

M. G. Science Institute, Ahmedabad

Autonomous | Affiliated to Gujarat University, Ahmedabad

(Managed by The Ahmedabad Education Society)

Department of Botany

Bachelor of Science (Hons.) in Botany

(Effective from Academic Year 2026-27)

Annexure 3: Semester- VI

Botany Major	BOM-361	Paleobotany, Systematic Botany, Plant Embryology, Advanced Plant Physiology and Biochemistry
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COs with cognitive Abilities:

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Understand Fossil Cryptogamic and Phanerogamic Diversity Demonstrate knowledge of the systematic classification, thallus organization, reproductive strategies, and life cycles of cryptogams, including algae, bryophytes, pteridophytes and gymnosperm.
CO2	REMEMBERING	Taxonomic Identification Skills Classify and describe the key diagnostic features of selected plant families, including: Menispermaceae, Sterculiaceae, Meliaceae, Asteraceae, Sapotaceae, Verbenaceae, Urticaceae, Chenopodiaceae, and Cannaceae.
CO3	UNDERSTANDING	Understanding embryo development , knowledge of embryonic stages, and familiarity with embryo structure. Appreciate plant reproduction; application in plant breeding and biotechnology. Practical skills- microscopic observation, dissection and analysis can develop.
CO4	APPLYING	Experimental skill in Plant Physiology Explain growth regulatory hormones, senescence and survival of plants. Know the biosynthesis, translocation and function of PGRs
CO5	ANALYZING	Explore Plant Biochemistry Explore biochemical processes in plants like Carbohydrate metabolism (Part of Respiration), Protein and Lipid metabolism. species, firewood plants, medicinal (drug) plants, and toxic (poisonous) species.

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	1	1	1		
CO 2	1	2	1		
CO 3		1	2		
CO 4		1	2		
CO 5	2		1		

Unit-1 Paleobotany	Contents	15 Hours
Introduction	<ul style="list-style-type: none"> History (Indian scientist contribution); Scope Fossil formation and types Geological time scale, carbon dating and techniques 	
Bryophyte Fossils	<ul style="list-style-type: none"> General account of Fossil Bryophytes 	
Pteridophytes Fossils	<ul style="list-style-type: none"> Psilophytales - <i>Rhynia</i> Lepidodendrales - <i>Lepidodendron</i>, <i>Lepidostrobus</i>, and <i>Lepidocarpon</i> Calamitales – General characters, <i>Calamites</i> and <i>Calamostachys</i> 	
Gymnosperm Fossil	<ul style="list-style-type: none"> Cycadofilicales – <i>Lygenopteris</i>, <i>Lygenostoma</i> and <i>Crossotheca</i> Cordaitales – <i>Cordaites</i>, <i>Cordainthus</i>, and <i>Cardiocarpus</i> Pentoxylales – General account 	
Unit-2 Systematic Botany	Contents	15 Hours
Classification	<ul style="list-style-type: none"> Phylogenetic classification: Engler and Prantl's classification system (Brief account, merits and demerits) APG classification system – General account 	
Families	<ul style="list-style-type: none"> Menispermaceae Sterculiaceae Meliaceae Asteraceae Sapotaceae Verbenaceae Urticaceae Chenopodiaceae Cannaceae 	

Unit-3 Plant Embryology	Content	15 Hours
Palynology	<ul style="list-style-type: none"> • Exine ornamentation, concept of palynogram • Application of Palynology in plant identification and forensic science • NPC system of classification 	
Endosperm	<ul style="list-style-type: none"> • Types and functions • Endosperm haustoria-structure and functions 	
Embryo development	<ul style="list-style-type: none"> • Monocotyledons: Sagittaria type • Dicotyledons: Crucifer type (Onagrad type) • Apomixis • Polyembryony 	
Unit-4 Advanced Plant Physiology and Biochemistry	Contents	15 Hours
Plant growth regulators	<ul style="list-style-type: none"> • Biosynthesis, translocation and physiological functions- Auxins, Abscisic acid, Ethylene • General account of Senescence 	
Carbohydrate metabolism	<ul style="list-style-type: none"> • Glycolysis • Krebs cycle 	
Protein metabolism	<ul style="list-style-type: none"> • Amino acid pool, Deamination, Transamination 	
Lipid metabolism	<ul style="list-style-type: none"> • Glycerol metabolism • Alpha oxidation of fatty acids (with structures) • Beta oxidation of saturated fatty acids 	

