



Accredited grade A+ by NAAC

Department of Botany
Faculty of Science, The Maharaja Sayajirao University of Baroda

Program Structure as per NEP, 2020 (approved in July 2023)

Semester	Major (Core)	Minor (Electives)	Multi / Inter-disciplinary	AEC	SEC/ Internship	VAC / IKS	Research Project / On-Job-training	Total Credit per semester	Qualification / certificate
I	8	4	4	2	2 (SEC)	2 (IKS)	-	22	UG Certificate
II	8	4	4	2	2 (SEC)	2 (VAC)	-	22	
1 st year total credits	16	8	8	4	4	4	-	44	
Exit option 1: Award of UG certificate in Botany with 48 credits. Additional 4 credit of summer internship in Botany specific NSQF defined course will be mandatory for a student willing to exit at this level.									
III	12	-	4	2	2 (SEC)	2 (IKS)	-	22	UG Diploma
IV	12	4	-	2	2 (SEC)	2 (VAC)	-	22	
2 nd year total credits	40	12	12	8	8	8	-	88	
Exit option 2: Award of UG Diploma in Botany with 92 credits. Additional 4 credit of summer internship in Botany specific NSQF defined course will be mandatory for a student willing to exit at this level.									
V	12	8	-	-	2 (SEC)	-	-	22	UG Degree
VI	12	4	-	2	4 (Internship)	-	-	22	
3 rd year total credits	64	24	12	10	14	8	-	132	
Exit option 3: Award of UG Degree in Botany with 132 credits.									
VII	12	4	-	-	-	-	6 (RP)	22	UG Honors with Research Degree
VIII	12	4	-	-	-	-	6 (RP)	22	
4 th year total credits	88	32	12	10	14	8	12	176	
Exit option 4: Award of UG Honors with Research degree in Botany with total 176 credits									
VII	12	4	-	-	-	-	6 (OJT)	22	UG Honors Degree
VIII	12	4	-	-	-	-	6 (OJT)	22	
4 th year total credits	88	32	12	10	14	8	12	176	
Exit option 5: Award of UG Honors in Botany with total 176 credits.									

**Details of the courses offered by
DEPARTMENT OF BOTANY
From July 2023
For UG students**

Semester 1	Type of Course	Paper Code	Title of the paper	Credits	Theory/ practical
	Major	BTM2001C	Anatomy of plants	3T+1P	Theory and practical
		BTM2011C	Prokaryotes and fungi	3T+1P	Theory and practical
	Minor	BTE2001C	Prokaryotes, fungi and thallophytes	4	Theory
	Multidisciplinary	MDC2191C	Plant interactions	4	Theory
	SEC	SEC2151C	Identification of microbes and non-vascular plants	2	Practical
	IKS	IKS2101C	Plants in ancient Indian knowledge system	2	Practical

Semester 2	Type of Course	Paper Code	Title of the paper	Credits	Theory / practical
	Major	BTM2002C	Non-vascular cryptogams	3T+1P	Theory and Practical
		BTM2012C	Cell biology	3T+1P	Theory and Practical
	Minor	BTE2002C	Cell biology and anatomy of plants	4	Theory
	Multidisciplinary	MDC2192C	Human dependence on plants	4	Theory
	SEC	SEC2172C	Plant architecture	2	Practical
	VAC	VAC2122C	Horticulture and gardening	2	Practical

Semester 3	Type of Course	Paper Code	Title of the paper	Credits	Theory/ practical
	Major	BTM2003C	Vascular cryptogams and phanerogams	3T+1P	Theory and practical
		BTM2013C	Plant genetics	3T+1P	Theory and practical
		BTM2023C	Plant evolution and diversity	3T+1P	Theory and practical
	Multidisciplinary	MDC2493C	Space biology and remote sensing	3T+1P	Theory and practical
	SEC	SEC2413C	Histochemistry and Microtechniques	1T+1P	Theory and practical
	IKS	IKS2323C	Traditional Knowledge and Folk medicine	1T+1P	Theory and practical

Semester 4	Type of Course	Paper Code	Title of the paper	Credits	Theory / practical
	Major	BTM2004C	Plant physiology	3T+1P	Theory and Practical
		BTM2014C	Ecology: Basics, Pattern and Process	3T+1P	Theory and Practical
		BTM2024C	Plant Biochemistry	3T+1P	Theory and Practical
	Minor	BTE2004C	Life of land plants	3T+1P	Theory and Practical
		BTE2014C	Quantitative Ecology	2T+2P	Theory and Practical
	SEC	SEC2404C	Bioremediation and Bioaugmentation	1T+1P	Theory and practical
	VAC	VAC2354C	Nutraceuticals	1T+1P	Theory and practical

Semester 5	Type of Course	Paper Code	Title of the paper	Credits	Theory / practical
	Major	BTM3005C	Angiosperms systematics	3T+1P	Theory and Practical
		BTM3015C	Molecular biology	3T+1P	Theory and Practical
		BTM3025C	Analytical techniques	3T+1P	Theory and Practical
	Minor/Elective	BTE3005C	Molecular techniques	3T+1P	Theory and Practical
		BTE3015C	Applied phycology, mycology, and pathology	3T+1P	Theory and Practical
		BTE3025C	Plant Management in public places	3T+1P	Theory and Practical
	SEC	SEC3635C	Plant resource management and innovation	1T+1P	Theory and practical
		SEC3645C	Biological image acquisition and processing	2P	Practical
		SEC3655C	Field studies in Botany	2P	Practical

Semester 6	Type of Course	Paper Code	Title of the paper	Credits	Theory / practical
	Major	BTM3006C	Developmental biology	3T+1P	Theory and Practical
		BTM3016C	Community and Ecosystem ecology	3T+1P	Theory and Practical
		BTM3026C	Plant biotechnology	3T+1P	Theory and Practical
	Minor/Elective	BTE3006C	Plant breeding and Crop Improvement	3T+1P	Theory and Practical
		BTE3016C	In silico biology	3T+1P	Theory and Practical
		BTE3026C	Home and Aquatic plants and plant propagation	2T+2P	Theory and Practical
	AEC	AEC3406C	Basics of scientific writing	2P	Practical
	SEC	SEC3446C	Internship in Botany	4P	Practical

B.Sc. BOTANY
MAJOR COURSES
SEMESTER I

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Bachelor of Science in Botany					
YEAR	1	BTM2001C Anatomy of plants		CREDITS	3T+ 1P
Semester	1			HOURS	75
OBJECTIVES: To familiarize the students with structure and function of plant tissue system					
COURSE CONTENT / SYLLABUS					
UNIT-I	Meristematic tissue				15 hrs.
	Plant cell and cell wall; pits and plasmodesmata; cell communication. Meristematic tissue: types, location, and function; organization of meristem; classification of meristem; various theories pertaining to root and shoot meristem; Root cap structure; Shoot apex structure.				
UNIT-II	Permanent tissues				15 hrs.
	Permanent simple tissues: parenchyma, collenchyma, sclerenchyma; Complex tissues: xylem, phloem, secretory tissue; Adaptive & protective system: epidermis and cuticle; root hairs, stomata and trichomes.				
UNIT-III	Growth and anatomy of organs				15 hrs.
	Architecture of plant organs: root, stem and leaf; nodal anatomy; root-stem transition; types of cambium; secondary growth in monocot and dicot; anomalous secondary growth; wood anatomy.				
UNIT-IV	Practical / laboratory work				30 hrs.
	Simple and compound microscopes; Basic tissue types in <i>Cucurbita</i> stem; anatomy of stem; leaf and root; types of trichomes and stomata; Secondary growth in dicot stem; Structure of periderm and bark; Secretory tissues; Anomalous secondary growth in <i>Boerhaavia</i> , <i>Bignonia</i> and <i>Salvadora</i> .				
REFERENCES					
1. Esau, K. (1965). Plant anatomy. (2nd Edition). 2. Evert, R. F. (2006). Esau's plant anatomy: meristems, cells, and tissues of the plant body: their structure, function, and development. John Wiley & Sons. 3. Fahn, A. (1982). Plant anatomy. Pergamon press. 4. Beck, C. B. (2010). An introduction to plant structure and development: plant anatomy for the twenty-first century. Cambridge University Press. 5. Crang, R., Lyons-Sobaski, S., & Wise, R. (2018). Plant anatomy: a concept-based approach to the structure of seed plants. Springer. 6. Pandey, B. P. (2001). Plant anatomy. S. Chand Publishing. 7. Bendre, A. (2010). Practical botany. Deep and Deep Publications. 8. Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company. 9. Norris, J. R., & Ribbons, D. W. (1972). Methods in microbiology. Academic Press					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER I

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Bachelor of Science in Botany					
YEAR	1	BTM2011C Prokaryotes and Fungi		CREDIT	3T + 1P
Semester	1			HOURS	75
OBJECTIVES:		To familiarize the students with different life forms and their classification including Bacteria, Archaea and fungi			
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction to life forms			15 hrs.	
	Origin of life; Cellular and acellular forms; Concepts of classification of organisms; Basis of different classification systems; Modern methods of classification; Bacteria and Archaea; evolution of eukaryotic cells; Plant kingdom, Introduction to different group of plants, Evolution of photosynthetic organisms and their diversification.				
UNIT-II	Cyanobacteria			15 hrs.	
	Occurrence and range of thallus organization, Characteristic features, cell structure and heterocyst structure, Methods of reproduction, Thallus organization and reproduction in: <i>Nostoc</i> , <i>Oscillatoria</i> , <i>Rivularia</i> , <i>Spirulina</i> . Economic importance of Cyanobacteria.				
UNIT-III	Fungal diversity			15 hrs.	
	General characteristics of fungi, Classification of fungi; Kingdom Straminipila and Eumycota; thallus structure and reproduction of fungi- <i>Phytophthora</i> , <i>Mucor</i> , <i>Aspergillus</i> , <i>Saccharomyces</i> , <i>Puccinia</i> , <i>Ustilago</i> , <i>Agaricus</i> .				
UNIT-IV	Practical / laboratory work			30 hrs.	
	Identification and culture of bacteria; Study of <i>Nostoc</i> , <i>Rivularia</i> , <i>Spirulina</i> ; Study of thallus and reproductive structures of <i>Aspergillus</i> ; <i>Saccharomyces</i> and its budding; <i>Agaricus</i> , <i>Puccinia</i> , <i>Ustilago</i> ; water mold.				
REFERENCES					
1. Pelczar, M. J., & Reid, R. D. (1958). Microbiology. 2. Prescott, L. M. (2002). Microbiology. 3. Norris, J. R., & Ribbons, D. W. (1972). Methods in microbiology. Academic Press. 4. Barton, N. H., Briggs, D., Eisen, J., Goldstein, D., & Patel, N. (2007). Evolution. 5. Stearns, S. C., & Hoekstra, R. F. (2000). Evolution, an introduction. Oxford University Press. 6. Dube, H. C. (2013). An introduction to fungi. Scientific Publishers. 7. Sinha, A. K. (1962). Botany for degree students fungi. S. Chand Publishing. 8. Tiwari, A. (Ed.). (2018). Cyanobacteria. BoD–Books on Demand. 9. Vashishta B.R., Sinha A.K. & Singh V.P. (2010). Botany for Degree Students, Algae, S. Chand & Co. 10. Vashishta B.R., Sinha A.K. & Kumar A. (2016). Botany For Degree Students Fungi, S. Chand & Co. 11. Smith, G. M. (1938). Cryptogamic botany. Volume I, Algae and fungi. 12. Webster, J., & Weber, R. (2007). Introduction to Fungi (3rd ed.). Cambridge: Cambridge University Press. 13. Bendre, A. (2010). Practical botany. Deep and Deep Publications. 14. Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company. 15. Norris, J. R., & Ribbons, D. W. (1972). Methods in microbiology. Academic Press					

**DEPARTMENT OF BOTANY OFFERED
MINOR COURSES for B.Sc. students
SEMESTER I**

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Department of Botany offered Minor subjects for B.Sc. students					
YEAR	1	BTE2001C		CREDIT	4T
Semester	1	Prokaryotes, Fungi and thallophytes		HOURS	60
OBJECTIVES:		To familiarize the students with the diversity, their thallus structure, reproduction, and life cycles of prokaryotes, fungi, algae, and bryophytes.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Introduction to life forms Concepts of classification of organisms; Basis of different classification systems; Modern methods of classification; Classification of prokaryotes: Kingdom Archaea, Bacteria; Occurrence, morphological forms; Cyanobacteria: General characters and life cycle of <i>Nostoc</i> , <i>Oscillatoria</i> , <i>Rivularia</i> and <i>Spirulina</i> .			15 hrs.
UNIT-II		Diversity of fungi General characteristics of fungi, Classification of fungi; Kingdom Straminipila and Eumycota; Structure, reproduction, and life cycle of following fungi- <i>Phytophthora</i> , <i>Mucor</i> , <i>Aspergillus</i> , <i>Saccharomyces</i> , <i>Puccinia</i> , <i>Ustilago</i> , <i>Agaricus</i> .			15 hrs
UNIT-III		Diversity of algae Occurrence and classification (G M Smith, 1955), Diversity of thallus organization; Economic importance of algae; Characteristic features, thallus structure, reproduction, and life cycle of: Chlorophyceae: <i>Volvox</i> ; Charophyceae: <i>Chara</i> ; Phaeophyceae: <i>Dictyota</i> ; Rhodophyceae: <i>Batrachospermum</i> .			15 hrs
UNIT-IV		Diversity of bryophytes General features of Bryophytes; Classification (Smith, 1955); Characteristic features and life cycles of: <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , <i>Funaria</i> ; Ecological and economical importance of bryophytes.			15 hrs.
REFERENCES					
1. Vashishta, B. R. (1983). Algae Botany for degree students Part I. S. Chand 8t. company Ltd., New Delhi. 2. Smith, G. M. (1938). Cryptogamic botany. Volume I, Algae and fungi. Cryptogamic botany. Volume I, Algae and fungi. 3. Chapman, D. J. (1973). The algae. Springer. 4. Smith, G. M. (1938). Cryptogamic botany. Volume II. Bryophytes and pteridophytes. Cryptogamic botany. Volume II. Bryophytes and pteridophytes. 5. Krishna A. (2010). Botany for Degree Students: Bryophyta. S. Chand Pvt. Limited. 6. Parihar, N S (2005). An introduction to embryophyta – bryophyta. Central Book Depot, Allahabad. 7. Sharma, OP (2017). Algae. 8. Sharma, OP (2017). Bryophyta. 9. Barton, N. H., Briggs, D., Eisen, J., Goldstein, D., & Patel, N. (2007). Evolution. 10. Stearns, S. C., & Hoekstra, R. F. (2000). Evolution, an introduction. Oxford University Press. 11. Dube, H. C. (2013). An introduction to fungi. Scientific Publishers. 12. Sinha, A. K. (1962). Botany for degree students fungi. S. Chand Publishing. 13. Smith, G. M. (1938). Cryptogamic botany. Volume I, Algae and fungi. 14. Vashishta B.R., Sinha A.K. & Singh V.P. (2010). Botany for Degree Students, Algae, S. Chand & Co.					

