxonomic units (OTU), Cluster analysis) <b>Phylogeny of Angiosperm:</b> Ancestors of angiosperms, primitive living angiosperm, time and place of origin of Angiosperms.</p>								
<b>Course Code</b>	<b>BOTP-MJ-804</b>								
<b>Course Title</b>	<b>Practical in Phanerogams and Paleobotany</b>								
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>To study the morphological, anatomical, and reproductive features of gymnosperm <i>Araucaria</i> through microscopic preparations, permanent slides and charts.</li> <li>To study the morphological, anatomical, and reproductive features of</li> </ol>								

	<p>gymnosperm <i>Taxus</i> through microscopic preparations, permanent slides and charts.</p> <ol style="list-style-type: none"> <li>3. To study the morphological, anatomical, and reproductive features of gymnosperm <i>Thuja</i> through microscopic preparations, permanent slides and charts.</li> <li>4. To study the morphological, anatomical, and reproductive features of gymnosperm <i>Zamia</i> through microscopic preparations, permanent slides and charts.</li> <li>5. To study the morphology and reproductive structures of fossil gymnosperm <i>Williamsonia</i> through diagrams and fossil records.</li> <li>6. To study the structural features and affinities of fossil gymnosperm <i>Cycadeoidea</i> using charts and preserved specimens/images.</li> <li>7. Study of locally available plants belonging to taxonomic families. Amaranthaceae, Anacardiaceae, Asteraceae, Basalaceae, Boraginaceae, Casuranaceae, Lamiaceae, Lythraceae, Oleaceae, Orchidaceae, Papavaraceae, Portulacaceae, Ranunculaceae, Rhamnaceae, Rutaceae and Sepindaceae</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Morphology of Gymnosperms — by K. R. Sporne</li> <li>2. Morphology of Vascular Plants — by D. W. Bierhorst</li> <li>3. Gymnosperms — by P. C. Vashishta</li> <li>4. Gymnosperms — by B. P. Pandey</li> <li>5. Paleobotany — by B. P. Pandey</li> <li>6. An Introduction to Paleobotany — by Chester A. Arnold</li> <li>7. Plant Taxonomy — by O. P. Sharma</li> <li>8. Plant Taxonomy — by G. H. M. Lawrence</li> <li>9. Taxonomy of Angiosperms — by V. Singh and D. K. Jain</li> <li>10. Plant Systematics — by Gurcharan Singh</li> <li>11. The Evolution and Classification of Flowering Plants — by Arthur Cronquist</li> <li>12. Introduction to Palynology — by P. K. K. Nair</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

[Subject code for Theory-2703000508034001]

[Subject code for Practical-2703000508034002]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
SYLLABUS**

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>8</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-805</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Plant Molecular Biology &amp; Genetics</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<b>CO1:</b> Understand DNA structure, replication, transcription, and translation. <b>CO2:</b> Explain gene regulation and expression in plants. <b>CO3:</b> Apply Mendelian and molecular genetics principles. <b>CO4:</b> Understand genetic engineering and biotechnology basics.							
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1			√	√		√	√
	CO2			√	√		√	√
	CO3			√	√		√	√
	CO4			√	√		√	√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>  Nucleic acids (DNA &amp; RNA) types and structure, Nucleosome, Chromatin structure, Euchromatin and Heterochromatin, Experiments demonstrating DNA as the genetic material  DNA Replication  Transcription in Prokaryotes  Post transcriptional modification (Splicing, Capping, Polyadenylation, mRNA editing)  Genetic code, Translation in prokaryotes,  Regulation of gene expression in prokaryotes (Lac operon), RNA interference</p> <p><b><u>Unit – 2</u></b>  Mutations: Spontaneous and induced mutations, Physical and chemical mutagens, Types of mutation (Ploidy, Chromosomal aberrations, Point mutation)  Mendel's laws of inheritance, Monohybrid cross, Dihybrid cross, Test Cross, Back Cross, Co-dominance and incomplete dominance  Linkage and crossing over  Basics of Cytoplasmic inheritance.</p>							
<b>Course Code</b>	<b>BOTP-MJ-806</b>							
<b>Course Title</b>	<b>Practical In Plant Molecular Biology &amp; Genetics</b>							
<b>Course Practical Content</b>	1. Rapid DNA isolation (spooling method).							

