

**Vitthalbhai Patel & Rajratna P. T. Patel Science College
(Autonomous)**



(Reaccredited with 'A' Grade by NAAC (CGPA 3.13)
Affiliated to SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
Syllabus effective from the Academic Year 2026-2027



(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester-VI

Course Code	US06MABOT01	Title of the Course	PLANT ECOLOGY AND PHYTOGEOGRAPHY
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. To understand the basic concepts of ecology and its interactions. 2. To study the local and geographical distribution, structural adaptations of organisms in particular environmental factors.
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Course Content		
Unit	Description	Weightage* (%)
1.	Plant Ecology: Introduction, Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis. Soil: Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.	25%
2.	Water: Importance; States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table. Light, temperature, wind and fire. Variations; adaptations of plants to their variation.	25%
3.	Biotic interactions: Trophic organization, basic autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop. Plant communities: Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts. Ecosystems: Structure; Processes; Trophic organization; Food chains and Food webs; Ecological pyramids. Biogeochemical cycles: Carbon, Nitrogen and Phosphorus.	25%

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4.	Phytogeography: Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India	25%
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Teaching-Learning Methodology	Classroom interactions, Chalk and talk Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation –NEP 2020, KCG and CCE (Continuous and Comprehensive Evaluation.	Weightage (%)
1.	Internal Examination Evaluation includes Class Test (At least one)-15(30%), Quiz (At least one)-15(30%), Active learning-05(10%), Home Assignment-05(10%), Class Assignment-05(10%), Attendance-05(10%) This makes total 50 Marks.	50
2.	Semester End Examination(50 Marks)	50

Course Outcomes:	
1.	Understand ecological concepts, with significance of its interrelationships.
2.	Do analysis of various components of ecosystems.
3.	Learn the concepts of phytogeography at large scale.

Suggested Reference Books:

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Sr. No.	Reference Books
1.	Odum, E. P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2.	Singh, J. S., Singh, S. P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India
3.	Sharma, P. D. Ecology and Environment. Rastogi Publications, Meerut, India. 13th edition.
4.	Wilkinson, D. M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5.	Kormondy, E. J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

On-line Resources :GOOGLE BOOKS,INFLIBNET,GOOGLE WEB,SHODHGANGA

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(Bachelor of Science)(Undergraduate)

B. Sc. (UG) Semester-VI

Course Code	US06MABOT02	Title of the Course	ANGIOSPERM PLANT SYSTEMATICS
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. To study the concepts and importance of Plant systematic. 2. To learn the importance of herbarium preparation. 3. To learn describing plant, its classification and identification with classical as well as advanced methods.
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Course Content		
Unit	Description	Weightage* (%)
1.	Significance of Plant systematics: Introduction to systematics; Plant identification, Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora. Documentation: Flora, Monographs, Journals; Identification Keys: Single access and Multi-access.	25%
2.	Taxonomic hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). Botanical nomenclature: Principles and rules (ICBN); Ranks and names; typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.	25%
3.	Systems of classification: Plant classification approach (cladistics, phenetics, phyletics). Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist. Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series).	25%

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4.	Phylogeny of Angiosperms: Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).	25%
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Teaching-Learning Methodology	Classroom interactions, Chalk and talk Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation –NEP 2020, KCG and CCE (Continuous and Comprehensive Evaluation.	Weightage (%)
1.	Internal Examination Evaluation includes Class Test (At least one)-15(30%), Quiz (At least one)-15(30%), Active learning-05(10%), Home Assignment-05(10%), Class Assignment-05(10%), Attendance-05(10%) This makes total 50 Marks.	50
2.	Semester End Examination(50 Marks)	50

Course Outcomes:	
1.	Understand the significance of angiosperm plant Systematics with their taxonomic hierarchy.
2.	Learn nomenclature, systems of classification and phylogeny of angiosperm plants.
3.	Understand classical and modern taxonomical studies.

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Suggested Reference Books:

Sr. No.	Reference Books
1.	Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition
2.	Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
3.	Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics- A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
4.	Shah G. L. (1978); Flora of Gujarat State. Part I & II. Pub. By Sardar Patel University, Gujarat.
5.	Singh, Pandey and Jain: A Text Book of Botany-Angiosperms.