DEPARTMENT OF BOTANY OFFERED
Multidisciplinary course for B.Sc. students
SEMESTER I

	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2023-2024		
Department of Botany offered multidisciplinary course for B.Sc. students						
YEAR	1	MDC2191C Plant interactions			CREDIT	4T
Semester	1				HOURS	60
OBJECTIVES:		To familiarize the students with the interactions of plant and its surrounding biotic and abiotic factors.				
COURSE CONTENT / SYLLABUS						
UNIT-I	Plant abiotic factor interactions				15 hrs.	
	Abiotic components; plant interactions and adaptation: hydrophytes, epiphytes, xerophytes, and halophytes; desiccation tolerant plants.					
UNIT-II	Plant-microbe interactions				15 hrs.	
	Life of microbes in rhizosphere with emphasis on chemical diversity; Life of microbes on aerial plant parts; Life of microbes inside the plant; Associations: Negative (destructive) associations (diseases); Positive (beneficial) associations (symbiosis); Microbe-microbe interactions: symbiosis, types and economic importance.					
UNIT-III	Plant animal interactions				15 hrs.	
	Plant-pollinator interactions: reproductive traits, defense signals; Plant-herbivore interactions; plant-nematode interaction; Myrmecophytism					
UNIT-IV	Plant-plant interactions				15 hrs.	
	Plant-plant interaction; Plant-parasite host response: Parasitic vascular plants; Mutualism, Allelopathy (inhibition of competitions).					
REFERENCES						
- Chapman, J. L. and Reiss, M. J. (1992). Ecology – Principles and Applications, Cambridge University Press, Cambridge, UK - Odum, E. P. and Barrett, G. W. (2005). Fundamentals of Ecology, 5th Edition, Cengage Learning, New Delhi, India - Sharma, P. D. (2009). Ecology and Environment, 10th Revised Edition, Rastogi Publications, Merrut, India - Smith, T. M. & Smith, R. L. (2006). Element of Ecology, 6th Edition, Pearson Education, New Delhi, India - Keshamma E and Lokare P (2022) Plant animal interaction. Book saga publications. - Ronald P C (2006) Plant Pathogen interactions. Humana press. - Taiz L, Zeiger E, Murphy A, Moller M, (2018) Fundamentals of Plant physiology. - Chittka Lars, Thomson J D (2004) Cognitive ecology of pollination. Cambridge University press. - Sebastien Patiny (2012). Evolution of Plant-pollinator relationships. Cambridge University press. - Urry, Cain, Wasserman, Minorsky, Reece (2017). Campbell Biology. Pearson.						

DEPARTMENT OF BOTANY OFFERED
Skill Enhancement Courses for B.Sc. students
SEMESTER I

	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2023-2024	
Department of Botany offered SEC subject for B.Sc. students					
YEAR	1	SEC2151C Identification of microbes and non-vascular plants		CREDIT	2P
Semester	1			HOURS	60
OBJECTIVES:		To impart practical knowledge and skills to students with morphological and anatomical features Of Prokaryotes, Fungi, Algae and Bryophytes.			
COURSE CONTENT / SYLLABUS					
Practical	- Study of Simple and compound microscopes - Study of <i>Aspergillus</i> and <i>Puccinia</i> - Study of <i>Saccharomyces</i> and its budding - Study of <i>Agaricus</i> - Study of water mold - Study of <i>Nostoc</i>, <i>Rivularia</i>, <i>Spirulina</i> - Study of Bacteria - Type study of Diatoms, <i>Volvox</i>, <i>Chara</i>, <i>Dictyota</i>, <i>Batrachospermum</i> - Type study of <i>Riccia</i>, <i>Marchantia</i>, <i>Anthoceros</i>, <i>Funaria</i>, <i>Bryum</i>				60 hrs.
REFERENCES					
- Bendre, A. (2010). Practical botany. Deep and Deep Publications. - Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company. - Norris, J. R., & Ribbons, D. W. (1972). Methods in microbiology. Academic Press - Pelczar, M. J., & Reid, R. D. (1958). Microbiology. Krishna Prakashan Media. - Pandey, B. P. (2001). Plant anatomy. S. Chand Publishing. - Dube, H. C. (2013). An introduction to fungi. Scientific Publishers. - Vasishta, B. R. (1990). Botany for Degree Students, Algae, S. Chand & Co. - Vashishta B.R., Sinha A.K. & Singh V.P. (2010). Botany for Degree Students, Algae, S. Chand & Co.					

DEPARTMENT OF BOTANY OFFERED
India Knowledge System Courses for B.Sc. students
SEMESTER I

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Department of Botany offered IKS subjects for B.Sc. students					
YEAR	1	IKS2101C Plants in ancient Indian knowledge system		CREDIT	2P
Semester	1			HOURS	60
OBJECTIVES:		To familiarize the students with ancient knowledge about plants and formulations in India.			
COURSE CONTENT / SYLLABUS					
Practical	1. Introduction to ancient Indian texts. 2. Introduction to ayurveda. Study of its sections and importance. 3. Introduction to Charaka Samhita with its sections. 4. Study of Ashtanga Hridayam and Bhavapraksha. 5. Kashaushadhi: types and examples. 6. Plants which shaped the Indian history (Tea, Coffee, Opium, Indigo, Teak, Rubber, Mahua, Cotton, Saffron). 7. Spices and silk as key entities in ancient trades. 8. References of plants from archeological sites in India (photographs). 9. Selected popular herbal formulations approved by AYUSH with references to Indian texts. 10. Catalogue of plants in selected ancient Indian texts. 11. Ethnobotany of Gujarat state.				60 hrs.
REFERENCES					
1. Bhishagratna, Kaviraj Kunjalal, editor-translator. Sushruta Samhita. 4th ed., 2 vols., Chowkhamba Sanskrit Series Office: Varanasi, India, 1991. 2. Sharma, Priyavrat V., editor-translator. Charaka Samhita. 4 vols. Chowkhamba Sanskrit Series Office: Varanasi, India, 1981-1994. 3. Sharma, Ram Karan, and Vaidya Bhagwan Dash, editors-translators. Caraka Samhita. 3d ed., 3 vols. Chowkhamba Sanskrit Series Office: Varanasi, India, 1992. 4. Srikantha Murthy, K.R., editor-translator. Ashtanga Hridayam by Vagbhata, 2 vols. Krishnadas Academy: Varanasi, India, 1991-1992. 5. Srikantha Murthy, K.R., translator. Bhavaprakasha by Bhavamishran, 2 vols. Krishnadas Academy: Varanasi, India, 1998. 6. Lad, Vasant. The Textbook of Ayurveda, Volume One. The Ayurvedic Press: Albuquerque, 2002.					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER II

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Bachelor of Science in Botany					
YEAR	1	BTM2002C Non-vascular cryptogams		CREDIT	3T + 1P
Semester	2			HOURS	75
OBJECTIVES:		To familiarize the students with the diversity, thallus structure, reproduction, and life cycles of algae and bryophytes.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Diversity of algae			15 hrs.	
	Occurrence and classification (Smith), Diversity of thallus organization; Characteristic features, thallus structure, reproduction, and life cycle of: Chlorophyceae: <i>Volvox</i> , <i>Oedogonium</i> ; Charophyceae: <i>Chara</i> ; Phaeophyceae: <i>Dictyota</i> ; Rhodophyceae: <i>Batrachospermum</i> .				
UNIT-II	Diversity of bryophytes			15 hrs.	
	General features of Bryophytes; Classification (G M Smith, 1955); Characteristic features and life cycles of: <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , <i>Funaria</i> .				
UNIT-III	Economic importance of algae and bryophytes			15 hrs.	
	Ecological and economical importance of bryophytes and algae; Industrial applications of algae; bioenergy; kelp forests; model organism of algae and bryophytes in research; applications as fertilizer and bioremediations; algal technology and cultivation.				
UNIT-IV	Practical / laboratory work			30 hrs.	
	Type study of Diatoms, <i>Volvox</i> , <i>Ulothrix</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Dictyota</i> and <i>Batrachospermum</i> ; Detailed study of bryophytes namely <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , <i>Funaria</i> , <i>Bryum</i> .				
REFERENCES					
1. Vashishta B.R., Sinha A.K. & Singh V.P. (2010). Botany for Degree Students, Algae. S. Chand & Co. 2. Vashishta B.R., Sinha A.K. & Singh V.P. (2010). Botany for Degree Students – Bryophyta. S. Chand & Co. 3. Smith, G. M. (1938). Cryptogamic botany. Volume I, Algae, and fungi. 4. Chapman, D. J. (1973). The algae. Springer. 5. Hoek, C., Mann, D., & Jahns, H. M. (1995). Algae: an introduction to phycology. Cambridge university press. 6. Smith, G. M. (1938). Cryptogamic botany. Volume II. Bryophytes and pteridophytes. 7. EV Watson (2015). The structure and life of Bryophytes. 8. Alain Vanderpoorten & Bernard Goffinet (2009). Introduction to Bryophytes 9. Parihar, N S (2005). An introduction to embryophyta – bryophyta. Central Book Depot, Allahabad. 10. Sharma, OP (2017). Algae. 11. Sharma, OP (2017). Bryophyta. 12. Bendre, A. (2010). Practical botany. Deep and Deep Publications. 13. Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company.					

**BOTANY
MAJOR COURSE
SEMESTER II**

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2023-2024	
Bachelor of Science in Botany						
YEAR	1	BTM2012C Cell Biology			CREDIT	3T + 1P
Semester	2				HOURS	75
OBJECTIVES: To familiarize the students with cell organelle, cell cycle and cell death.						
COURSE CONTENT / SYLLABUS						
UNIT-I	Introduction to cellular Organization				15 hrs.	
	General structure and constituents of cell; Origin and Evolution of Cells, structure and function of plant cell wall, structure and function of cell membrane, Cell receptors, Signal transduction mechanisms, cell Junction, cytoskeletal elements, organization of the cytoskeleton.					
UNIT-II	Cellular organelle				15 hrs.	
	Structure and function of major organelles: Chloroplasts, Mitochondria, Ribosomes, Lysosomes, Peroxisomes, Endoplasmic reticulum, Golgi apparatus, Vacuoles, transport vesicles.					
UNIT-III	Cell cycle and Cell death				15 hrs.	
	Nucleus structure and Function; Cell division -Mitosis, Meiosis; cell cycle and its regulation, Kinetochore and spindle apparatus-structural organization and functions, Mechanism of cell cycle control; cell death – types, factors involved and its mechanism.					
UNIT-IV	Practical / laboratory work				30 hrs.	
	Differential cell wall staining; Cytoplasmic streaming; Demonstration of cytoskeleton and its components; demonstration of Mitosis and Meiosis; Karyotyping of the chromosomes; Senescence and cell death demonstration; Electron micrographs of cell organelles					
REFERENCES						
1. Earnshaw WC, Johnson GT, 2017. Cell biology. 3rd Ed, Elsevier cop. 2. Karp J, Iwasa J, Marshall W, 2018. Karp's Cell biology. 8th Ed, John Wiley. 3. Lodish HF et al. 2016. Molecular Cell Biology. 8th Ed. W.H. Freeman-Macmillan learning. 4. Primrose SB. 2001. Molecular Biotechnology. Panima. 5. Krebs JE, Goldstein ES, Kilpatrick ST, 2018. Lewin's Genes XII. Jones and Bartlett learning. 6. Bruce Alberts, 2017. Molecular Biology of the Cell. 6th Ed. Garland Science. 7. Gunning B, Steer MW, 1996. Plant cell biology: structure and function. Jones and Bartlett Publishers. 8. Bendre, A. (2010). Practical botany. Deep and Deep Publications. 9. Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company.						

**DEPARTMENT OF BOTANY OFFERED
MINOR COURSES for B.Sc. students
SEMESTER II**

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Department of Botany offered Minor subjects for B.Sc. students					
YEAR	1	BTE2002C		CREDIT	4T
Semester	2	Cell biology and anatomy of plants		HOURS	60
OBJECTIVES: To familiarize the students with cellular organelles and internal organization in plants.					
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction to cellular Organization				15 hrs.
	General structure and constituents of cell; Origin and Evolution of Cells, structure and function of plant cell wall, structure and function of cell membrane, Cell receptors, Signal transduction mechanisms, cell Junction, cytoskeletal elements, organization of the cytoskeleton.				
UNIT-II	Cellular organelle				15 hrs.
	Structure and function of major organelle: Chloroplasts, Mitochondria, Ribosomes, Lysosomes, Peroxisomes, Endoplasmic reticulum, Golgi apparatus, Vacuoles, transport vesicles.				
UNIT-III	Plant tissue system				15 hrs.
	Meristematic tissue; types of cambium; secondary growth with anomalies; Permanent simple tissues: parenchyma, collenchyma, sclerenchyma; organ: anatomy of stem, root and leaf; nodal anatomy; root-stem transition; Plant cell wall; pits and plasmodesmata.				
UNIT-IV	Complex and reproductive tissues				15 hrs.
	Complex tissues: xylem, phloem, secretory tissue; Adaptive & protective system: epidermis and cuticle; stomata and trichomes. Structural organization of flower: Structure of anther, structure and type of ovules, embryo sac, structure of embryo.				
REFERENCES					
1. Earnshaw WC, Johnson GT, 2017. Cell biology. 3rd Ed, Elsevier cop. 2. Karp J, Iwasa J, Marshall W, 2018. Karp's Cell biology. 8th Ed, John Wiley. 3. Lodish HF et al. 2016. Molecular Cell Biology. 8th Ed. W.H. Freeman-Macmillan learning. 4. Primrose SB. 2001. Molecular Biotechnology. Panima. 5. Krebs JE, Goldstein ES, Kilpatrick ST, 2018. Lewin's Genes XII. Jones and Bartlett learning. 6. Bruce Alberts, 2017. Molecular Biology of the Cell. 6th Ed. Garland Science. 7. Gunning B, Steer MW, 1996. Plant cell biology: structure and function. Jones and Bartlett Publishers.					