	<ol style="list-style-type: none"> <li>2. To study experiments proving DNA as genetic material.</li> <li>3. To understand semi-conservative DNA replication using animations/models/diagrams.</li> <li>4. Study of special types of chromosomes (lampbrush and polytene) using photographs.</li> <li>5. To understand the principle and mechanism of DNA condensation.</li> <li>6. To interpret the primary structure of protein using codon charts.</li> <li>7. To solve the given genetic problem based on monohybrid, dihybrid, trihybrid, test cross and back cross.</li> <li>8. Calculation of recombination frequency and gene mapping.</li> <li>9. To observe and identify Barr bodies (inactivated X-chromosomes) in human buccal</li> <li>10. To observe and identify Barr bodies (inactivated X-chromosomes) in human buccal mucosal epithelial cells, and to correlate their presence with genetic sex.</li> <li>11. To prepare and observe mitotic chromosomes from plant root tips (e.g., onion – <i>Allium cepa</i>) to study chromosome number and morphology.</li> <li>12. To observe and illustrate the various stages of meiotic cell division in a plan</li> <li>13. To construct a karyotype from a photomicrograph or stained slide of metaphase chromosomes (typically from human lymphocytes or plant root tips), arranging homologous pairs by size, centromere position, and banding pattern.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Molecular Biology of the Gene — by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick</li> <li>2. Lewin's Genes — by Jocelyn E. Krebs, Elliot S. Goldstein and Stephen T. Kilpatrick</li> <li>3. Molecular Cell Biology — by Harvey Lodish</li> <li>4. Cell and Molecular Biology — by E. D. P. De Robertis and E. M. F. De Robertis</li> <li>5. Principles of Genetics — by Gardner, Simmons and Snustad</li> <li>6. Concepts of Genetics — by William S. Klug and Michael R. Cummings</li> <li>7. Genetics — by P. K. Gupta</li> <li>8. Genetics — by Verma and Agarwal</li> <li>9. Molecular Biology — by David P. Clark and Lonnie D. Russell</li> <li>10. Molecular Biology and Biotechnology — by J. M. Walker and R. Rapley</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT



B.Sc. HONOURS PROGRAM  
IN  
BOTANY

Semester- VIII  
**Without OJT/ RP**

Effective from-2026-27

**Veer Narmad South Gujarat University, Surat**  
**B.Sc. Honours Semester-8 (Botany)**  
**Effective from-2026-27**  
**Without OJT/ Research**

Course Category	Course Code	Course Title	Mark Sheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
					TH	PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	BOT- MJ-801	Bryophyta and Pteridophyta	Bryophyta and Pteridophyta	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-802	Practical In Bryophyta and Pteridophyta	Practical In Bryophyta and Pteridophyta	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOP-MJ-803	Phanerogams and Paleobotany	Phanerogams and Paleobotany	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-804	Practical In Phanerogams and Paleobotany	Practical In Phanerogams and Paleobotany	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOT-MJ-805	Plant Molecular Biology & Genetics	Plant Molecular Biology & Genetics	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-806	Practical In Plant Molecular Biology & Genetics	Practical In Plant Molecular Biology & Genetics	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	BOT-MJ-807	Applied Botany & Entrepreneurship	Applied Botany & Entrepreneurship	400-499	02	-	01	-	02	-	25	-	25	-	50	-
	BOTP-MJ-808	Practical In Applied Botany & Entrepreneurship	Practical In Applied Botany & Entrepreneurship	400-499	-	04	-	04 to 06	-	02	-	25	-	25	-	50
	MJ-	*Research Methodology	Research Methodology	400-499	02	-	01	-	02	-	25	-	25	-	50	-
MINOR ELECTIVE	ME-	*Entrepreneurship	Entrepreneurship	400-499	04	-	02	-	04	-	50	-	50	-	100	-

\*Research Methodology Syllabus and course code will prepare by Adhoc Board of Research Methodology of VNSGU, Surat.