Botany Major	BOM-362	Environmental biology, Phytogeography & Forestry, Plant breeding, Genetics & Biotechnology
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COs with cognitive Abilities:

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Explore the relationship between organisms and their environment. Recognize impact of human activities on environment, analyzing the effect of pollution, climate change, and conservation. Apply knowledge to promote sustainability.
CO2	UNDERSTANDING	Understanding the plant geographical distribution patterns, helps to understand how plants are distributed across different climates and habitats, and factors influencing it. Knowledge applied to agriculture, forestry and environmental management.
CO3	UNDERSTANDING	Develop understanding of forestry investment, analysis and evaluate typical financial investments in forestry. Demonstrate ability to develop and execute strategic, tactical and operational forest plants.
CO4	APPLYING	Study the relationship between plants and people, particularly in traditional culture. They will explore the indigenous knowledge and uses of plants, examines cultural and spiritual significance of plants and their utilization

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	1	1	1		
CO 2	1	2	1		
CO 3		1	2		
CO 4	1		2		

Unit-1 Environmental Biology	Contents	15 Hours
Brief account	<ul style="list-style-type: none"> • Environmental Impact Assessment (EIA) • Air Quality Index (AQI) • Man, and Biosphere Program (MAB) • Green Audit 	
Environmental Laws	<ul style="list-style-type: none"> • Wildlife (Protection) Act; 1972 • Biological Diversity Act; 2002 • Indian Forest (Amendment) Bill 2023 • National Green Tribunal Act; 2010 	
Greenhouse Gases	<ul style="list-style-type: none"> • Sources, effects and control measures- CO₂, CH₄, N₂, CFCs 	
Brief account of Climate change and its consequences	<ul style="list-style-type: none"> • Acid rain • Global warming • Sea level rise • Greenhouse effect • Ozone depletion 	
Effects of Pollution	<ul style="list-style-type: none"> • Effects of Air, Water and Soil pollution on vegetation 	
Unit-2 Phytogeography & Forestry	Contents	15 Hours
Introduction	<ul style="list-style-type: none"> • Principles of Phytogeography • Climatic and phytogeographic regions of India • Vegetation of Gujarat • Continental drift 	
Benefits of Forest	<ul style="list-style-type: none"> • Commercial, Ecological and Aesthetical • General account of Forests products-major products- (lumber, timber& firewood) and minor products • Wood- Physical properties, structural features and identification of wood • Timber extraction and Paper industry • Wild life and biosphere reserves 	

Unit-3 Genetics and Biotechnology	Contents	15 Hours
Genetics	<ul style="list-style-type: none"> • General account and techniques of gene mapping • DNA sequencing and DNA fingerprinting – techniques and application • Transposable elements • Mitochondrial genome; coding and non-coding (introns and exons) sequences 	
Biotechnology	<ul style="list-style-type: none"> • Methods of gene transfer in plants: Physical Methods-Micro injection, electroporation, particle gun method • Biological method- <i>Agrobacterium</i>-mediated gene transfer 	
Application of Biotechnology in health and agriculture	<ul style="list-style-type: none"> • Human insulin and vaccine production, edible Vaccines from plants, gene therapy • Cryopreservation and Germplasm storage 	
Unit-4 Ethnobotany	Contents	15 Hours
Plants used by tribes of Gujarat	<ul style="list-style-type: none"> • Plants used in Traditional Craft: Bamboo, <i>Arundinaria</i> sps. (Cane palm), <i>Chochorus</i> sps. • Cosmetic, skin and Hair Care: Kalonji (<i>Nigella sativa</i>), Bhrigraj (<i>Eclipta alba</i>), Aritha (<i>Sapindus trifoliatus</i>) and Shikakai (<i>Acacia concinna</i>) • Food Plants: <i>Dioscorea alata</i>, <i>Moringa oleifera</i>, <i>Paspalum scorobiculatum</i> • Medicinal Plants: <i>Asparagus racemosus</i>, <i>Vitex negundo</i>, <i>Butea monosperma</i> 	