DEPARTMENT OF BOTANY OFFERED
Multidisciplinary course for B.Sc. students
SEMESTER II

	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2023-2024	
Department of Botany offered Multidisciplinary subject for B.Sc. students					
YEAR	1	MDC2192C		CREDIT	4T
Semester	2	Human dependence on plants		HOURS	60
OBJECTIVES: To familiarize the students with domestication and economical uses of plants.					
COURSE CONTENT / SYLLABUS					
UNIT-I	Plants as an edible resource				15 hrs.
	Domestication of plants (case studies of wheat, rice and maize); plants as food resources; legumes and Pulses; cereals; millets; beverages their sources and processing: tea, coffee, and cocoa; alcohol fermentation; Vegan milk; Mushroom: Importance, Biology and cultivation; Nutritive sweetening, flavoring and coloring agents; Nutraceuticals and food supplements; Narcotic plants; Plant toxins.				
UNIT-II	Plants as other resources				15 hrs.
	Commercially important plant-based resources: fibers; wood and timber; medicinal plants; dyes; fodder; aroma and fragrances; rubber; ornamental plants; forests and non-timber forest products; Economics of plant resources.				
UNIT-III	Genetically modified plants for human welfare				15 hrs.
	GMOs and crop biotechnology; Modified plants with suitable examples: insect resistant plants (Bt cotton, brinjal and maize), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality and nutrition (flavrSavrtomato, golden rice, Amflora potatoes, Arctic apples), edible vaccine, improved ornamental plants (blue rose and GM carnation, orange petunia).				
UNIT-IV	Plant bioreactors and bioenergy				15 hrs.
	Plant bioreactor; Plants engineered for production of carbohydrates, lipids and proteins (enzymes, antibodies, vaccines and therapeutic proteins); vitamins and other commercially valuable metabolites; single cell proteins; Plant based bioenergy; Lignocellulosic biofuels; biodiesel, algae-based biofuel; issues and environmental impact of biofuel.				
REFERENCES					
1. A. Hill - (1972) Economic Botany. 2. P.L. Kochar -(1981) Economic Botany. 3. S.D. Sabnis and M. Daniel – (1990) A Phytochemical Approach to economic Botany. 4. B. D. Singh – (2022) Plant biotechnology, MedTech science press. 5. P. K. Gupta – (2010) Plant biotechnology, Rastogi publications. 6. M Z Abdin, U Kiran, Kamaluddin, A Ali – (2017) Plant biotechnology: principles and applications, Springer. 7. U Satyanarayana – (2020) Biotechnology. Books and allied pvt ltd.					

DEPARTMENT OF BOTANY OFFERED
Skill Enhancement Courses for B.Sc. students
SEMESTER II

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Department of Botany offered SEC subject for B.Sc. students					
YEAR	1	SEC2172C Plant architecture		CREDIT	2P
Semester	2			HOURS	60
OBJECTIVES:		To familiarize the students practically with anatomical features of flowering plants.			
COURSE CONTENT / SYLLABUS					
Practical	1. Differential cell wall staining. 2. Cytoplasmic streaming. 3. Demonstration of cytoskeleton and its components 4. Demonstration of Mitosis and Meiosis. 5. Karyotyping of the chromosomes 6. Senescence and cell death demonstration 7. Electron micrographs of cell organelles 8. Basic tissue types in <i>Cucurbita</i> stem 9. Secondary growth in dicot stem 10. Study of stem, leaf, and root anatomy 11. Nodal anatomy and root-stem transition 12. Observation of trichomes and stomata types 13. Types of ovules and embryo				60 hrs.
REFERENCES					
1. Bendre, A. (2010). Practical botany. Deep and Deep Publications. 2. Strasburger, E. (1899). Handbook of practical botany. Macmillan & Company. 3. Krishna A. (2010). Botany for Degree Students: Bryophyta. S. Chand Pvt. Limited. 4. Earnshaw WC, Johnson GT, 2017. Cell biology. 3rd Ed, Elsevier cop. 5. Karp J, Iwasa J, Marshall W, 2018. Karp's Cell biology. 8th Ed, John Wiley. 6. Lodish HF et al. 2016. Molecular Cell Biology. 8th Ed. W.H. Freeman-Macmillan learning. 7. Primrose SB. 2001. Molecular Biotechnology. Panima.					

DEPARTMENT OF BOTANY OFFERED
Value added course for B.Sc. students
SEMESTER II

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara - 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2023-2024	
Department of Botany offered VAC subject for B.Sc. students					
YEAR	1	VAC2122C Horticulture and Gardening		CREDIT	2P
Semester	2			HOURS	60
OBJECTIVES:		To make students equipped with techniques of horticulture and gardening.			
COURSE CONTENT / SYLLABUS					
Practical	1. Garden implements and their uses. 2. Landscaping for gardens 3. Demonstration of preparing potting mixture; Demonstration of potting, de-potting, and repotting. 4. Propagation practices by seed, vegetative propagation, cutting, layering, budding, grafting, tissue culture. 5. Visit to a nursery; Demonstration of erecting nursery structures; Demonstration of various nursery management practices in nursery (irrigation, weeding, spraying etc.); Demonstration of nursery layout and record. 6. Fertilizers and manure. 7. Garden soil and water analysis. 8. Method of preparing bonsai, Bottle Garden / Terrarium, Hanging baskets, Dish garden. 9. Identification of pests and diseases in nursery plants. 10. Preparation of natural insecticides – Neem arka , Dashparni arka, Seetaphal powder, Tobacco extracts.				60 hrs.
REFERENCES					
1. Bhattacharjee, S K (2012) Landscape Gardening and Design with Plants. Nabhi Publications 2. Bose T K & Chowdhury B. (2001) Tropical Garden Plants in Color. Nabhi Publications 3. Dorling Kindersley (2010) Gardening Step by Step, Royal Horticultural Society 4. Sinha Amita (2006) Landscapes in India: Forms and Meanings University Press of Colorado					

DEPARTMENT OF BOTANY OFFERED

B. Sc. (Hons.) BOTANY (4-years UG program) EXIT COURSES FOR UG Certificate and UG Diploma in Botany

Year 1 Exit Course

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany					
YEAR	1	Paper 1 Internship in Botany for certificate		CREDITS	4P
Semester	2			HOURS	120
OBJECTIVES:		To enhance employability and to develop research aptitude in students who wish to exit UG course after 1 st year.			
COURSE CONTENT / SYLLABUS					
1	Any of the following: Hands on training, short research project, seminar attendance, read assigned journal to prepare for seminar, study certain entrepreneurs, study of enterprises / farmers, social projects				120 hours

B.Sc. BOTANY
MAJOR COURSES
SEMESTER III

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2003C		CREDITS	3T+1P
Semester	1	Vascular Cryptogams and Phanerogams		HOURS	75
OBJECTIVE:		To familiarize the students with the diversity, their thallus structure, reproduction, and life cycles of Pteridophytes, Gymnosperms and important fossil members.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Pteridophytes				15 hrs.
	General features of Pteridophytes; Classification (Smith, 1955); Characteristic features and Life cycles of: <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Azolla</i> , <i>Nephrolepis</i> ; Ecological and economical importance of Pteridophytes.				
UNIT-II	Gymnosperms				15 hrs.
	General features of gymnosperms, Classification (Sporne) and economic importance; important features and life history of <i>Cycas</i> , <i>Pinus</i> , <i>Ephedra</i> , <i>Gnetum</i> and <i>Zamia</i> .				
UNIT-III	Palaeobotany				15 hrs.
	Geological time scale; Types of fossils; methods of fossilization; General features of Rhyniales: <i>Rhynia</i> , Glossopteridales: <i>Glossopteris</i> , and Pentoxylales: <i>Pentoxylon</i> . Lepidophyta (<i>Lepidodendron</i>) and Gymnosperms: Cycadopsida (<i>Bennettites</i>) Coniferopsida (<i>Cordaites</i>)				
UNIT-IV	Practical/ laboratory work				30 hrs.
	1. Stele types in pteridophytes 2. Type study of <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Azolla</i> , <i>Nephrolepis</i> 3. Type study of <i>Cycas</i> , <i>Zamia</i> , <i>Pinus</i> , <i>Ephedra</i> , <i>Gnetum</i> 4. Slides and fossils specimens related to extinct genera 5. Leaf anatomy of Gymnosperms				
REFERENCES					
1. Smith, G. M. (1938). Cryptogamic botany. Volume II. Bryophytes and pteridophytes. Cryptogamic botany. Volume II. Bryophytes and pteridophytes. 2. Krishna A. (2010). Botany for Degree Students: Bryophyta. S. Chand Pvt. Limited. 3. Gangulee, S.C., Das, K.S, Dutta, C.D. and Kar, A.K. (1972) College Botany Vol. II & III. New central book agency(P) Ltd. 4. Vasishtha, B.R. (1974) Botany for Degree studentsPteridophyta. 5. O P Sharma (2017) Pteridophyta. McGraw Hill education. 6. O P Sharma (2016) Gymnosperm. Pragati Prakashan. 7. Vasishtha, B.R. (1974) Botany for Degree students Gymnosperm. 8. Edith L Taylor, Thomas N Taylor and Michael Krings (2009). Paleobotany: The biology and evolution of fossil plants. Academic press inc. 9. S R Mishra (2010). Text book of Palaeobotany. Discovery publishing pvt ltd.					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER III

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2013C Plant genetics		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVE: To develop basic understanding of classical genetics and population genetics.					
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction to Genetics				15 hrs.
	Early concepts of inheritance; Mendelian and Non-Mendelian inheritance, multiple Allelism; Sex determination, Differentiation and sex-linkage, Sex-influenced and sex-limited traits; linkage, recombination, and genetic mapping.				
UNIT-II	Cytogenetics				15 hrs.
	Numerical changes in chromosomes: Aneuploidy and Polyploidy: Types, examples, meiotic behavior and importance of Aneuploidy, Polyploidy; Speciation and evolution through polyploidy. Structural changes in chromosomes: Types, meiotic behavior of Deletion, Duplication, Translocation, and Inversion, male sterility and genetic incompatibility				
UNIT-III	Population genetics				15 hrs.
	Population Genetics: Populations and gene pool, Genetic variation, and evolution; Genotypic and gene frequencies; Evolutionary change and the Hardy-Weinberg law; applications of the Hardy-Weinberg law; Migration; random genetic drift; Founder effect and bottlenecks.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Problems on monogenic and digenic inheritance 2. Problems on genetic interactions 3. Problems of sex-linkage 4. Problems of genetic recombination mapping 5. Male sterility analysis 6. Problems on genotypic and gene frequencies and Hardy-Weinberg equilibrium				
REFERENCES					
1. Snustad, D. P. and Simmons M.J. (2015). Principles of Genetics, 7th Ed. John Wiley & Sons. 2. Strickberger, M.W. (2015). Genetics. 3rd ed. Pearson. 3. Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2016). Concepts of Genetics (10th ed.). Pearson. 4. A Brief History of Genetics: Defining Experiments in Genetics. Cambridge, MA: NPG Education, 2010. Retrieved from http://nature.com/scitable/ebooks/a-brief-history-of-genetics-defining-experiments-16570302 . 5. Miko, I. & LeJeune, L., eds. Essentials of Genetics. Cambridge, MA: NPG Education, 2009. Retrieved from http://www.nature.com/scitable/ebooks/essentials-of-genetics-8 .					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER III

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2023C Plant evolution and diversity		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVE:		To develop an understanding of basic concepts of evolution, phylogeny, biodiversity and conservation of plants.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Trends of evolution and theories				15 hrs.
	Basic concept of evolution: Account of origin of life, changes in atmosphere, theory of special creation. Chemical evolution; experimental evidences for chemical evolution: Miller's, Fox and Urey's experiments. Evidences for evolution, Theories of evolution: Lamarck, Darwin, Mutation and Neo-Lamarckism, Neo-Darwinism and it's present understanding. Synthetic theory of evolution: Steps involved, chromosomal variation and Natural selection of organisms, Reproductive isolation, Major trends: Origin of higher categories, rate of evolution and evolutionary constancy. History of life on earth; Darwinian view of life; origin of species; phylogeny and tree of life.				
UNIT-II	Origin of plant including land plants				15 hrs.
	Geological time scale, Origin of earth, A general account of the origin and evolution of algae to angiosperms (special reference to Bennettitalean, Gnetalean, Caytonialean and herbaceous origin theories); primitive living angiosperms- basal angiosperms; co- evolution of angiosperms. Speciation: origin of species: Species, racial differences in species, reproductive isolation, sibling sps. and isolating mechanisms. Origin of plants; Agents of Change; Responses to selection; Natural selection and adaptation; Plants colonizing terrestrial habitat.				
UNIT-III	Biodiversity				15 hrs.
	Introduction to Biodiversity, and its importance. Biogeographical classification of India, India as a mega-diversity nation, Hot-spots of biodiversity. Present Status Floral Biodiversity of Gujarat. India's share in global biodiversity. Endemic forms. Threatened forms. Threats to biodiversity. What Has Happened to the Species? Types of diversity- Species diversity, Genetic Diversity and Ecosystem Diversity; Ecosystem Function, resilience and ecosystem services				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Herbarium preparation techniques 2. Measuring biodiversity using alpha and beta biodiversity index 3. Biodiversity hotspots of India ; IUCN Categorisation of plants. 4. Comparison of primitive and advanced characters of angiosperms 5. Techniques of <i>Ex- situ</i> plant biodiversity conservation 6. Study examples of plants for cultural benefits and herbal gardens. 7. Biodiversity of mangrove ecosystems				
REFERENCES					
1. G.S. Mani - (2000) Evolutionary dynamics of genetic diversity. Springer-Verlag, 312p. 2. G.L. Stebbins - (1977) Process of Organic evolution. Ed. 3. Engle-woodcliffs, NJ:Prentice hall. 3. G.L. Stebbins - (1984) Variation and evolution in plants. Columbia University Press,New York 4. T.H. Dobzhanski - (1982) Genetics & Origin of species. Columbia university Press,New York 5. F. J. Ayala –Population and Evolutionary genetics: A primer., Benjamin/Cummings, Menlo Park, CA. 6. K. V. Krishnamurthy. 2003. An Advanced Textbook on Biodiversity Principles and Practice. Oxford & IBH Publishing C. Pvt. Ltd. New Delhi					

COURSES OFFERED BY DEPARTMENT OF BOTANY
MULTIDISCIPLINARY COURSES (Open for all semester III students)
SEMESTER III