\*Entrepreneurship Syllabus and course code will prepare by Commerce including B.A. Board of studies of VNSGU, Sura

<b>VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT</b>																																																																									
<b>PROGRAM TITLE</b>																																																																									
<b>Name of Program</b>	Bachelor of Science (Honours) Botany																																																																								
<b>Program Abbreviation</b>	<b>BOT-Botany, MJ-Major, BOTP-Botany Practical, ME-Minor Elective</b>																																																																								
<b>Duration</b>	One Year																																																																								
<b>Eligibility Criteria</b>	As per university norms.																																																																								
<b>Pre-requisite</b>	B.Sc. in Botany																																																																								
<b>Medium of Instruction</b>	English / Gujarati																																																																								
<b>Objective of Program</b>	<p>The objective of this semester is to provide students with practical, research-oriented, and professional experience:</p> <ul style="list-style-type: none"> <li>• To develop a scientific approach through research projects</li> <li>• To improve skills in data collection, analysis, and report writing</li> <li>• To prepare students for higher studies (Ph.D.) and careers in industry</li> <li>• To enhance understanding of environmental awareness and plant-based applications</li> </ul>																																																																								
<b>Program Outcome (PO)</b>	<p><b>PO1:</b> Understand fundamental and advanced concepts of plant sciences including taxonomy, physiology, genetics, ecology, and evolution.  <b>PO2:</b> Develop scientific thinking and analytical skills for studying plant diversity and processes.  <b>PO3:</b> Apply biological knowledge in agriculture, horticulture, and environmental management.  <b>PO4:</b> Demonstrate laboratory skills and use of modern tools and techniques in plant sciences.  <b>PO5:</b> Analyze environmental issues and propose sustainable solutions.  <b>PO6:</b> Communicate scientific information effectively in oral and written forms.  <b>PO7:</b> Use ICT tools and statistical methods for data analysis and presentation.  <b>PO8:</b> Develop ethical awareness and responsibility toward biodiversity conservation.</p>																																																																								
<b>Program Specific Outcomes (PSO)</b>	<p><b>PSO1:</b> Identify and classify plants from lower groups (Bryophyta, Pteridophyta) to higher groups (Phanerogams).  <b>PSO2:</b> Understand plant evolution through fossil records and paleobotanical evidence.  <b>PSO3:</b> Explain molecular mechanisms of gene expression, inheritance, and variation in plants.  <b>PSO4:</b> Apply genetic principles in plant improvement and breeding practices.  <b>PSO5:</b> Demonstrate knowledge of horticultural practices for crop production and management.  <b>PSO6:</b> Use modern molecular and ICT tools in plant science studies.  <b>PSO7:</b> Analyze research data using statistical and computational methods.</p>																																																																								
<b>Mapping between Pos and PSOs</b>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>PSO1</th> <th>PSO2</th> <th>PSO3</th> <th>PSO4</th> <th>PSO5</th> <th>PSO6</th> <th>PSO7</th> </tr> </thead> <tbody> <tr> <td>PO1</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO2</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>PO3</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>PO4</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>PO5</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>PO6</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO7</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>PO8</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> </tbody> </table>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	√	√	√			√	√	PO2	√	√	√	√	√		√	PO3			√	√	√			PO4	√	√			√	√	√	PO5	√	√	√		√	√	√	PO6	√	√				√	√	PO7	√	√	√	√		√	√	PO8		√	√	√	√		
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7																																																																		
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PO8		√	√	√	√																																																																				

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
 SYLLABUS

<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>8</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Entrepreneurship/ Skill development							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-801</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Bryophyta and Pteridophyta</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO1:</b> Understand classification, morphology, and life cycles of Bryophytes and Pteridophytes.</p> <p><b>CO2:</b> Explain evolutionary significance of these lower vascular and non-vascular plants.</p> <p><b>CO3:</b> Identify economically and ecologically important species.</p> <p><b>CO4:</b> Study alternation of generations and reproductive strategies.</p>							
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√	√			√	√
	CO2	√		√	√	√	√	
	CO3	√		√	√	√		
	CO4	√	√	√				
<b>Course Content</b>	<p><b>Unit - 1</b>                  Characteristic features and classification of Bryophyta                  Evolution of sporophyte in Bryophyta                  Affinities of bryophytes with algae and pteridophytes                  Comparative account of Hepaticopsida, Anthocertopsida and Bryopsida                  Economic and ecological importance of Bryophyta</p> <p><b>Unit – 2</b>                  Characteristic features and classification of pteridophyta                  Characteristics feature of following sub divisions (Psiliophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida)                  Affinities of pteridophytes with bryophytes and gymnosperm                  Heterospory and Seed Habit in Pteridophyta                  Telome theory                  Stellar system and evolution of stele in pteridophyta</p>							
<b>Course Code</b>	<b>BOTP-MJ-802</b>							
<b>Course Title</b>	<b>Practical In Bryophyta and Pteridophyta</b>							
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>To study external morphology, internal structure and reproductive features of bryophyte <i>Plagiochasma</i> through microscopic preparations, permanent slides and charts.</li> <li>To study external morphology, internal structure and reproductive features of bryophyte <i>Pelia</i> through microscopic preparations, permanent slides and</li> </ol>							