On-line Resources :GOOGLE BOOKS,INFLIBNET,GOOGLE WEB,SHODHGANGA

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(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester-VI

Course Code	US06MIBOT01	Title of the Course	INFORMATICS AND STATISTICS FOR BOTANY
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	1. Understand the scope and applications of bioinformatics in fields like genomics, proteomics, and drug discovery. 2. Learn to navigate key biological databases such as NCBI, UniProt, and KEGG for data retrieval and analysis. 3. Grasp the basics of descriptive and inferential statistics in the context of biological data. Apply statistical methods like mean, median, standard deviation, and range to analyze and interpret biological data.
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Course Content		
Unit	Description	Weightage* (%)
1.	Introduction to Bioinformatics Historical background, Aims and scope, bioinformatics in Genomics, Transcriptomics, Proteomics, Metabolomics, Systems biology and drug discovery, Applications and Limitations in bioinformatics. Biological databases Introduction to biological databases - Primary, secondary and composite databases. Study of following databases: NCBI (Genbank, PubChem, Pub Med and its tools (BLAST)), introduction to EMBL, DDBJ, Uni Prot, PDB, EXPASY and KEGG	50%
2.	Introduction to Biostatistics – Definition, statistical methods, biological measurement, kinds of biological data, functions of statistics and limitation of statistics. Data types and presentation Collection of data, sampling and sampling design, classification and tabulation, types of representations, graphic – bar diagrams, pie diagrams and curves Descriptive Statistics	50%

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	Measures of central tendency - mean, median, and mode; Measures of dispersion - range, standard deviation, and standard error.	
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Teaching-Learning Methodology	Classroom interactions, Chalk and talk Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation –NEP 2020, KCG and CCE (Continuous and Comprehensive Evaluation.	Weightage (%)
1.	Internal Examination Evaluation includes Class Test (At least one)-10(40%), Quiz (At least one)-05(20%),, Home Assignment-05(20%),Attendance-05(10%)Which makes total 25 Marks.	50
2.	Semester End Examination(25 Marks)	50

Course Outcomes: Upon completion of this course, the students will be able to:	
1.	The student will understand • the basics of bioinformatics and develop awareness of the interdisciplinary nature of this field. • learn about biological databases, sequence retrieval, alignment, and phylogenetic analysis using various tools. • understand the basic concept of sampling methods, data classification, presentation and statistical analysis.



Suggested Reference Books:

Sr. No.	Reference Books
1.	Ghosh, Z., Mallick, B. (2008). <i>Bioinformatics – Principles and Applications</i> , 1st edition. New Delhi, Delhi: Oxford University Press.
2.	Baxevanis, A.D., Ouellette, B.F., John (2005). <i>Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins</i> , 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.
3.	Roy, D. (2009). <i>Bioinformatics</i> , 1st edition. New Delhi, Delhi: Narosa Publishing House
4.	Andreas, D., Baxevanis, B.F., Francis, Ouellette. (2004). <i>Bioinformatics: A practical guide to the analysis of genes and proteins</i> , 3rd edition. New Jersey, U.S.: John Wiley and Sons.
5.	Khan, I.A., Khanum, A. (2004). <i>Fundamentals of Biostatistics</i> , 5th edition. Hyderabad: Ukaaz publications

On-line resources : Shodhganga, INFLIBNET

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(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester-V

Course Code	US06MIBOT02	Title of the Course	Practical	
Total Credits of the Course	02	Hours per Week	04	

Course Objectives:	To build an understanding in silico/computational approaches in various aspects of understanding biology and biological research.
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No	Practical
1.	1. Biological databases (NCBI, EMBL, UniProt, PDB) 2. ExPasy-Enzyme nomenclature database 3. Sequence retrieval (protein and gene) from NCBI (formats - FASTA, GenBank) 4. Protein Structure retrieval from PDB (in pdb format) and visualization by viewing tools (Ras Mol/ J mol/Mol*/Swiss 3D Viewer/Pymol) 5. Multiple sequence alignment (MEGA/Clustal omega) 6. Construction of phylogenetic tree (PHYLIP/ MEGA/ Clustal omega). 7. Making of Bar diagrams, Pie chart, Histogram, Frequency polygon, Cumulative frequency curve (any four) in the given data set using Microsoft Excel 8. Calculation of mean, mode, median, standard deviation and standard error (through manual calculation and using manual and Microsoft Excel) (use only ungrouped data) 9. Student's t-test (using Microsoft Excel only), chi square test (Manual and using Microsoft Excel) 10. Submission.

Teaching-Learning Methodology	Observation of specimen Handling of specimen Using student's microscope Using certain required chemical for test Dissection of specimen Preparing journal though drawing various figures with description Learn through charts/model Field visits for live experience. Preparing field visit note.
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Evaluation Pattern

Sr. No.	Details of the Evaluation –NEP 2020,KCG and CCE(Continuous and Comprehensive Evaluation.	Weightage%
1.	Internal Examination Evaluation includes Lab Work Assignment-10(40%), Viva voice/Lab Quiz-10(40%), Attendance-05(20%) This makes total 25 Marks.	50
2.	Semester End Examination Evaluation includes Lab Work Assignment-20(80%), Viva voice/Lab Quiz-05(20%), Which makes total 25 Marks.	50