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	MDC2493C Space biology and remote sensing		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVE:		To familiarize students with Astrobiology and Remote sensing techniques			
COURSE CONTENT / SYLLABUS					
UNIT-I	Astrobiology				15 hrs.
	Prerequisites and progression (of Physical and Chemical world) in building a habitable planet; Requisite chemicals of life, Key biological molecules, Nature and evolution of habitability; Requirements and energy acquisition by life; Autotrophic world, Cyanobacteria adaptation to extreme environments, Stromatolites, Reported physical and chemical features on the Moon and Mars, Possibility of extra-terrestrial life.				
UNIT-II	Basics of remote sensing				15 hrs.
	Principles of electromagnetic radiation; Reflectance spectra of major earth features; Different platforms and sensors for data acquisition; Introduction to optical, microwave and LIDAR remote sensing. Spatial, radiometric, spectral and temporal resolution.				
UNIT-III	Applications of remote sensing				15 hrs.
	Elements of visual image interpretation; Reference data collection; Monitoring Atmospheric constituents, and of Aquatic systems; Vegetation monitoring – crops, forest covers; commonly used vegetation indices.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Perception of scale in photography 2. Shape based identification of common trees 3. Data acquisition from open platforms 4. Different vegetation indices 5. Monitoring crop / tree phenology 6. Utility of google earth engine. 7. Culture activities of microorganisms (Both autotrophic and heterotrophic Bacteria) on a standard media, 8. Testing the selective omission of molecules on the growth and establishment of microorganisms, 9. Impact of Physical factors (Light, Temperature, water) on the Microbial culture				
REFERENCES					
1. Atkinson, P.M. and Tate, N.J.(Eds.) 1999 Advances in remote sensing and GIS analysis., Wiley, New York. 2. Recknagel, F. 2002 Ecological Informatics: Understanding Ecology by Biologically-Inspired Computation. Springer, New York. 3. Earth: Evolution of a Habitable World, Jonathan Lunine, 2nd edition, Cambridge University Press, 2013. 4. Life in the Universe, Jeffrey Bennett & Seth Shostak, 5 th edition, Princeton University Press, 2022					

COURSES OFFERED BY DEPARTMENT OF BOTANY
SKILL ENHANCEMENT COURSES
(Open for all Semester III students)
SEMESTER III

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	SEC2413C Histochemistry and Microtechniques		CREDITS	1T+1P
Semester	1			HOURS	45
OBJECTIVE:		To familiarize the students theoretically and practically with the different histochemical and micro techniques in Botany			
COURSE CONTENT / SYLLABUS					
UNIT-I	Microtechniques				15 hrs.
	Types of Microtomy, Its principle and applications- Rotary, sledge, Freezing, Cryostat and Ultratomes ,Preparation of sample: (i) Killing and fixing: Principles and techniques of killing and fixing; properties of reagents, fixation images; properties and composition of important fixative, (ii) Dehydration: Principles of dehydration, properties and uses of important dehydrating and clearing agents - alcohols, acetone, xylol, glycerol, chloroform, dioxin and Dehydration Methods: (a) Embedding: Paraffin embedding and principles,(b) Sectioning: Free hand sections – Prospects and problems.				
	Histochemistry				
	Classification , Principles and chemistry of Biological stains. Difference between stain and reagent. Bright-field dyes and fluorochromes, Detection and localization of structural and storage components in plants using specific dyes and fluorochromes– Starch, protein, lipid, nucleic acids, cellulose, lignin, potassium, magnesium, calcium, iron, alkaloids, terpenoids, phenolics (tannin), glycosides.				
UNIT-II	Practical / laboratory work				30 hrs.
	1. Visit to an anatomy laboratory 2. Protocol for preparation of (i) Natural stains - Haematoxylin and Carmine (ii) Coal tar dyes – Fast green, Orange G, Safranin, Crystal violet, Cotton Blue and Oil Red O. (iii) reactive dyes and fluorochromes (including genetically engineered protein labelling with GFP and other tags), 3. Techniques of staining: (i) Single staining; Staining with Safranin or crystal violet (ii) Double staining; Safranin-Fast green method, Safranin-Crystal violet method (iii) Triple staining; Safranin Crystal violet-Orange G method. 4. Squash, smear , maceration and whole mount of plant samples 5. Types of sectioning (LS, TS, RLS, TLS) 6. Sectioning method using microtomy – sample preparation and sectioning 7. Histochemical localization of starch, protein, lipid and lignin cellulose, pectin, lignin, suberin, callose – demonstration 8. Photography and image processing methods				
REFERENCES					
1. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A. 2. Marques J P R, Soares M K M (2022). Handbook of techniques in plant histopathology, Springer. 3. Edita Tylova, Ales Soukup (2019). Essential Methods of Plant Sample Preparation for Light Microscopy, Springer protocols. 4. Edward Chee Tak Yeung, Claudio Stasolla, Michael John Sumner, Bing Quan Huang (2015). Plant microtechniques and protocols, Springer. 5. Pandey, BP (2001). Plant anatomy, S. Chand publications.					

COURSES OFFERED BY DEPARTMENT OF BOTANY

INDIAN KNOWLEDGE SYSTEM COURSES

(Open for all Semester III students)

SEMESTER III

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	IKS2323C		CREDITS	1T+1P
Semester	1	Traditional Knowledge and Folk medicine		HOURS	45
OBJECTIVE: To familiarize students with the traditional practices in human health					
COURSE CONTENT / SYLLABUS					
UNIT-I	Traditional knowledge and folk medicine				15 hrs.
	Ethnomedicine: Definition, history and scope. Collection of ethnic information. Different tribes of Gujarat. Importance of medicinal plants: Role in human health care. Introduction to basic concepts of folk medicine and Ayurveda, Naturopathy and Yoga: methods of disease diagnosis and treatment. Study of some Ayurvedic drugs: Bael, Pipal, Haldi, Guggul, Ashoka, Shatavari, Sarapgandha, Kalmegh, Gokhru, Punarnava, Ashwagandha, Yastimadu, Isabgol, and Vasaka.				
UNIT-II	Practical / laboratory work				30 hrs.
	1. Evaluation methods for crude drugs-organoleptic, chemical. 2. Preparation and Evaluation of traditional ayurvedic kadha 3. Use of plants and plant products for various purposes by the ethnic groups of Gujarat. 4. Traditional and ayurvedic foods of Indian origin				
REFERENCES					
1. Wallis T. E.(2005). Textbook of Pharmacognosy. 5 th Edition. CBS publishers & Distributors Pvt.Ltd. 2. Trease and Evans 2002. Pharmacognosy. W.B. Saunders. London. 3. Chauhan MG and Pillai APG Microscopic profile of powdered drugs used in Indian Systems of Medicine- Volume I- Bark drugs. Published by Gujarat Ayurved University, Jamnagar. 4. Chauhan MG and Pillai APG Microscopic profile of powdered drugs used in Indian Systems of Medicine- Volume 2- Leaf drugs. Published by Gujarat Ayurved University, Jamnagar. 5. Chauhan MG and Pillai APG Microscopic profile of powdered drugs used in Indian Systems of Medicine- Volume 3- Seed drugs. Published by Gujarat Ayurved University, Jamnagar. 6. Kokate CK. Textbook of Pharmacognosy. 7. Mohammed Ali. 2007. Textbook of Pharmacognosy.system : concepts and applications 9. M.D. Ninivaggi, Frank John .2010. Ayurveda: A Comprehensive Guide to Traditional Indian Medicine for the West. Publisher Rowman & Littlefield. 10. Preetam Sarkar, Lohith Kumar DH, Chanda Dhumal , Shubham Subrot Panigrahi, Ruplal Choudhary. Traditional and ayurvedic foods of Indian origin. J Ethn Foods 2 (2015) 97-109. 11. S.K. Jain 2010. Manual of Ethnobotany, 2nd Revised Ed. Scientific Publishers 12. Awadesh N, Ghoeami A and Sharma R, 2006. Indigenous Health Care and Ethnomedicine, Sarup and Sons. 13. Pushpangadan, P., Ulf Nyman and V. George 2017. Glimpses of Indian Ethano-Pharmacology. Tropical Botanic Garden & Research Institute. 14. Textbook of Pharmacognosy by C. K. Kokate, Purohit, Ghokhale, Nirali Prakashan.					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2004C Plant physiology		CREDITS	3T+1P
Semester	2			HOURS	75
OBJECTIVE:		To understand the major concepts and principles of plant physiology			
COURSE CONTENT / SYLLABUS					
UNIT-I	Transport mechanism in plants				15 hrs.
	Water and plant cells, water balance of plants, xylem structure and water transport function, evolution of plant water transport system, phloem structure and translocation in the phloem, transpiration, stomatal movements, Role of carbon di-oxide, potassium ion, abscisic acid (ABA) and blue light in stomatal movement, Anti-transpirants, mineral nutrition.				
UNIT-II	Photosynthesis & Respiration				15 hrs.
	Photosynthesis: Photopigments and its role, Photosystem structure: Antenna complex and reaction centers, light reactions: Electron transport pathways in chloroplast membranes; Rubisco, carbon reactions - the Calvin–Benson cycle; CO ₂ concentrating mechanisms: C ₄ and CAM plants. Photorespiration: The photorespiratory pathway, role of photorespiration in plants; photoinhibition and regulation of photosynthesis; Respiration pathway and ATP yield.				
UNIT-III	Plant hormones and light relations				15 hrs.
	Phytohormones and its physiological roles: Auxins, Cytokinins, Gibberellins, Ethylene, Absciscic acid, Brassinosteroids, Strigolactones, Jasmonic acid, Salicylic acid; Phototropism and gravitropism; photoreceptors; phytochromes and light control of plant development; photoperiodism; circadian rhythms; vernalization; Senescence and cell death.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Protoplasmic streaming in response to light in Hydrilla 2. Calculate water potential using potato 3. Effect of KCl on stomatal movement 4. Effect of anti-transpirants on stomata 5. Separation of plant pigments by paper chromatography 6. Effect of plant hormones on rate of transpiration 7. Diurnal acid cycle in succulent plants 8. Comparative C ₃ and C ₄ anatomy 9. Calculate rate of photosynthesis 10. Effect of monochromatic light on rate of photosynthesis 11. Find effects of phototropism and gravitropism in plants 12. Effect of circadian rhythm on plant growth 13. Structure of plant meristems 14. Calculation of growth rate in plant leaf				
REFERENCES					
1. Salisbury FB, Ross CW, 2009. Plant physiology. 4th Ed., Cengage learning. 2. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Plant physiology and development. 6th Ed, Oxford University press. 3. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Fundamentals of plant physiology. 1st Ed, Oxford University press. 4. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2nd Ed., Wiley-Blackwell. 5. Voet D. Voet JG. Pratt CW. 2016. Fundamentals of Biochemistry. 5th Ed.. Wiley.					

B.Sc. BOTANY
MAJOR COURSES
SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2014C Ecology: Basics, Pattern and Process		CREDITS	3T+1P
Semester	2			HOURS	75
OBJECTIVE:		Help students understand specific plant population characteristics and ecological role of plants in ecosystem			
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction to ecology				15 hrs.
	History of ecology, Plants: their environment and adaptations, Ecological niche, Ecology at different levels of organisation (Individual, Population, Community, and Ecosystem approach), Dispersal and diversification				
UNIT-II	THE PHYSICAL ENVIRONMENT				15 hrs.
	The climate: components and variability. The terrestrial environment: Vertical distribution of light in different plant forms, Soil formation, soil characteristics. The Aquatic environment: Light, temperature variation with depth. Properties of water important for organisms. Difference between fresh, marine and brackish water conditions.				
UNIT-III	POPULATION ECOLOGY				15 hrs.
	Population: group properties, Metapopulation, Population dynamics, Population regulation. Plant population regulation. Plant population studies.				
UNIT-IV	Practical / Laboratory work				30 hrs.
	1. Morphological and Anatomical Adaptations in Xerophytes 2. Morphological and Anatomical Adaptations in Hydrophytes 3. Morphological and Anatomical Adaptations in Halophytes 4. Morphological and Anatomical Adaptations in Epiphytes 5. To study positive plant-microbe interaction. 6. To study negative plant- plant interaction. 7. Analysis of various climatic factors using graphical representation. 8. Mapping of different biogeographic zones of India. 9. To study effect of population density on the growth of plant.				
REFERENCES					
1. A textbook of plant ecology, Ambasht and Ambasht, 16 thedi. CBS Publishers and distributors, 2022 2. Plant ecology and Phytogeography, P.D. Sharma Rastogi Publication 2019 3. Fundamentals of Ecology E.P. Odum Cengage India Pvt. Ltd. 2017 4. Elements of Ecology Thomas and Smith and Robert Leo Smith Perason Education India 2015 5. Ecology: The experimental Analysis of Distribution and Abundance Charles J Krebs Pearson Eduction India 2016 6. The Text book of Plant Ecology, H. Lewindevasahayan And Darwin Christ Agribiovat Press 2019 7. Ecology: Concepts and applications, Manuel C. Molles Jr & Anna Sher Simon, Mc Graw Hill 8 th Edition 2019.ISBN: 978-1-259-88005-6 8. Ecology: The economy of Nature, Robert Ricklefs & Rick Relyea, 9 th Edition, 2021. W. H. Freeman & Co. ISBN-13; 978-1319383817					

B.Sc. BOTANY

MAJOR COURSES SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany					
YEAR	2	BTM2024C Plant Biochemistry		CREDITS	3T+1P
Semester	2			HOURS	75
OBJECTIVES:		To understand how the chemical properties of molecules determine the ways in which they interact and react with each other. To understand different types of chemical reactions and how they are used by living organisms.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Biomolecules				15 hrs.
	Amino acids, peptides and proteins; Sugars, polysaccharides and glycoproteins; Nucleic acids; Lipids and their types; Enzymes and kinetics; Coenzymes; Thermodynamics.				
UNIT-II	Carbohydrates & Lipid metabolism				15 hrs.
	Catabolism and anabolism; Pathways of Carbohydrate metabolism; aspects of Lipid metabolism.				
UNIT-III	Metabolism of Nitrogen compounds				15 hrs.
	Metabolism of Nitrogen and amino acids; metabolism of aromatic compounds and nucleic acids. Nitrogen metabolism: Assimilation of nitrate by plants, Biochemistry of dinitrogen fixation in Rhizobium, GS and GOGAT enzyme system				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Types of solutions – calculations (Molar, Molal, percent, ppm etc) 2. Preparation of buffers of different strengths and pH values 3.Estimation of amino acids and nucleic acids 4.Separation of biomolecules by TLC and paper chromatography 5.Estimation of Carbohydrates and Lipids 6.Separation of amino acids by paper chromatography 7. Pasteur effect by estimation of sugars – anaerobic metabolism 8. Separating nitrogenous bases by paper chromatography. 9. To separate chloroplast pigments by column chromatography				
REFERENCES					
1. Plumer, D.T. (1979) An Introduction to Practical Biochemistry. 2. Wilson, K. and Walker, J.M. (1996) Principles & Techniques of Practical Biochemistry. 3. Plant Biochemistry by Hans-Walter Heldt 3rd edition by Academic Press, 2004. 4. Plant Biochemistry by Hans-Walter Heldt and Birgit Piechulla 4th edition by Academic Press, 2010. 5. Plant Biochemistry by P. M. Dey and J. B. Harborne 1st edition by Academic Press, 1997. 6. Plant Biochemistry by James Bonner and Joseph E. Varner 3rd edition by Academic Press, 1977. 7. Voet D, Voet JG, Pratt CW, 2016. Fundamentals of Biochemistry. 5th Ed., Wiley 8. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2nd Ed., Wiley-Blackwell					

COURSES OFFERED BY DEPARTMENT OF BOTANY

MINOR/ ELECTIVE COURSES

(For students who opted for Botany as a Minor Course at FY)

SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	BTE2004C		CREDITS	3T+1P
Semester	2	Life of land plants		HOURS	75
OBJECTIVES:		To familiarize the students with the diversity, their thallus structure, reproduction, and life cycles of Pteridophytes and Gymnosperms. To familiarize students with the various morphological and taxonomical aids for identification of Angiosperms.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Pteridophytes				15 hrs.
	Classification; Occurrence, Characteristic features of <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Nephrolepis</i> (Life cycles); Ecological and economical importance of Pteridophytes.				
UNIT-II	Gymnosperms				15 hrs.
	Classification; Characteristic features of <i>Cycas</i> , <i>Pinus</i> (life cycle); Ecological and economical importance of Gymnosperms; Paleobotany and relevant examples; Paleobotany with reference to India.				
UNIT-III	Angiosperms				15 hrs.
	Systems of classification; Nomenclature: Principles and rules of Nomenclature; Angiosperm morphology: introductory morphology of angiosperm, Families of Angiosperms: Polypetalae: Malvaceae, Fabaceae; Gamopetalae: Apocynaceae, Solanaceae; Monoclamydae: Euphorbiaceae; Monocotyledonae: Poaceae.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Type study of <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , and <i>Nephrolepis</i> . 2. Type study of <i>Cycas</i> and <i>Pinus</i> 3. Study of root, leaf, stem, flower, fruit, seed morphology 4. Study of Angiosperm families – Malvaceae, Fabaceae, Apocynaceae, Euphorbiaceae, Poaceae 5. Preparation of plant herbarium and vouchers.				
REFERENCES					
1.B.P. Pandey - (1980) Taxonomy of Angiosperms. S. Chand Limited, 600 p. 2.Cronquist, A. (1988). The evolution and classification of flowering plants. 3.Davis, P.H. and Heywood V.H. (1967). Principles of Angiosperm Taxonomy. 4.Gangulee, S.C., Das, K.S, Dutta, C.D. and Kar, A.K. (1972) College Botany Vol. II & III. New central book agency(P) Ltd. 5. Goldberg, A. (1986). Classification, evolution, and phylogeny of the families of Dicotyledons. 6. Heywood, V.H. and Moore D.M. (1984). Current concepts in Plant Taxonomy.					

COURSES OFFERED BY DEPARTMENT OF BOTANY
MINOR/ ELECTIVE COURSES
(Open for all Semester IV students)
SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	BTE2014C		CREDITS	2T+2P
Semester	2	Quantitative Ecology		HOURS	90
OBJECTIVES: To provide foundation of techniques commonly used for survey, data collection and analysis					
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction & survey in Aquatic systems				15 hrs.
	Need for vegetation surveys, Survey types: Quick vs. comprehensive sampling; natural veg. vs urban veg survey. Introduction to PBRs and the different types of sheets. Aquatic vegetative sampling, Plankton survey Methods, Submerged vegetation survey methods Floating vegetation survey methods				
UNIT-II	Terrestrial plant survey				15 hrs.
	Sampling methods, Types of transects and quadrates, Plotless sampling methods Standard methods for comprehensive vegetation sampling vs. quick sampling Sampling methods for Trees, shrubs, herbs, climbers and epiphytic vegetation. Online tools for survey data collection, analysis and storage. Vegetation maps				
UNIT-III	Aquatic vegetation study practicals				30 hrs.
	Basic safety guidelines of aquatic plant sampling. Requirements for Aquatic plant sampling – Instruments & consumables, Water collection for water quality and biodiversity analysis, Introduction to PBR data sheets ,Common algal forms in water (from fresh water samples), Phytoplanktonic / Zooplankton discrimination analysis Density of phytoplankton/ Zooplankton, Identification of common aquatic plants - I (angiosperms & Pteridophytes), Identification of common aquatic plants - II (Angiosperms & Pteridophytes), Quantification of floating/submerged vegetation (live/simulated condition)				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Plotless vegetation sampling (Graphical exercise) 2. Belt and segmented belt transect in vegetation sampling (graphical exercise) 3. Study of herbaceous vegetation using square quadrates 4. Study of tree vegetation using square quadrates 5. Tree/shrub vegetation surveys in urban environments. 6. Basics of vegetation maps 7. Vegetation map extraction using Google Earth / Google maps 8. Different mobile apps used in vegetation surveys 9. Vegetation mapping in science faculty using mobile app 10. Vegetation data in mobiles and its integration into GIS.				
REFERENCES					
1. Sutherland, W. J. (2006) Ecological census techniques, 2 nd Edition, Cambridge University press, 300 p 2. Cook, C. D. K. (1996) Aquatic and Wetland plants of India, Oxford University press, 394 p 3. Anon (2009) Plant Biodiversity Register Guidelines, National Biodiversity Authority of India, http://nbaindia.org/uploaded/pdf/PPT_PBRs_Guidelines.pdf 4. Introduction to QGIS 5. Plant vegetation sampling 6. Sharma, P. D. Ecology and Environment					

COURSES OFFERED BY DEPARTMENT OF BOTANY
SKILL ENHANCEMENT COURSES
(Open for all Semester IV students)
SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara –390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	SEC2404C Bioremediation and Bioaugmentation		CREDITS	1T+1P
Semester	2			HOURS	45
OBJECTIVES:					
To understand the key concept of waste management To sensitize the learners about the problem of waste generation and its impact on the environment and human health. To familiarize the learners to different methods of bioremediation					
COURSE CONTENT / SYLLABUS					
Unit -I		Biowaste and characterization			15 hrs
		Different types of biowaste and Identification of sources of the different waste and its characterization. Importance of waste management- Ecological consequences of improper waste disposal. Basics of bioremediation: Principle and Process. Types of bioremediation - In situ bioremediation, Ex situ bioremediation, Phytoremediation. Factors affecting Bioremediation process, Application of bioremediation in environmental management.			
UNIT-II		Practical / laboratory work			30 hrs.
		1. Value added products: Floral waste valorization - incense sticks, charcoal, dyes, volatile oils, Preparation of dry flower arrangements 2. Cultivation of mushrooms using agricultural waste. 3. Preparation of biofertilizers 4. Green waste recycling- Separation and recycling of plant-based waste including leaves, grass clipping and pruning to create mulch 5. Source of bioactive compounds for food applications (from agro-waste) (polyphenolic compounds, vitamins, minerals, fatty acids, volatiles, anthocyanins, and pigments that have valuable health benefits).			
REFERENCES					
1. Waste Management-An overview. Amrita Chakraborty; SBS Publishers and Distributors Pvt. Ltd, 2010 2. Waste Mangement- A comprehensive Guide to Sustainable Solutions; Manish R. Moroliya and Akshay D.Anjkar, Notion Press, 2023. 3. Waste Treatment and Disposal, Williams P. John Wiley 2012. 4. Agricultural Waste Threats and Technologies for Sustainable Management. Edited By Rouf Ahmad Bhat, Khalid Rehman Hakeem, Humaira Qadri, Moonisa Aslam Dervash.2023. Apple Academic Press 5. Waste Valorization for Value added Products. Volume 1. Series Title: Waste Valorization. Editors: Vinay Kumar, Sivarama Krishna Lakkaboyana , Neha Sharma .2023. Bentham Books Publisher					

COURSES OFFERED BY DEPARTMENT OF BOTANY
VALUE ADDED COURSES
(Open for all Semester IV students)
SEMESTER IV

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2024-2025	
Bachelor of Science					
YEAR	2	VAC2354C Nutraceuticals		CREDITS	1T+1P
Semester	2			HOURS	45
OBJECTIVES: To teach the students the advantages of functional foods over conventional medicine. To distinguish between food, functional food and dietary supplements.					
COURSE CONTENT / SYLLABUS					
UNIT-I		Nutraceuticals and its types			15 hrs.
		Introduction to Nutraceuticals, Definitions of Nutraceuticals, Functional foods, and Dietary supplements, History and Classification. Importance of nutraceuticals in human health, Nutraceutical factors in specific foods: Factors based on chemical nature and mechanism of action. Safety, Scientific evidence and market trends: Local and Global. Probiotics: Taxonomy and Important Features of Probiotic Microorganisms and Health Effects. Prebiotics and Synbiotics Plant based nutraceutical with their Occurrence, Structure and Properties, chemical composition and uses.			
UNIT-II		Practical / laboratory work			30 hrs.
		1. Examples of plant sources used as Phytochemicals 2. Examples of Neutraceuticals and its Chemical compositions 3. Nutraceutical importance of Pulses, <i>Spirulina</i> , Flax seeds, Roselle, ben oil, <i>Hibiscus</i> , 4. Millets, <i>Clitoria</i> , Ashwagandha, Shatavari, Giloy etc. 5. Nutraceuticals and health benefits 6. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition 7. Education in community, Limitations of Nutraceuticals			
REFERENCES					
1. Handbook of Nutraceuticals and Functional Foods, Second Edition, Eds Robert E.C. Wildman, CRC Press, Taylor and Francis 2. Nutraceuticals in Health and Disease Prevention edited by Klaus Kramer, Peter-Paul Hoppe, Lester Packer, Marcel Decker New York 3. Nutraceuticals: Efficacy, Safety and Toxicity edited by Ramesh C. Gupta Academic Press, Elsevier Publication 4. Handbook of Nutraceuticals Volume I: Ingredients, Formulations, and Applications edited by Yashwant Vishnupant Pathak, CRC Press, Taylor and Francis 5. Wildman, R. E. (2016). Handbook of Nutraceuticals and Functional Foods. CRC Press 6. Gibson, G. R. and Williams, M. C. (2001). Functional Foods Concept to Product. CRC Press. 7. Vatter, D.A. and Maitin V. (2016). Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications. DEStech Publications, Inc 8. Gupta, R. C. (2016). Nutraceuticals: Efficacy, Safety and Toxicity. Academic Press. 9. Ajay Kumar Shukla, Santram Lodhi, Mohanlal Kori Concise course in Dietary supplements and Neutraceuticals..Publisher S Vikas and Company .2020 10. Laxmikant Zawar, Prashant L, Pingale. A textbook of Dietary supplements and Neutraceuticals. Everest Publishing House,Pune.2023.					

B. Sc. (Hons.) BOTANY (4-years UG program)

EXIT COURSES FOR UG Certificate and UG Diploma in Botany

Year 2 Exit Course

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2024-2025	
Bachelor of Science in Botany						
YEAR	2	Paper 1 Internship in Botany for diploma			CREDITS	4P
Semester	2				HOURS	120
OBJECTIVES: To enhance employability and to develop research aptitude in students who wish to exit UG course after 2 nd year.						
COURSE CONTENT / SYLLABUS						
1	Any of the following: Hands on training, short research project, seminar attendance, read assigned journal to prepare for seminar, study certain entrepreneurs, study of enterprises / farmers, social projects					120 hours

B. Sc. (Hons.) BOTANY (4-years UG program)**MAJOR COURSES****SEMESTER V**

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTM3005C		CREDITS	3T+ 1P
Semester	1	Angiosperm systematics		HOURS	75
OBJECTIVES:		To understand the fundamentals of identification, classification, nomenclature and documentation of Angiosperms.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Basics of plant systematics Introduction: Aims and components of systematics; identification, nomenclature and classification, Taxonomic categories; species concept. Nomenclature: Principles and rules of Nomenclature; Nomenclature changes- review, ranks and names; type method. Identification: Types of taxonomic keys. Floras, Monographs, Synopsis and Revision.			15 hrs.
UNIT-II		Phylogeny of Angiosperms Contemporary Taxonomy: Supporting evidence for taxonomy; taxonomy in relation to anatomy, embryology, palynology, ecology, cytology; chemotaxonomy. Different approaches and their utility for taxonomy a brief review. Evolution of Characters: Bessey’s Dicta, evolution in vegetative characters (roots, stem and leaf), evolution in floral characters and fruit. Systems of Classification: Bentham and Hooker’s System, Outline of Cronquist’s classification System and Angiosperm Phylogeny Group (APG). Phylogenetic Methods: Basics of phenetics and cladistics, cladogram and it’s components, principle components, how cladograms are prepared. Softwares used for cladograms, recent molecular techniques.			15 hrs.
UNIT-III		Families of Angiosperms Polypetalae: Annonaceae, Malvaceae, Tiliaceae, Sterculiaceae, Rutaceae, Meliaceae, Anacardiaceae, Fabaceae, Caesalpiniaceae, Mimosaceae, Myrtaceae, Apiaceae. Gamopetalae: Asteraceae, Rubiaceae, Asclepiadaceae, Apocynaceae, Solanaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Scrophulariaceae, Verbenaceae. Monoclamydae: Amaranthaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae (Inclu. Phyllanthaceae), Polygonaceae. Monocotyledonae: Commelinaceae, Amaryllidaceae, Liliaceae, Cyperaceae Poaceae.			15 hrs.
UNIT-IV		Practical / laboratory work 1. Morphology of Root, Stem and Leaves. 2. Morphology of Inflorescence, Flowers and Fruit. 3. Plant collection, preservation and maintenance of Herbarium; Herbarium techniques and documentation in detail. 4. Illustration, photography and description of plant. 5. Identification and comparison of Families given in Unit 3. 6. Cladogram preparation through UPGMA method (Without software).			30 hrs.
REFERENCES					
1. Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (1999). Plant systematics: a phylogenetic approach. Ecología mediterránea. 2. Simpson, M. G. (2019). Plant systematics. Academic press. 3. Lawrence, G. H. M. (2017). Taxonomy of vascular plants. Scientific Publishers. 4. Singh, G. (2019). Plant systematics: an integrated approach. CRC Press. 5. Stuessy, T. F. (2009). Plant taxonomy: the systematic evaluation of comparative data. Columbia University Press. 6. Sharma O.P. (2017). Plant Taxonomy. McGraw Hill Education.					