	<p>charts.</p> <ol style="list-style-type: none"> <li>3. To study external morphology, internal structure and reproductive features of bryophyte <i>Notothyllus</i> through microscopic preparations, permanent slides and charts.</li> <li>4. To study external morphology, internal structure and reproductive features of bryophyte <i>Polytrichum</i> through microscopic preparations, permanent slides and charts.</li> <li>5. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Lycopodium</i> through microscopic preparations, permanent slides and charts.</li> <li>6. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Adiantum</i> through microscopic preparations, permanent slides and charts.</li> <li>7. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Pteris</i> through microscopic preparations, permanent slides and charts.</li> <li>8. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Azolla</i> through microscopic preparations, permanent slides and charts.</li> <li>9. To study the morphological, anatomical, and reproductive features of pteridophyte <i>Salvinia</i> through microscopic preparations, permanent slides and charts.</li> <li>10. To study the morphology and evolutionary significance of fossil pteridophyte <i>Rhynia</i> using charts, models, and diagrams.</li> <li>11. To study the morphology and evolutionary significance of fossil pteridophyte <i>Horneophyton</i> using charts, models, and diagrams.</li> <li>12. To study stelar organization in pteridophytes (protostele, siphonostele, etc.) using charts and slides.</li> <li>13. To prepare an herbarium of locally available bryophytes and pteridophytes with proper labeling.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Bryophyta — by P. C. Vashishta</li> <li>2. Bryophytes — by B. R. Vashishta</li> <li>3. An Introduction to Bryophyta — by A. C. Rashid</li> <li>4. Morphology of Pteridophytes — by K. R. Sporne</li> <li>5. Pteridophyta — by P. C. Vashishta</li> <li>6. Pteridophyta — by R. K. Sinha</li> <li>7. Morphology of Vascular Plants — by D. W. Bierhorst</li> <li>8. The Biology of Bryophytes — by Bernard Goffinet and A. Jonathan Shaw</li> <li>9. Pteridophyta — by B. P. Pandey</li> <li>10. Plant Morphology — by N. S. Parihar</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
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<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>								
<b>Semester</b>	<b>8</b>								
<b>NCrF Credit Level</b>	<b>6.0</b>								
<b>Course Type</b>	<b>Major</b>								
<b>Course Subtype</b>	Nil								
<b>Subject Type</b>	Discipline Specific								
<b>Course Code</b>	<b>BOT-MJ-803</b>								
<b>Course Level</b>	<b>400-499</b>								
<b>Course Title</b>	<b>Phanerogams and Paleobotany</b>								
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>			<b>04</b>	
<b>Effective From</b>	<b>Academic Year : 2026-27</b>								
<b>Course Outcomes</b>	CO1: Understand classification and diversity of gymnosperms and angiosperms. CO2: Analyze evolutionary trends in seed plants. CO3: Study fossil plants and their role in plant evolution. CO4: Interpret paleobotanical data for understanding past vegetation.								
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1	√	√		√	√			
	CO2	√	√	√	√	√		√	
	CO3	√	√						
	CO4	√	√	√					
<b>Course Content</b>	<p><b><u>Unit-1</u></b>                      General characters and Classification of Gymnosperms (Sporne 1965, Bierhorst 1971)                      Affinities with Pteridophytes and Angiosperms                      Characteristic features of following gymnosperm orders (Cycadofilicales, Bennettitales, Cycadales, Cordaitales, Coniferales, Ginkgoales, and Gnetales)                      Economic importance. Geological Time Scale, Types of Fossils</p> <p><b><u>Unit-2</u></b>  <b>Taxonomic evidences:</b> Morphology, Anatomy, Palynology, Embryology, Cytology, and Phytochemistry                      Palynology (NPC system of classification of pollen)                      Brief overview of Angiosperm Phylogeny Group (APG IV) classification  <b>Numerical Taxonomy</b> (Principles, concepts, operational taxonomic units (OTU), Cluster analysis)  <b>Phylogeny of Angiosperm:</b> Ancestors of angiosperms, primitive living angiosperm, time and place of origin of Angiosperms.</p>								
<b>Course Code</b>	<b>BOTP-MJ-804</b>								
<b>Course Title</b>	<b>Practical in Phanerogams and Paleobotany</b>								
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>To study the morphological, anatomical, and reproductive features of gymnosperm <i>Araucaria</i> through microscopic preparations, permanent slides and charts.</li> <li>To study the morphological, anatomical, and reproductive features of</li> </ol>								