Course Outcomes: Having completed this course, the learner will be able to

1.	The student will understand • the basics of bioinformatics and develop awareness of the interdisciplinary nature of this field. • learn about biological databases, sequence retrieval, alignment, and phylogenetic analysis using various tools. • understand the basic concept of sampling methods, data classification, presentation and statistical analysis.
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Suggested Reference Books:

Sr. No.	Reference Books
1.	Ghosh, Z., Mallick, B. (2008). <i>Bioinformatics – Principles and Applications</i> , 1st edition. New Delhi, Delhi: Oxford University Press.
2.	Baxeavanis, A.D., Ouellette, B.F., John (2005). <i>Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins</i> , 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.
3.	Roy, D. (2009). <i>Bioinformatics</i> , 1st edition. New Delhi, Delhi: Narosa Publishing House
4.	Andreas, D., Baxeavanis, B.F., Francis, Ouellette. (2004). <i>Bioinformatics: A practical guide to the analysis of genes and proteins</i> , 3rd edition. New Jersey, U.S.: John Wiley and Sons.

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5.	Khan, I.A., Khanum, A. (2004). Fundamentals of Biostatistics, 5th edition. Hyderabad: Ukaaz publications
6.	Campbell, R.C. (1998). Statistics for Biologists. Cambridge, U.S.A.: Cambridge University Press

On-line Resources : <https://www.wiziq.com/tutorials/practical>

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(Bachelor of Science)(Undergraduate)
B. Sc. (UG) Semester-VI

Course Code	US06MABOT03	Title of the Course	Practical
Total Credits of the Course	04	Hours per Week	08(PartA-4 and PartB-4)

Course Objectives:	1. To understand the basic concepts of ecology and its interactions. 2. To study the local and geographical distribution, structural adaptations of organisms in particular environmental factors. 3. To study the concepts and importance of Plant systematic. 4. To learn the importance of herbarium preparation. 5. To learn describing plant, its classification and identification with classical as well as advanced methods.
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PART-A	SECTION-I	CREDIT-2	PRACTICAL-4 HOUR-50%
1.	Ecology 1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 2. Determination of pH of various soil and water samples (pH meter, universal indicator and pH meter) 3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests. 4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method. 5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats. 6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources. 7. Study of morphological adaptations of hydrophytes and xerophytes (four each). 8. Study of biotic interactions of the following: Stem parasite (<i>Cuscuta</i>), Root parasite (<i>Orobancha</i>); Epiphytes, Predation (Insectivorous plants). 9. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed). 10. Quantitative analysis of herbaceous vegetation in the college campus for		



	frequency and comparison with Raunkiaer's frequency distribution law. 11. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus. 12. Field visit to familiarize students with ecology of different sites.	
PART-B	50%	
1	Plant systematics 1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Ranunculaceae, Brassicaceae, Myrtaceae, Umbelliferae, Asteraceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Poaceae. 2. Learn the how to identify taxa using local/regional Flora as reference. 3. Field visit, plant collection and herbarium preparation and submission. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).	

Teaching-Learning Methodology	Observation of specimen Handling of specimen Using student's microscope Using certain required chemical for test Dissection of specimen Preparing journal though drawing various figures with description Learn through charts/model Field visits for live experience. Preparing field visit note.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation –NEP 2020, KCG and CCE (Continuous and Comprehensive Evaluation.	Weightage%
1.	Internal Examination Evaluation includes Lab Work Assignment-20(40%), Viva voice/Lab Quiz-20(40%), Attendance-10(20%) Which	50

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	makes total 50 Marks.	
2.	Semester End Examination Evaluation includes Lab Work Assignment-40(80%), Viva voice/Lab Quiz-10(20%) This makes total 50 Marks.	50

Course Outcomes: Having completed this course, the learner will be able to

1.	Abiotic and biotic factors that affect, the distribution, dispersal, and behavior of organisms, how ecological systems work at different spatial and temporal scales.
2.	Biodiversity and evolution of organisms from single cell structures.
3.	Understand how to describe and identify family.
4.	Prepare herbarium.

Suggested Reference Books:

Sr. No.	Reference Books
1.	Sharma, P. D. Ecology and Environment. Rastogi Publications, Meerut, India. 13th edition
2.	Wilkinson, D. M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
3.	Lawrence, G.H.M. Vascular Plant Systematics.
4.	Gurucharn Singh, (1999), Plant Systematics; Oxford & IBH pub. New Delhi
5.	Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
6.	Shah G. L. (1978); Flora of Gujarat State. Part I & II. Pub. By Sardar Patel University, Gujarat.
7.	Singh, Pandey and Jain: A Text Book of Botany-Angiosperms.



8.	B. P. Pandey, A text book of botany-Angiosperms
9.	Kumar, H. D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi

On-line Resources : <https://www.wiziq.com/tutorials/practical>