B. Sc. (Hons.) BOTANY (4-years UG program)**MAJOR COURSES****SEMESTER V**

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTM3015C Molecular Biology		CREDITS	3T+ 1P
Semester	1			HOURS	75
OBJECTIVES: To understand the fundamental cellular processes at molecular level.					
COURSE CONTENT / SYLLABUS					
UNIT-I	Gene, genome and replication				15 hrs.
	Gene and Genome organization in prokaryotes and eukaryotes, organelle genome; Structure of genes: Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, miR genes, Oncogenes, Repetitive elements, Gene families; DNA replication mechanism in prokaryotes and eukaryotes; DNA supercoiling; Molecular basis of mutations and repair mechanisms in prokaryotes and eukaryotes; Inhibitors of Replication				
UNIT-II	Gene transcription				15 hrs.
	Transcription in prokaryotes and eukaryotes: RNA types, Transcription and Processing of RNA in prokaryotes and eukaryotes, splicing and alternative splicing; spicing mechanisms and types of Introns; Transcriptional factors; Transcription in organelles; Reverse transcription; inhibitors of transcription.				
UNIT-III	Translation				15 hrs.
	Operon concept: lac-operon, trp-operon, ara-operon; Important features of gene regulation in prokaryotes and eukaryotes. Translation in prokaryotes and eukaryotes: Ribosomes; r-RNA; t-RNA; Aminoacyl tRNA synthetases; mediator complexes; Genetic code; Translational and post-translational modifications in prokaryotes and eukaryotes; post-translational modifications of proteins; Protein folding and proteasomal degradation; inhibitors of Translation				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Problems and models based on DNA, RNA and proteins; 2. Anatomy of A-, B-, Z-DNA, DNA bending and proteins; 3. Movies and animations of replication, DNA repairs, mutation, transcription and translation; 4. Numerical problems based in auxotrophic mutants, 5. Experimental evidence of replication, mutation, transcription, translation and proteins; 6. Molecular biology lab visit				
REFERENCES					
1. Alberts Bruce, 2017. Molecular Biology of the Cell. 6 th Ed. Garland Science. 2. Brown TA, 2018. Genomes. 4 th Ed. Garland science. 3. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2 nd Ed., Wiley-Blackwell. 4. Clark David, Pazdernik NJ, McGehee MR, 2019. Molecular biology. 3 rd Ed., Academic press. 5. Grotewold E, Chappell J, Elizabeth Kellogg E. 2015. Plant genes, genomes, and genetics. Wiley-Blackwell. 6. Krebs JE, Goldstein ES, Kilpatrick ST, 2018. Lewin’s Genes XII. Jones and Bartlett learning. 7. Watson JD, 2017. Molecular biology of the gene. 7 th Ed, Pearson Education.					

B. Sc. (Hons.) BOTANY (4-years UG program)**MAJOR COURSES****SEMESTER V**

	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2025-2026
Bachelor of Science (Hons.) in Botany				
YEAR	3	BTM3025C Analytical techniques	CREDITS	3T+ 1P
Semester	1		HOURS	75
OBJECTIVES:		To understand the fundamentals of microscopy, spectroscopy and chromatography and their applications in biology.		
COURSE CONTENT / SYLLABUS				
UNIT-I	Advanced Microscopy techniques			15 hrs.
	Introduction to microscopy: Development of microscopes, basic principles of light and electron microscopy. Types of Microscopes: Light, Dark field, phase contrast, fluorescence, atomic force, confocal, polarization microscopy, Electron microscopy - Scanning & transmission, Scanning Probe, Inverted, Acoustic, X-ray, Pocket and USB microscopes. Advanced microscopes: Super-resolution microscopy, live-cell imaging, Cryo-electron microscopy. Applications of Microscopy in Biology, Medical, Environmental and Material sciences.			
UNIT-II	Spectroscopic techniques			15 hrs.
	Properties of light, Electromagnetic spectrum, Absorption and emission spectroscopy, Principles and applications of γ - ray, X-ray, UV-Vis Spectroscopy, Fluorescence spectroscopy, IR spectroscopy, ORD & CD, Raman, ESR and NMR spectroscopy, Photoelectron spectroscopy, Atomic absorption spectroscopy, Mass spectroscopy, FTIR.			
UNIT-III	Separation techniques			15 hrs.
	Principles of separation techniques (Polarity, ionic nature, size and shape). Chromatography: – Principles, applications, and methodology of: adsorption, Thin-layer (planar), partition, ion-exchange, molecular exclusion (gel filtration), affinity (hydrophobic interaction chromatography and hydroxyapatite chromatography), gas-liquid chromatography (high, ultra and fast performance liquid chromatography). Centrifugation: - Centrifugal force, Basic principles of sedimentation, types of centrifuges, types of rotors, types of centrifugations and safety aspects of centrifuges.			
UNIT-IV	Practical / laboratory work			30 hrs.
	1. Instruments: pH meter, Centrifuge (Bench, Cooling, and Ultra), spectrophotometer, calorimeter, GC and HPLC, NMR, Fluorescence microscope, Stereo-zoom microscope. 2. Sample analysis using Darkfield, Phase contrast and Fluorescence microscopes. 3. Experiments using calorimeters for qualitative and quantitative detection of biomolecules. 4. Experiments using spectrophotometer qualitative and quantitative detection of biomolecules. 5. Paper chromatography for plant pigments, amino acids, fatty acids and carbohydrates.			
REFERENCES				
1. Wilson and Walker's Principles and Techniques of Biochemistry and molecular biology 8 th Ed 2018 (Cambridge low-price editions) 2. Analytical Biochemistry and Separation Techniques a laboratory manual for B.Sc and M.Sc 5 th Ed by P. Palanivelu. 3. Handbook-of-Analytical-Techniques-by-Helmut-Gunzler-and-Alex- Williams , Wiley-vch. 4. Voet D, Voet JG (2018). Biochemistry. Global Ed., Wiley. 5. Joseph R. Lakowicz (2013) Principles of Fluorescence Spectroscopy, 3rd edition, 3rd edition. Springer Science & Business Media. 6. Berlyn, G.P. and Miksche, J.P. (1976) Botanical Microtechnique and Cytochemistry. 7. J Southworth, H.M. (1982) Introduction to modern microscopy. 8. Willard, H.H., Meritt, L.L., Dean, J.A. and Settle, F.A. (1986) Instrumental Methods of Analysis. 9. Rodney C.W. (2002) Biophysics : An introduction				

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES
SEMESTER V

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTE3005C Molecular techniques		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVES:		To understand the fundamental concepts and principles of molecular techniques and their applications in elucidating actions of biomolecules.			
COURSE CONTENT / SYLLABUS					
UNIT-I		ANALYSIS OF NUCLEIC ACIDS AND PROTEINS			15 hrs.
		Isolation of nucleic acids, qualitative and quantitate estimation of nucleic acids (DNA and RNA), isolation of proteins. Dialysis, Ultrafiltration and lyophilization. Electrophoresis – Principles and applications of paper, agarose gel, PFGE, CHEF, Field inversion gel electrophoresis, Native PAGE, SDS PAGE and 2D-PAGE. Foot printing/Gel retardation assay.			
UNIT-II		Blotting Techniques/methods:			15 hrs.
		Principle, methodology and applications of Southern blotting, Northern blotting, Western blotting and Eastern botting, In-situ hybridization, FISH, Colony hybridization, plaque assays, Preparation of probes for DNA, RNA and Protein, Dot blot, Yeast one hybrid and two hybrids. DNA sequencing and its different methods, Chemical synthesis of DNA, Microarrays and gene manipulation, GWAS, NGS.			
UNIT-III		Polymerase Chain Reaction and Immunotechniques			15 hrs.
		Principle of PCR, Master-mix, types of PCR, applications, precautions and limitations of PCR. RT-PCR, Inverse PCR, Nested PCR, AP-PCR, Multiplex PCR, ARMS-PCR, Asymmetric PCR, Real Time PCR, RAPD, RACE and AFLP. Introduction to immunochemical techniques, immune precipitation, labelling of Antibody, Immune assays, Immuno histo/cytochemistry, CHIP, ELISA, Radioactivity and measurements. Cell sorting and flow cytometry.			
UNIT-IV		Practical / laboratory work			30 hrs.
		Molecular biology Lab visit (within university campus); DNA isolation – genomic and plasmid; Gel pictures of Genomic and Plasmid DNA prep; Models of restriction enzymes and its calculations; Models and problems of restriction sites on plasmid DNA; Problems of Genetic engineering and rDNA technology; Plant tissue culture basics and media; Demonstration of varieties of culture techniques			
REFERENCES					
1. Primrose SB, Twyman R, 2009. Principles of gene manipulation and genomics. 7th Ed, Wiley. 2. T.A. Brown Gene Cloning and DNA Analysis 8 th Ed, 2021. Wiley Blackwell 3. Molecular Biology, 3 rd Edition David P. Clark, Nanette J. Pazdernik and Michelle R. McGehee (Academic press Elsevier) 4. Sambrook et al., 2014. Molecular cloning: a laboratory manual part 1 to 3. 4th Ed., Cold spring harbor laboratory press. 5. Biotechnology 2 nd Ed. David P. Clark (Academic press ELSEVIER) 6. Biochemistry A Short Course 4 th ED 2019. Lubert Stryer Freeman Macmillan learning 7. Singh BD, 2011. Plant biotechnology. 2nd Ed, Kalyani publishers. 8. Bhojwani SS, Soh WY, 2003. Agrobiotechnology and plant tissue culture. Science publishers. 9. Thorpe Trevor et al., 2013. Plant tissue culture: Techniques and experiments. 3rd Ed, Academic press.					

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES
SEMESTER V

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTE3015C Applied phycology, mycology, and pathology		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVE S		To study the life cycle of different members of Algae, fungi and lichens and their adaptive strategies. To develop an understanding of various plant diseases, plant defense responses and disease management.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Applied Phycology			15 hrs.
		Phycology: Characters, Range of thallus, Reproductive Methods, Chemical constituents of sea weeds, Techniques in algae: General preservation methods of algae, Culture methods for fresh water (<i>Chlorella</i>) and marine water alga (<i>Gracillaria</i>), symbiotic associations of algae. Life cycles of important forms: <i>Ulva</i> , <i>Laminaria</i> , <i>Porphyra</i> and <i>Gracillaria</i>			
UNIT-II		Applied Mycology			15 hrs.
		Introduction- General Characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction. General characteristics, ecology and significance, life cycle: <i>Penicillium</i> , <i>Alternaria</i> , <i>Puccinia</i> . Symbiotic associations of fungi: Lichen: Occurrence, characteristics, forms, range of thallus organization & reproduction. Mycorrhiza: characteristics, thallus (Glomeromycota) organization. Importance.			
UNIT-III		Plant Pathology			15 hrs.
		Disease concept, Classification of diseases, Disease triangle, Disease cycle Symptoms, Causal organism, Disease cycle and Control measures of the following: Diseases caused by fungi: White rust of crucifers, Red rot of sugarcane, Tikka disease of ground nut, Stripe rust of wheat. Diseases caused by bacteria: Citrus canker, angular leaf spot of cotton; Diseases caused by Viruses: Leaf curl of papaya, Yellow leaf vein mosaic of Bhindi, Tobacco mosaic.			
UNIT-IV		Practical / laboratory work			30 hrs.
		1. Life cycles of important forms: <i>Ulva</i> , <i>Laminaria</i> , <i>Porphyra</i> and <i>Gracillaria</i> 2. Study life cycle of <i>Penicillium</i> , <i>Alternaria</i> , <i>Puccinia</i> to identify them. 3. Analysis of Growth Characteristics of Filamentous Fungi in Different Nutrient Media. 4. Study examples of plant diseases caused by fungi, bacteria and Viruses. 5. Study examples of lichens. 6. Isolation of fungal strains from soil and other substratum 7. Preparation of PDA medium. Study principles and working of instruments like autoclave and laminar air flow etc. 8. Preparation of medium for algal cultivation and Algal culture.			
REFERENCES					
1. Alexopolous C J and Mims C W and Blackwell M. (1996). Introductory Mycology. 4 th edition. John Wiley & amp; Sons (Asia) Singapore. 2. Vasishta, B.R. (1974) Botany for Degree students Vol I Algae 3. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India. 4. Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi and Their Allies, Macmillan Publishers India Ltd. 5. Sharma Neeta, Avantina Sharma and Abhishek Tripathi (2018). Basic plant Pathology 6. Y.S. Paul 2nd edition Textbook of Mycology and Plant pathology. 7. Smith M E and Read DJ. (2008). Mycorrhizal symbiosis. 8. Varma, Ajit, Prasad, Ram, Tuteja. (2017). Mycorrhiza: State of the Art, Genetics and Molecular Biology, Eco-Function, Biotechnology, Eco-Physiology, Structure and Systematics. 9. Robert Edward Lee. 2008. Phycology.					

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES

SEMESTER V

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMI C YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTE3025C Plant Management in Public spaces		CREDITS	3T+1P
Semester	1			HOURS	75
OBJECTIVES:		To familiarize the students with structure and function of plant tissue system			
COURSE CONTENT / SYLLABUS					
UNIT-I		Ornamental Plants			15 hrs.
		Ornamental plant diversity; Ornamental trees – flowering and foliage trees, palms and cycads, coniferous trees, deciduous trees; Ornamental shrubs – classification of shrubs, flowering shrubs, monocot and dicot foliage shrubs, Climbers and creepers – classification, foliage and flowering creepers and climbers, Bulbous plants for warm and cold seasons			
UNIT-II		Landscaping			15 hrs.
		Principles of landscaping, diversity of public landscapes, Plant utility in common public landscapes like public gardens, commercial establishments, academic institutions, roads etc. Functional vs aesthetic utility of plants in public landscape spaces. Maintenance issues with plants in public spaces. Common pests and diseases with trees in public spaces and their treatment.			
UNIT-III		Vegetation in public spaces			15 hrs.
		History of gardens- garden types and styles, famous gardens of the world and India. Specialty gardens, their principles and their management needs in India i.e. botanical gardens, butterfly gardens, halophyte and desert gardens, Arogyavan, Nakshatravan. Miyawaki forest system, its utility and limitations in the Indian scenario. Plants in religio-cultural spaces e.g. sacred grooves, graveyards etc.			
UNIT-IV		Practical / laboratory work			30 hrs.
		• Preparation of a landscape plan for a specialty garden including a map. • Visit to any two public gardens of Vadodara (except sayajibaug) and their report preparation. • Visit to Miyawaki garden developed of SOCLEEN and food garden. 1. Preparation of charcoal traces of bark of different common trees. 2. Identification and classification of common trees using veg characters 3. Identification of common foliage herbs used in institutional establishments. 4. Identification of common insect pests found on ornamental pests. 5. Identification of different underground plant parts like corms, cormels, bulbs etc. 6. Particulate matter trapping by leaves of different trees.			
REFERENCES					
1. Acquaah, George (2002) Horticulture – Principles and practices, 2nd Edition, Pearson Education Asia, New Delhi, 787p (ISBN-81-7808-832-0) 2. Hartmann, H.T., Kester, D.E., Davies, F.T., and Geneve, R.L. (2015) Plant propagation – Principles and practices, 8th Edition, PHI learning private Ltd, New Delhi, 915p (ISBN – 978-81-203-5024-3) 3. Thekkayam Sabina (2009), Ornamental plants, New India Publishing Agency, New Delhi, 320 p (ISBN-978-81-90851-26-8) 4. Das, S.N. (2010) Growing bulbous ornamental plants, Agrotech publishing academy, Udaipur, 240p (ISBN-8185680825) 5. Bernard O Dodge (2011) Diseases and pests of ornamental plants, Read Books, New Delhi, 648p (ISBN-987-1447417538) 6. Hannah Lewis and Paul Hawken (2022) Mini-Forest revolution: Using the Miyawaki Method to rapidly rewild the world, Chelsea Green Publication Co., 206p, (ISBN – 978-1645021278)					