	<p>gymnosperm <i>Taxus</i> through microscopic preparations, permanent slides and charts.</p> <ol style="list-style-type: none"> <li>3. To study the morphological, anatomical, and reproductive features of gymnosperm <i>Thuja</i> through microscopic preparations, permanent slides and charts.</li> <li>4. To study the morphological, anatomical, and reproductive features of gymnosperm <i>Zamia</i> through microscopic preparations, permanent slides and charts.</li> <li>5. To study the morphology and reproductive structures of fossil gymnosperm <i>Williamsonia</i> through diagrams and fossil records.</li> <li>6. To study the structural features and affinities of fossil gymnosperm <i>Cycadeoidea</i> using charts and preserved specimens/images.</li> <li>7. Study of locally available plants belonging to taxonomic families. Amaranthaceae, Anacardiaceae, Asteraceae, Basalaceae, Boraginaceae, Casuranaceae, Lamiaceae, Lythraceae, Oleaceae, Orchidaceae, Papavaraceae, Portulacaceae, Ranunculaceae, Rhamnaceae, Rutaceae and Sepindaceae</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Morphology of Gymnosperms — by K. R. Sporne</li> <li>2. Morphology of Vascular Plants — by D. W. Bierhorst</li> <li>3. Gymnosperms — by P. C. Vashishta</li> <li>4. Gymnosperms — by B. P. Pandey</li> <li>5. Paleobotany — by B. P. Pandey</li> <li>6. An Introduction to Paleobotany — by Chester A. Arnold</li> <li>7. Plant Taxonomy — by O. P. Sharma</li> <li>8. Plant Taxonomy — by G. H. M. Lawrence</li> <li>9. Taxonomy of Angiosperms — by V. Singh and D. K. Jain</li> <li>10. Plant Systematics — by Gurcharan Singh</li> <li>11. The Evolution and Classification of Flowering Plants — by Arthur Cronquist</li> <li>12. Introduction to Palynology — by P. K. K. Nair</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
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<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>8</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-805</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Plant Molecular Biology &amp; Genetics</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<b>CO1:</b> Understand DNA structure, replication, transcription, and translation. <b>CO2:</b> Explain gene regulation and expression in plants. <b>CO3:</b> Apply Mendelian and molecular genetics principles. <b>CO4:</b> Understand genetic engineering and biotechnology basics.							
<b>Mapping between Cos and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1			√	√		√	√
	CO2			√	√		√	√
	CO3			√	√		√	√
	CO4			√	√		√	√
<b>Course Content</b>	<p><b><u>Unit - 1</u></b>                      Nucleic acids (DNA &amp; RNA) types and structure, Nucleosome, Chromatin structure, Euchromatin and Heterochromatin, Experiments demonstrating DNA as the genetic material                      DNA Replication                      Transcription in Prokaryotes                      Post transcriptional modification (Splicing, Capping, Polyadenylation, mRNA editing)                      Genetic code, Translation in prokaryotes,                      Regulation of gene expression in prokaryotes (Lac operon), RNA interference</p> <p><b><u>Unit – 2</u></b>                      Mutations: Spontaneous and induced mutations, Physical and chemical mutagens, Types of mutation (Ploidy, Chromosomal aberrations, Point mutation)                      Mendel's laws of inheritance, Monohybrid cross, Dihybrid cross, Test Cross, Back Cross, Co-dominance and incomplete dominance                      Linkage and crossing over                      Basics of Cytoplasmic inheritance.</p>							
<b>Course Code</b>	<b>BOTP-MJ-806</b>							
<b>Course Title</b>	<b>Practical In Plant Molecular Biology &amp; Genetics</b>							
<b>Course Practical Content</b>	1. Rapid DNA isolation (spooling method).							