Major Practical	BOM-363	Practical based on BOM 361 and BOM 362
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Syllabus: BOM- 363 (Practical -A) (Major)

No.	Practical
UNIT I. PALEOBOTANY	
Following Fossil Specimens/ slides or Charts should be studied	
1.	PTERIDOPHYTA: 1. PSILOPHYTALES: <i>Rhynia</i> : Stem T.S 2. LEPIDODENDRALES: <i>Lepidodendron</i> Stem T.S. 3. LEPIDODENDRALES: <i>Lepidocarpon</i> V.S.Slide 4. CALAMITALES: <i>Calamites</i> : Impression, Stem, T.S. 5. CALAMITALES: <i>Calamostachys</i> : Peel / Slide, Cone L.S
2.	GYMNOSPERMS: 6. CYCADOFILICALES: <i>Lygenopteris oldhamia</i> – Stem, T.S 7. CYCADOFILICALES: <i>Crossotheca</i> (Male organ) 8. CORDAITALES: <i>Cordianthus</i> – L.S of Cone. 9. CORDAITALES: <i>Cordaites</i> : Stem T.S
UNIT II. SYSTEMATIC BOTANY	
i). Classification chart of families (as per Bentham and Hooker system classification)	
ii). Study of the following families including floral formula and floral diagram	
3.	1. Menispermaceae 2. Sterculiaceae 3. Meliaceae 4. Asteraceae 5. Sapotaceae 6. Verbenaceae 7. Urticaceae 8. Chenopodiaceae 9. Cannaceae
UNIT III. PLANT EMBRYOLOGY:	
Study through specimens/permanent slides/charts	
4.	i) Expose and mount: a. Endosperm haustoria: <i>Cucumis</i> , <i>Cassia</i> sps. b. Developing embryo: Mustard/ <i>Raphanus</i> , <i>Cassia</i> ii) Study of permanent slides/Chart: Types of Endosperms iii) Study of types of pollen grains through mounting (temporary) slide: Pollen units – monad (<i>Hibiscus</i>), and Pollinia (<i>Calotropis</i>)

UNIT IV. ADVANCED PLANT PHYSIOLOGY & BIOCHEMISTRY: Performance/Demonstration/Charts of Physiological experiments	
5.	<p>1.The following physiological experiments to be performed by the students:</p> <ol style="list-style-type: none"> To detect seed viability Qualitative tests for proteins from plant material Separation of amino acids in a mixture by paper chromatography and their identification by comparison with Rf value <p>2.The following physiological experiments to be demonstrated:</p> <ol style="list-style-type: none"> Demonstration of physiological role of Auxin involving: <ol style="list-style-type: none"> Phototropism Apical Dominance Demonstration of physiological role of Ethylene involving: <ol style="list-style-type: none"> Abscission treatment Fruit ripening To demonstrate anaerobic respiration (carbohydrate metabolism) To demonstrate the process of fermentation (by Kuhne’s tube method) <p>Charts of the following structure of macromolecules as per theory syllabus:</p> <ol style="list-style-type: none"> Amino acids – Glycine, Valine, Aspartic acid, Serine, Cysteine and Cystine Proteins – Primary, Secondary and Tertiary level of organisation Lipids - Linoleic acid, Linolenic acid and Palmatic acid Carbohydrates – Glucose, Fructose, Maltose, Sucrose, Cellulose
6.	Chart preparation or collection of plant specimen for submission