B. Sc. (Hons.) BOTANY (4-years UG program)
SEC COURSES

SEMESTER V

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	SEC3635C Plant resource management and innovation		CREDITS	1T+ 1P
Semester	1			HOURS	45 hr
OBJECTIVES: To make familiar the students with different forest produce and their utility					
COURSE CONTENT / SYLLABUS					
UNIT-I		Introduction, non-timber forest produce (NTFP), wild food resources- wild vegetables, tubers, fruits, millets. Plant – Innovation and technological advance Plant intelligence, Memories without brain, moving without muscles, The sublime art of Mimesis, Green democracies, The capsiphagous and other slaves of plants, Archi plants, Living without fresh water, plants to planetoids space plants.			15 hrs.
UNIT-II		Practical / laboratory work 1. Wild plant used as leafy vegetables – <i>Suaeda nudiflora</i> (Willd.) Moq., <i>Trianthemma monogya</i> , <i>Boerhavia diffusa</i> , <i>Moringa concanensis</i> , <i>Amranthus virdis</i> , <i>Chlorophytum</i> leaves, <i>Aloe vera</i> inflorescence etc. 2. Wild plant used as tuber – <i>Pureria tuberosa</i> , <i>Phaseolous vexilata</i> , <i>Dioscorea</i> species, <i>Curcilago orchiodes</i> etc. 3. Frutis- <i>Spondia pinnata</i> , <i>Carrisa caranda</i> , <i>Capparis decidua</i> , Tender <i>Oroxylum</i> fruits etc. 4. Plant intelligence – Observing the leaf movement in <i>Mimosa pudica</i> , <i>Biophytum sensitivum</i> 5. Moving without muscles – Observing seeds and Fruits across different families 6. The sublime art of Mimesis – Cacti correlations 7. The capsiphagous and other slaves of plants – Plants used as spices 8. Archi plants – Observing plants like <i>Nymphea</i> , <i>Nelumbo</i> , <i>Calotropis</i> , <i>Aristolochia</i> flowers, <i>Stereospermum</i> , <i>Pterospermum acerifolium</i> etc 9. Living without fresh water – suitable examples from arid and semi-arid zones 10. Plants to planetoids space plants – plant robotics in association with technology department			30 hrs.
REFERENCES					
1. Stefano Mancuso. The Revolutionary Genius of Plants, Atria Books					

B. Sc. (Hons.) BOTANY (4-years UG program)
SEC COURSES

SEMESTER V

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany					
YEAR	3	SEC3645C Biological image acquisition and processing		CREDITS	2P
Semester	1			HOURS	60
OBJECTIVES:		To impart knowledge of image acquisition and processing for scientific analysis and research publications.			
COURSE CONTENT / SYLLABUS					
UNIT-I	BIOLOGICAL IMAGE ACQUISITION				30 hrs.
	1. Photography – field, wet mount 2. Basics of videography 3. Microscopic image acquisition by stereo-zoom for biological specimen 4. Microscopic image acquisition by Fluorescence microscopes 5. Microscopic image acquisition by confocal microscopes 6. High-resolution light microscope-based image acquisition for anatomy 7. 3D image acquisition 8. Aerial photography (UAV): Drones, specialized vehicles (Different parameters to be considered during image acquisition) 9. Acquisition of gel images using X-ray, UV transilluminator and chemi-doc				
UNIT-II	BIOLOGICAL IMAGE PROCESSING				30 hrs.
	1. Photographs and video processing by commercial and open-source software 2. Image processing for light-microscopes: Micro-morphometric images 3. Image processing for light-microscopes: Anatomical images 4. Image processing for fluorescence images 5. Image processing for confocal images 6. Using ImageJ and other open-source image analysis software for images 7. Image editing and production of figures for scientific publication				
REFERENCES					
1. Peter K. Burian, Robert Caputo (1999). National Geographic Photography Field Guide: Secrets to Making Great Pictures (2 nd Ed.). National Geographic. ISBN 9780792256762 2. Fatima A. Merchant and Kenneth R. Castleman (2022). Microscope image processing (2 nd ed.). Academic press. ISBN 978-0-12-821049-9 3. Bryan Heit (2022) Fluorescent Microscopy. Springer Protocols. ISBN 978-1-0716-2051-9 4. Manuals and protocols for microscopes by Leica, Zeiss and such reputed manufacturers.					

B. Sc. (Hons.) BOTANY (4-years UG program)
SEC COURSES
SEMESTER V

 सत्यं त्विदं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany					
YEAR	3	SEC3655C Field Studies in Botany		CREDITS	2P
Semester	1			HOURS	60
OBJECTIVES:		To equip students with necessary skills that will enable them to study natural vegetation and prepare vegetation survey reports.			
COURSE CONTENT / SYLLABUS					
UNIT-I & II		1. Visit to any natural vegetated area\Research station\Experimental stations in and around Gujarat. 2. Survey of vegetation and associated large fauna of the study area. 3. To study the phytosociological parameters of the plant community of the area. 4. To prepare a vegetation study report.			60 hrs.
REFERENCES					
1. G.L.Shah 1978, Flora of Gujarat State, Sardar Patel University. 2. Cook, 1903, The flora of the presidency of Bombay, Taylor and Francis. 3. Ambasht and Ambasht ,2022, A Textbook of Plant Ecology, 16 Ed. 4. Mueller-Dombois and Ellenberg, 2003, Aims and Methods of Vegetation Ecology, The Blackburn Press.					

B. Sc. (Hons.) BOTANY (4-years UG program)
MAJOR COURSES

SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTM3006C Developmental Biology		CREDITS	3T+ 1P
Semester	2			HOURS	75
OBJECTIVES:		To develop an understanding of the plant development and study the genetic and molecular events involved in developmental processes.			
COURSE CONTENT / SYLLABUS					
UNIT-I	VEGETATIVE DEVELOPMENT				15 hrs.
	Plant model system; Organization and maintenance of shoot and root apical meristems, plant stem cell niches, pluripotent and totipotent stem cells; Primary and lateral root development; shoot branching; Leaf development, leaf identity, leaf polarity and leaf complexity; Organization and maintenance of vascular cambium, xylem and phloem development; Trichome, root hair and stomata development.				
UNIT-II	Floral development and gametogenesis				15 hrs.
	The transition from vegetative to reproductive development; flower development, Structure of a typical flower, ABC-DE model of floral organ development; Androecium- Anther structure and function, Microsporogenesis, Pollen morphology- Pollen wall structure, Gynoecium-Ovule structure, types, Megasporogenesis and Megagametogenesis. Embryo sac development; Genetic control of male and female gametophyte development.				
UNIT-III	Embryo and seed development				15 hrs.
	Pollination types and significance, Genetic self-incompatibility, Fertilization, Double fertilization; Embryogenesis, Dicot and monocot seeds, Endosperm development embryo and seed development, molecular basis of embryogenesis; genetic imprinting and Seed Development, endosperm development. Seed maturation, polyembryony and apomixes				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Life cycle of <i>Antirrhium</i> , <i>Arabidopsis</i> , and rice (growth, movies and animation); 2. Shoot and root apical meristem 3. Developmental pathways elucidation by mutants (photographic plates); 4. Development of anomaly analysis of vascular cambium, xylem and phloem (photographic plates); 5. Structure of primary and secondary cell wall; 6. Analysis of development of leaf; 7. Stages of flower development; 8. Stages of anther, and ovule and embryo development; 9. Pollen development and morphology and its viability; 10. Types of seed and germination; polyembryonic seeds.				
REFERENCES					
1. Bhojwani SS and Bhatnagar SP. 2002. The Embryology of Angiosperms, Vikas Publications, New Delhi. 2. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2 nd Ed., Wiley-Blackwell. 3. Evert RF. 2006. Esau’s Plant Anatomy. John Wiley & Sons, Inc. 4. Rose RJ. 2016. Molecular Cell Biology of the Growth and Differentiation of Plant Cells. CRC Press. 5. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Plant physiology and development. 6 th Ed, Oxford University press. 6. Reviews published in Trends in Plant Science, Plant Cell, The Plant Journal, Plant Physiology, New Phytologist, Development and Journal of Experimental Botany.					

B. Sc. (Hons.) BOTANY (4-years UG program)
MAJOR COURSES
SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTM3016C		CREDITS	3T+ 1P
Semester	2	Community and ecosystem ecology		HOURS	75
OBJECTIVES:		To familiarize the students with structure and functioning of the community and ecosystem levels of ecological hierarchy. It also introduces major issues is climate change biology			
COURSE CONTENT / SYLLABUS					
UNIT-I	Community ecology				15 hrs.
	Introduction to community: Biological and physical structure of Community, Community boundaries (Ecotones & Edges). Characteristics of Community –Analytical and Synthetic Characters. Methods to study plant community. Community succession. Species interactions (2)				
UNIT-II	Ecosystem ecology				15 hrs.
	Introduction to ecosystems: Structure, function and diversity of ecosystems. Ecosystem energetics – Energy flow, food chains, food webs. Productivity and decomposition in ecosystems. Biogeochemical cycling of major components.				
UNIT-III	Ecological biogeography				15 hrs.
	Characteristics, diversity and functioning of terrestrial, aquatic and wetland ecosystems. Biome ecology and largescale patterns in plant distribution. Introduction to Climate change ecology, El-nino and La-nina phenomena.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. To determine minimum size of quadrat using species-area curve method. 2. Field study to collect basic phytosociological data for herbaceous vegetation using quadrat studies. 3. Calculation of quantitative characters of community (frequency, density, abundance, basal area and dominance) 4. Preparation of rank-abundance curves and IVI. 5. Calculation of different diversity indices (Shannon-Weiner Index, Simpson's Index, Sorenson's coefficient of community). 6. Estimation of primary productivity (using dark bottle method). 7. Estimation of litter decomposition rate (using pit method). 8. Impact of human disturbance on vegetation. 9. Solving Problems based on productivity (energy efficiency for different trophic level). 10. Preparation of terrarium (to study ecological succession). 11. To study the species composition of an area for analyzing biological spectrum and comparison with Raunkier's normal biological spectrum. 12. Estimation of biomass. 13. To determine plankton biomass of pond. 14. To study effect of inter-species competition on plant growth.				
REFERENCES					
1. Smith, T.M. and Smith, R.L. (2016). Elements of Ecology, 9th Global Edition, Pearson Publications, 706p (ISBN-1-292-07740-9). 2. Sharma, P.D. (2015) Ecology and Environment, 13th Edition, Rastogi Publications, 803p (ISBN-78-9350780688) 3. Ambasth R.S. and Ambashth, N. K. (2017). A textbook of plant Ecology, 15th Edition, CBS Publications, 444p, (ISBN-978-8123916002) 4. Odum, E. P. (2017) Fundamentals of Ecology, 5th Indian Edition, Cengage India Publications, 624p, (ISBN- 978-8131500200) 5. Begon, M and Townsend, C. (2021) Ecology – from Individuals to Ecosystems, 5th Editions, 864p, Wiley Publications, (ISBN- 978-1119279358)					

B. Sc. (Hons.) BOTANY (4-years UG program)
MAJOR COURSES
SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTM3026C Plant biotechnology		CREDITS	3T+ 1P
Semester	2			HOURS	75
OBJECTIVES:		To familiarize the students with major principles and applications of Plant Biotechnology.			
COURSE CONTENT / SYLLABUS					
UNIT-I	PLANT TISSUE CULTURE				15 hrs.
	Concepts of plant tissue culture, Scope and importance in plant Improvement; Totipotency and in vitro morphogenesis; Nutritional requirements of in vitro cultures, culture media; Role of plant hormones in in vitro morphogenesis, Direct and indirect organogenesis, Micropropagation, meristem culture, shoot tip culture, anther culture, endosperm culture. Somatic embryogenesis and synthetic seeds; Somaclonal variation.				
UNIT-II	Genetic engineering				15 hrs.
	Concept of genetic engineering, scope and importance, methods of gene cloning, type of Vectors; binary vector system, Ti and Ri Plasmids; Direct and indirect methods of gene transfer in plants, chloroplast transformation, screening and selection of transformants, selection markers (nptII, hpt, bar, gox) and reporter genes (GUS, GFP, Luciferase). Genetic and molecular analyses of transgenics.				
UNIT-III	Applications of transgenics				15 hrs.
	Transgenic and Cisgenic approaches for plant improvement; RNAi, gene knockouts and overexpression, gene stacking, Gene editing tools: CRISPR-Cas system, Zinc finger nucleases, TALENs; achievements in crop biotechnology, environment and industry (suitable example), virus resistant plants (Rainbow and Sunup Papaya), insect resistant plants (Bt cotton, Bt-peanut and BT-Brinjal), herbicide resistant (Roundup Ready Soyabean, Corn, canola), disease and stress tolerance, transgenic crop with improved quality (flavrSavr tomato, golden rice, Amflora potato, Zeaxanthin potato, Purple tomato, Arctic apples, Blue rose, Moondust carnation), role of transgenic in pollution degradation (super-bug), leaching of minerals, production of industrial enzymes, edible vaccine, transgenic plants as bioreactors, biosafety issues of transgenics.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Laboratory set-up for tissue culture and genetic engineering, 2. Preparation of culture media, 3. Handling and sterilization of media and explants, Inoculation and subculturing, 4. Cell, tissue and organ culture, 5. Vectors for gene cloning, 6. Preparation of competent cells, 7. Transformation of <i>E. coli</i> and <i>Agrobacterium</i> , 8. Culture of transformed <i>E. coli</i> and <i>Agrobacterium</i> cells, 9. Gene transfer methods in plants, 10. Selection of transformed plants, 11. Verification of transgenics (T-DNA, Bt-cotton)				
REFERENCES					
1. Bhojwani SS, Soh WY, 2003. Agrobiotechnology and plant tissue culture. Science publishers. 2. Primrose SB, Twyman R, 2009. Principles of gene manipulation and genomics. 7 th Ed, Wiley. 3. Primrose SB. 2001. Molecular Biotechnology. Panima. 4. Razdan MK, 2019. Introduction to Plant Tissue culture. 3 rd Ed, Oxford and IBH Pub. 5. Sambrook et al., 2014. Molecular cloning: a laboratory manual part 1 to 3. 4 th Ed., Cold spring harbor laboratory press. 6. Singh BD, 2011. Plant biotechnology. 2 nd Ed, Kalyani publishers. 7. Thorpe Trevor et al., 2013. Plant tissue culture: Techniques and experiments. 3 rd Ed, Academic press.					