	<ol style="list-style-type: none"> <li>2. To study experiments proving DNA as genetic material.</li> <li>3. To understand semi-conservative DNA replication using animations/models/diagrams.</li> <li>4. Study of special types of chromosomes (lampbrush and polytene) using photographs.</li> <li>5. To understand the principle and mechanism of DNA condensation.</li> <li>6. To interpret the primary structure of protein using codon charts.</li> <li>7. To solve the given genetic problem based on monohybrid, dihybrid, trihybrid, test cross and back cross.</li> <li>8. Calculation of recombination frequency and gene mapping.</li> <li>9. To observe and identify Barr bodies (inactivated X-chromosomes) in human buccal</li> <li>10. To observe and identify Barr bodies (inactivated X-chromosomes) in human buccal mucosal epithelial cells, and to correlate their presence with genetic sex.</li> <li>11. To prepare and observe mitotic chromosomes from plant root tips (e.g., onion – <i>Allium cepa</i>) to study chromosome number and morphology.</li> <li>12. To observe and illustrate the various stages of meiotic cell division in a plan</li> <li>13. To construct a karyotype from a photomicrograph or stained slide of metaphase chromosomes (typically from human lymphocytes or plant root tips), arranging homologous pairs by size, centromere position, and banding pattern.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Molecular Biology of the Gene — by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick</li> <li>2. Lewin's Genes — by Jocelyn E. Krebs, Elliot S. Goldstein and Stephen T. Kilpatrick</li> <li>3. Molecular Cell Biology — by Harvey Lodish</li> <li>4. Cell and Molecular Biology — by E. D. P. De Robertis and E. M. F. De Robertis</li> <li>5. Principles of Genetics — by Gardner, Simmons and Snustad</li> <li>6. Concepts of Genetics — by William S. Klug and Michael R. Cummings</li> <li>7. Genetics — by P. K. Gupta</li> <li>8. Genetics — by Verma and Agarwal</li> <li>9. Molecular Biology — by David P. Clark and Lonnie D. Russell</li> <li>10. Molecular Biology and Biotechnology — by J. M. Walker and R. Rapley</li> </ol>
<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
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<b>Program Name</b>	<b>B.Sc. Botany (Honours)</b>							
<b>Semester</b>	<b>8</b>							
<b>NCrF Credit Level</b>	<b>6.0</b>							
<b>Course Type</b>	<b>Major</b>							
<b>Course Subtype</b>	Nil							
<b>Subject Type</b>	Discipline Specific							
<b>Course Code</b>	<b>BOT-MJ-807</b>							
<b>Course Level</b>	<b>400-499</b>							
<b>Course Title</b>	<b>Applied Botany &amp; Entrepreneurship</b>							
<b>Credit</b>	<b>Theory:</b>	<b>02</b>	<b>Practical:</b>	<b>02</b>	<b>Total:</b>	<b>04</b>		
<b>Effective From</b>	<b>Academic Year : 2026-27</b>							
<b>Course Outcomes</b>	<p><b>CO1:</b> Understand plant biotechnology techniques including tissue culture and micropropagation.</p> <p><b>CO2:</b> Explain modern farming systems and greenhouse technology for high-value crop production.</p> <p><b>CO3:</b> Apply nursery management practices and plant growth regulation techniques.</p> <p><b>CO4:</b> Demonstrate knowledge of mushroom cultivation, herbal product development, and value addition.</p> <p><b>CO5:</b> Understand biofertilizer production and basics of IPR and biosafety regulations.</p>							
<b>Mapping between COs and PSOs</b>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1			√	√	√	√	
	CO2				√	√	√	
	CO3				√	√		
	CO4					√	√	
	CO5			√	√	√	√	√
<b>Course Content</b>	<p><b><u>Unit 1: Plant Biotechnology &amp; High-Tech Horticulture</u></b>  <b>Commercial Tissue Culture:</b> Lab design, sterilization techniques, micropropagation of orchids and bananas, and hardening processes.  <b>Modern Farming:</b> Introduction to Hydroponics, Aeroponics, and Vertical Farming; Nutrient Film Technique (NFT).  <b>Greenhouse Technology:</b> Types of polyhouses, climate control, and cultivation of high-value crops like Capsicum and Gerberas.  <b>Nursery Management:</b> Seed science, nursery bed preparation, and use of growth regulators.</p> <p><b><u>Unit 2: Bio-Resources &amp; Value Addition</u></b>  <b>Mushroom Technology:</b> Cultivation of Oyster and Button mushrooms; processing and packaging.  <b>Herbal Product Development:</b> Extraction methods for essential oils and medicinal compounds; basic formulation of herbal soaps or sanitizers.  <b>Bio-fertilizers:</b> Mass production of <i>Rhizobium</i>, <i>Azotobacter</i>, and Vermicomposting at a commercial scale.  <b>Intellectual Property Rights (IPR):</b> Basics of Patents, Plant Breeder's Rights, and</p>							