Syllabus: BOM- 363 (Practical -B) (Major)

No.	Practical
I. Environmental Biology	
A.	<p>Titration method for determination of water samples:</p> <ol style="list-style-type: none"> Determination of Chloride content in water sample Determination of Carbonate and Bicarbonate in water sample Determination of Calcium content in water sample Determination of Total hardness of water sample
B.	<p>Determination of Carbonate/Nitrate deficiency from the given soil sample (Qualitative/ rapid tests)</p>

II. Phytogeography & Forestry	
	<p>1. To prepare map showing vegetation of Gujarat and to comment on it.</p> <p>2. To prepare map of India with respect to –Biogeographical regions</p> <p>3. Properties of wood samples – <i>Tectona</i>, <i>Eucalyptus</i> and <i>Dalbergia</i></p>
III. Plant genetics, Plant Breeding and Biotechnology	
	<p>Charts as per theory syllabus:</p> <ul style="list-style-type: none"> • Gene mapping/DNA sequencing/DNA fingerprinting • Mitochondria /chloroplast genome • Human insulin and vaccine production • Edible Vaccines from plants • Gene transfer in plants: Physical-Micro injection, electroporation, particle gun • Biological method- Agrobacterium-mediated gene transfer • Cryopreservation and Germplasm storage
IV. Ethnobotany	
	<p>i. Study of Ethnobotanical importance of following specimens:</p> <p>Plants used in Traditional Craft: Bamboo, <i>Arundinaria</i> sps.(Cane palm), <i>Chochorus</i> sps.</p> <p>Cosmetic, skin and Hair Care: Kalonji (<i>Nigella sativa</i>), Bhrigraj (<i>Eclipta alba</i>), Aritha (<i>Sapindus trifoliatus</i>) and Shikakai (<i>Acacia concinna</i>)</p> <p>Food Plants: <i>Dioscorea alata</i>, <i>Moringa oleifera</i>, <i>Paspalum scorobiculatum</i></p> <p>Medicinal Plants: <i>Asparagus racemosus</i>, <i>Vitex negundo</i>, <i>Butea monosperma</i></p> <p>ii. To create a database of local plants of respective institute and their traditional uses</p>
V	Case study/Project

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End Semester Examination Pattern for Practical Examination
B.Sc. Sem. – VI Botany Practical
DSC-C-BOT- 363- Practical - A
Based on DSC-C-BOT- 361
(PALEOBOTANY, SYSTEMATIC BOTANY, PLANT EMBRYOLOGY, ADVANCED
PLANT PHYSIOLOGY AND BIOCHEMISTRY)

Maximum marks – 25

Date:

Time: 5 hours

Q.1	Family	04 Marks
Q.2	Mounting of embryo/ haustoria	03 Marks
Q.3	Physiological exp /biochemical test	04 Marks
Q.4	Specimens / slides/ charts— Fossil of Pteridophyta Fossil of Gymnosperms Embryology Physiological experiment	10 Marks
Q.5	Journal & Submissions/ Tour Report	04 Marks

DSC-C-BOT- 363- Practical - B
Based on DSC-C-BOT- 362
(ENVIRONMENTAL BIOLOGY, PHYTOGEOGRAPHY & FORESTRY, PLANT
BREEDING, GENETICS & BIOTECHNOLOGY)

Maximum marks – 25

Date:

Time: 5 hours

Q.1	Titration /rapid test	05 Marks
Q.2	As per instruction given in MAP/ Identification of Wood	03 Marks
Q.3	Plant Breeding	04 Marks
Q.4	Round table (a) Genetics, (b) Biotechnology, (c & d) Ethnobotany	08 Marks
Q.5	Journal& Project report / Submissions	05 Marks