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES
SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTE3006C Plant breeding and crop improvement		CREDITS	3T+ 1P
Semester	2			HOURS	75
OBJECTIVES:		To familiarize the students with major principles and applications of Plant Breeding.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Plant propagation and in vitro culture				15 hrs.
	Plant propagation methods, Principles of grafting and budding, Grafting and budding methods, characteristics of scion and rootstocks, interstocks, Scions and Rootstocks of important vegetables, ornamentals and fruits trees; Graft-union; Vascular cambium and differentiation of phloem and xylem in graft union, physiological and genetic basis of graft-union, genetic limits of grafting, graft-incompatibility; Effects of rootstock on scion and scion on rootstock; micro-grafting, chimeric grafting or Transgrafting. Tissue culture and its application in plant breeding; wide hybridization and Embryo rescue; cell culture, Protoplast isolation, Culture, Manipulation and Fusion of protoplast, somatic hybridisation, somatic hybrids and cybrids, Applications in crop improvement.				
UNIT-II	Plant breeding methodologies				15 hrs.
	Introduction and objectives of plant breeding, breeding systems-modes of reproduction in crop plants, important achievements and undesirable consequence of plant breeding. Methods of crop improvement: Introduction- centres of origin and domestication of crop plants; Plant genetics resources, acclimatization, selection methods- for self-pollinated, cross pollinated, and vegetatively propagated crops, hybridization- procedure, advantages and limitations. Mass selections and Pure line selection, Back cross method; polyploidy and mutation breeding; Wild relatives and evolution of crops.				
UNIT-III	Advanced Plant Breeding				15 hrs.
	Heterosis and hybrid seed production, Self-incompatibility and male sterility and their importance in plant breeding, Use of genetic self-incompatibility and male sterility in F1 hybrid seed production, Engineering male sterility, Inbreeding and inbreeding depression, effect of outcrossing. Molecular Breeding approaches; Marker-Assisted Selection (MAS); Genome-wide association studies (GWAS). Plant breeders’ rights and regulations for plant variety protection and farmers rights.				
UNIT-IV	Practical / laboratory work				30 hrs.
	1. Visit to experimental plant breeding setup, 2. Identification of important weeds of crop field; 3. Floral structure and biology of self-pollinated and cross pollinated crops; 4. Emasculation and hybridization techniques in self-pollinated crops, 5. Emasculation and hybridization techniques in cross pollinated crops; 6. Handling of segregation populations: 7. Pedigree method, analysis of segregating populations and their evaluation; 8. Designs used in plant breeding experiment, 9. Analysis of Randomized Block Design; 10. Cataloguing and preservation of specimens; 11. Maintenance of experimental records; 12. Analysis of male sterility in crops; 13. Analysis of crop seed variability; 14. Analysis of crop seed viability; 15. Detection of mutations for agronomic traits, 16. Analysis of main characteristics of released crop varieties.				
REFERENCES					

1. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
2. B.D. Singh, 2006. Plant breeding. Kalyani Publishers.
3. Bhojwani SS, Soh WY, 2003. Agrobiotechnology and plant tissue culture. Science publishers.
4. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
5. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
6. Hartmann HT, Kester DE, Davies FT, Robert L. Geneve RL. 2014. Hartmann & Kester's Plant Propagation: Principles and Practices. Pearson Prentice Hall.
7. Poehlman JM, 2005. Breeding field crops. Blackwell publishers.
8. Singh BD, 2011. Plant biotechnology. 2 nd Ed, Kalyani publishers.

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES
SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science (Hons.) in Botany					
YEAR	3	BTE3016C In silico biology		CREDITS	3T+ 1P
Semester	2			HOURS	75
OBJECTIVES:		To understand the basic principles and applications of statistics and Bioinformatics.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Foundations of biostatistics			15 hrs.
		Introduction to Biostatistics, Types of Biological data, Accuracy and significant figures, Frequency & cumulative frequency distributions. Populations and samples: Populations, Methods of sampling, Experimental design. Descriptive statistics: Descriptive methods for categorical data and continuous data. Probabilities: Permutations & combinations, sets, Probability of an event (Adding and multiplying), contingency tables.			
UNIT-II		Data analysis techniques			15 hrs.
		Probability distribution, Discrete random variables and continuous random variables, Normal distribution: Symmetry and kurtosis, distribution of Means. Measures of central tendency: Arithmetic mean, Median, Quartiles, Mode and other measures. Measures of dispersion and variability: Range, Mean deviation, Variance, Standard deviation, Coefficient of variance. Hypothesis testing: Parametric and non-parametric tests. Correlation and Regression.			
UNIT-III		Basics of Bioinformatics			15 hrs.
		Introduction to bioinformatics, overview and exploring available bioinformatics resources like PUBMED, NCBI, EBI, EMBL, UNIPORT, TAIR, Phytozome, gene bank, gene expression database etc; Applications of bioinformatics in plant sciences. Database search using BLAST, FASTA; Gene Prediction (GENSCAN, GRAIL, FGENESH); Pair-wise alignment of protein and DNA (CLUSTAL-W), Phylogenetic Analysis: Maximum Likelihood, Parsimony methods; Interpretation of output and its biological significance for DNA and protein sequences; Primer designing and its guidelines, Image J program and its applications.			
UNIT-IV		Practical / laboratory work			30 hrs.
		1. Computational exercises and data interpretation, 2. Measures of central tendency, t-test, chi-square test, 3. Analysis of variance, 4. Probability distribution, 5. Graphical Representation. 6. Analysis and usage of expression and gene databases, 7. Retrieval of DNA and protein sequences from databases, gene prediction analysis; 8. BLAST analysis, Multiple sequence analysis, 9. Primer designing tools, 10. Phylogenetic analysis using DNA and protein sequences, 11. Image J analysis of microphotographs.			
REFERENCES					
1. Forthofer, RN, Lee, ES, & Hernandez, M 2006. Biostatistics: a guide to design, analysis and discovery. Elsevier. 2. Daniel, W. W., Cross, C. L. 2017. Biostatistics: basic concepts and methodology for the health sciences. Wiley. 3. Rastogi V.B. 2015. Biostatistics. Medtech Publications. 4. Selvin, S. 2004. Biostatistics: How it works. Pearson Education Publications. 5. Annadurai, B. 2007. A Textbook of Biostatistics. New Age International. 6. Zar, J. H. 1999. Biostatistical analysis. Pearson Education India. 7. Pagano, M., Gauvreau, K., & Mattie, H. 2022. Principles of biostatistics. Chapman and Hall/CRC. 8. Arthur M. Lesk. 2003. Introduction to Bioinformatics, Oxford University Press, Indian edition. 9. Des Higgins and Willie Taylor. 2000. Bioinformatics, Sequence, structure and databanks. A practical approach. Oxford University Press, Indian edition, Second impression, New Delhi. 10. Rastogi, S.C., Mediratta, N. and Rastogi. P. 2004. Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd., New Delhi. 11. Baxevanis, A. D. and Ouellette, B. F. F. 2002. Bioinformatics: A Practical Guide to the analysis of Genes and Proteins. (2nd Ed.), New York, John Wiley & Sons, Inc. Publications. 12. Attwood, T. K. and Parry-Smith, D. J. 2001. Introduction to Bioinformatics Delhi. Pearson Education (Singapore) Pvt. Ltd					

B. Sc. (Hons.) BOTANY (4-years UG program)
MINOR / ELECTIVE COURSES
SEMESTER VI

	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany					
YEAR	3	BTE3026C Home and aquatic plants and plant propagation		CREDITS	2T+2P
Semester	2			HOURS	90
OBJECTIVES:		To train students on the general methods of propagation of common ornamental plants and understanding the diversity of home and aquatic plants.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Home Plants Indoor and outdoor home plants and their diversity, Requirements for cultivation and maintenance of indoor plants. Bonsai- scientific and aesthetic principles involved in bonsai preparation and maintenance. Utility of indoor plants e.g. oxygen plant, lucky bamboo, money plant etc. Requirements and cultivation of outdoor home plants. Cultural and religiously important home plants				15 hrs.
	Aquatic plants Aquatic plants and their diversity. Sourcing and cultivation of indoor aquatic plants. Diversity of aquarium plants and their growth and management. Concept of aquatic gardens. Growing aquatic plants in terraces, balconies and open home spaces. Economic importance of aquatic plants. Aquatic plant cultivation on commercial scale				
UNIT-II	Practicals 1. Exhibition of ornamental plants as part of Science Day celebrations (major task to be completed by all concerned students) 2. Participation in any one external competition by any organization in Vadodara city. 3. Project on major commercial suppliers of different types of ornamental plants in Vadodara and their comparative assessment. 4. Visit to tree transplantation site 5. Garden implements used in plant vegetative propagation. 6. General climatic instruments used in gardening. 7. Practical use of major garden instruments – lawn mower and branch cutter 8. Practical use of major garden instruments – hedge cutter and herb trimmer 9. Plant propagation through seeds 10. Plant propagation through cuttings – root, stem and leaf cutting 11. Plant propagation through layering – types 12. Plant propagation through grafting – different types and utility in different plants 13. Methods and use of different PGRs for rooting of vegetatively propagated plants. 14. Substrate preparation for garden soils 15. Substrate preparation for soils used in pots and indoor plants 16. Diversity of shapes, sizes of pots and plates. 17. Demonstration of vermicomposting and millicomposting. 18. Demonstration of leaf composting by fungi and bacterial consortia. 19. Irrigation types in gardens and homes (overhead, surface, underground and drip). 20. Weeding and pruning – general technique, use of auxins as weedicides. 21. Requirements for Bonsai preparation.				60 hrs.
REFERENCES					
1. Acquaah, George (2002) Horticulture – Principles and practices, 2 nd Edition, Pearson Education Asia, New Delhi, 787p (ISBN-81-7808-832-0) 2. Hartmann, H.T., Kester, D.E., Davies, F.T., and Geneve, R.L. (2015) Plant propagation – Principles and practices, 8 th Edition, PHI learning private Ltd, New Delhi, 915p (ISBN – 978-81-203-5024-3) 3. Cook, Christopher DK. (1996) – Aquatic and Wetland Plants of India: A reference book and Identification manual, Oxford University Press, UK, 385 pages, (ISBN-978-0198548218) 4. William Tricker (2018), Tub garden collection: Water lilies, aquatic plants and ornamental fishes, Forgotten books, 56p (ISBN – 978-0428147303). 5. Bhattacharjee, S.K. (2006) Bulbous ornamentals and aquatic plants, Pointer Publishers, Jaipur, (ISBN-81-7132472x) 6. Hiscock, P. (2003), Encyclopedia of Aquarium Plants. Interpret, 205p, (ISBN- 9781903098462)					

B. Sc. (Hons.) BOTANY (4-years UG program)
ABILITY ENHANCEMENT COURSES
SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in		ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany					
YEAR	3	AEC3406C		CREDITS	2P
Semester	2	Basics of scientific writing		HOURS	60
OBJECTIVES:		To improve skills of scientific writing among students for their research career. To prepare students for career in writing and journalism in life science.			
COURSE CONTENT / SYLLABUS					
		BASICS OF SCIENTIFIC LITERATURE 1. General guidelines in scientific writing: Academic integrity, building an argument, critical reading and writing 2. Introduction and examples of types of scientific publications: Newspaper, Journal, Book, Thesis, Monographs, social media 3. Search engines: PubMed, Google Scholar, AI tools and others. 4. Detailed analysis of a Monographs – Thesis (Master and PhD) 5. Detailed analysis of a Journal Articles (Examples of various types of research articles from reputed peer reviewed journals) 6. Detailed analysis of a Book and book chapter (Textbook and thematic books) 7. Analysis of a Newspaper and social media – popular science writings 8. Guidelines of publications (Examples of reputed peer reviewed Journals) 9. Introduction to Peer reviewed Journals, indexing, impact factor, APC, editor and review process 10. Editing and proofreading 11. Use of AI and tools WRITING SCIENTIFIC LITERATURE 1. Writing a newspaper article for a given research article 2. Writing an abstract for a given research article 3. Impactful title, abstract, conclusion and summary for a research article 4. Literature review and synthesis (extracting and paraphrasing) 5. Writing clear and reproducible methods for research 6. Representation of scientific data based on figures and tables (Prepare writeup based on given figures and tables) 7. Writing a research article, review, and book chapter 8. Writing a research proposal 9. Writing a project completion report 10. Writing bibliography for scientific publications: citations, styles, bibliographic software (Mendeley, Endnote) 11. Introduction to plagiarism: types and software 12. Career development: Statement of purpose, research statement and cover letter		60 hrs.	
REFERENCES					
1. University of Wisconsin-Madison. The Writing Center (2021). UW-Madison writer’s handbook. 2. Gladwell, Malcolm (2021). How to write a good argumentative essay: easy step-by-step guide. 3. Amgoud, L. (2009). Using arguments for making and explaining decisions. Artificial Intelligence, 173, 3-4, pp. 413-436. 4. Pirozzi, R., Starks-Martin, G., and Dziewisz, J. (2014). Critical Reading, critical thinking: a contemporary issues approach. 4th ed. Harlow: Pearson Education. ISBN-13: 978-0205100156 5. Joshi, Y. (2013). 9 tips on presenting your table effectively. Editage Insights. 6. Rodrigues, V. (2013). Tips on effective use of tables and figures in research papers. Editage insights. 7. Gahan, C. (2019). How to paraphrase sources. 8. Roig, M. (2010). Plagiarism and paraphrasing criteria of College and University professors. Ethics & Behavior, 11, 3, pp. 307-323. 9. Rowe, (2011). Towards a greater diversity in writing styles, argumentative strategies and genre of manuscripts. European Journal of Information Systems, 20, pp. 491–495. 10. Pain, E. (2018) How to write your Ph.D. thesis. Sciencemag.org. 11. Single, P.B. (2009). Demystifying dissertation writing: A streamlined process from choice of topic to final text. Stylus Publishing. ISBN: 978-1579223137 12. Jones, MP (2022) Scientific writing: A complete guide (Scientific writing for beginners). Mitchell P Jones. 13. Gastel B, Day R (2024) How to write and publish a scientific paper (9 th Ed.). Cambridge university press. ISBN 9781009477536 14. Hilary Glasman-Deal (2010). Science research writing for non-native speakers of English (1 st Ed.). Imperial college press. 15. Any articles of Journal, newspapers, books, and webpages of relevance					

B. Sc. (Hons.) BOTANY (4-years UG program)
SKILL ENHANCEMENT COURSE

SEMESTER VI

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Botany Sayajigunj, Vadodara – 390002. head-botany@msubaroda.ac.in			ACADEMIC YEAR 2025-2026	
Bachelor of Science in Botany						
YEAR	3	SEC3446C Internship in Botany			CREDITS	4P
Semester	2				HOURS	120
OBJECTIVES:						
To train students on the general methods of propagation of common ornamental plants and understanding the diversity of home and aquatic plants.						
COURSE CONTENT / SYLLABUS						
1	Any of the following: Hands on training, short research project, seminar attendance, read assigned journal to prepare for seminar, study certain entrepreneurs, study of enterprises / farmers, social projects					120 hours