	Bio-safety regulations.
<b>Course Code</b>	<b>BOTP-MJ-808</b>
<b>Course Title</b>	<b>Practical in Applied Botany &amp; Entrepreneurship</b>
<b>Course Practical Content</b>	<ol style="list-style-type: none"> <li>1. To study and identify the different instruments used in <b>plant tissue culture</b> and understand their functions in maintaining aseptic conditions and supporting plant growth in vitro.</li> <li>2. Preparation of MS Medium and inoculation of explants for plant tissue culture (Demonstration).</li> <li>3. To study and perform <b>Air Layering</b> (Gooti) to induce root formation on a branch for producing new independent plants.</li> <li>4. To study and practice <b>Grafting</b> by joining a scion and a rootstock to create a single superior plant.</li> <li>5. To study and perform <b>Budding</b> by inserting a single bud from a mother plant into a rootstock for clonal propagation.</li> <li>6. <b>Hydroponics:</b> Setting up a mini-hydroponic system and measuring EC (Electrical Conductivity) and pH of nutrient solutions.</li> <li>7. <b>Phytochemistry:</b> Extraction of alkaloids or essential oils using a Soxhlet apparatus or Clevenger apparatus.</li> <li>8. Preparation of Bio-pesticides.</li> <li>9. <b>Mushroom Cultivation:</b> Preparation of spawn and substrate (bedding) for mushroom growth.</li> <li>10. To estimate the <b>Available Nitrogen</b> from the soil sample.</li> <li>11. To determine the <b>Available Phosphorus</b> content from the given soil sample.</li> <li>12. To measure the <b>Potassium</b> content from the given soil sample.</li> <li>13. <b>Industrial Visit:</b> Mandatory visit to a commercial nursery, tissue culture lab, or botanical garden and submission of a project report.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Plant Tissue Culture: Theory and Practice – Bhojwani, S.S. &amp; Razdan, M.K. (1996)</li> <li>2. Introduction to Plant Biotechnology – Chawla, H.S. (2009)</li> <li>3. Plant Biotechnology – Slater, A., Scott, N. &amp; Fowler, M. (2008)</li> <li>4. Soilless Culture: Theory and Practice – Raviv, M. &amp; Lieth, J.H. (2008)</li> <li>5. Hydroponic Food Production – Resh, H.M. (2013)</li> <li>6. Greenhouse Engineering – Aldrich, R.A. &amp; Bartok, J.W. (1994)</li> <li>7. Protected Cultivation of Horticultural Crops – Peter, K.V. (2008)</li> <li>8. Plant Propagation: Principles and Practices – Hartmann, H.T. &amp; Kester, D.E. (2011)</li> <li>9. Fundamentals of Horticulture – Edmond, J.B. et al. (1977)</li> <li>10. Mushroom Cultivation – Tewari, P. &amp; Kapoor, S.C. (1988)</li> <li>11. The Biology and Cultivation of Edible Mushrooms – Chang, S.T. &amp; Miles, P.G. (1989)</li> <li>12. Textbook of Pharmacognosy – Kokate, C.K. (2010)</li> <li>13. Handbook of Herbs and Spices – Peter, K.V. (2012)</li> <li>14. Biofertilizers in Agriculture and Forestry – Subba Rao, N.S. (1993)</li> <li>15. Vermiculture Technology – Edwards, C.A. (2004)</li> <li>16. Intellectual Property Rights – Narayanan, P. (2007)</li> <li>17. Plant Breeding and Biotechnology – Singh, B.D. (2006)</li> </ol>

<b>Teaching Methodology</b>	Class work, Discussion, Self Study, Project, Seminar or/and Assignment, Laboratory work, Field Visit, Journal preparation
<b>Evaluation Method</b>	Internal Assessment : 25 Marks External Assessment : 25 Marks