

**SARDAR PATEL UNIVERSITY,**  
**Vallabh Vidyanagar, Anand Gujarat**  
**Structure of Core subject at B. Sc. Semester V**  
**Subject: Botany**  
**Effective from June 2020**

Paper code	Title of Paper	Credit	Lectures per week	Internal exam	External exam	External exam hrs
US05CBOT21(T)	Microbiology and Phycology	4	4	30/12	70/28	3
US05CBOT22(T)	Genetics and Molecular Biology	4	4	30/12	70/28	3
US05CBOT23(T)	Plant Ecology and Phytogeography	4	4	30/12	70/28	3
US05CBOT24(T)	Plant Systematics	4	4	30/12	70/28	3
US05CBOT25(P)	Botany Practical	6	12	45/18	105/42	6
US05DBOT26(T)	Taxonomy and Conservation Of Angiosperms or Bioinstrumentation	2	2	-----	50/20	2
OR US05DBOT27(T)						
		24	30 hrs/week			

**SARDAR PATEL UNIVERSITY**  
**Programme: B. Sc. (BOTANY)**  
**Semester: V**  
**Paper Code: US05CBOT21 (T)**  
**Title of Paper: MICROBIOLOGY AND PHYCOLOGY**  
**Total Credit: 4 (Four Lectures per week)**  
**(Total Marks 100, Internal-30 marks, External 70-marks)**  
**Syllabus with effect from: June 2020**

Learning Outcome:

The student will be able to

- Understand about micro-organisms and basic principles of staining.
- Understand cellular organization and reproduction in prokaryotes and Eukaryotes
- Able to identify and compare the characteristics of viruses, Bacteria, Cyanobacteria and algae.

US05CBOT21		4 CREDIT
MICROBIOLOGY AND PHYCOLOGY		
UNIT	CONTENT	
1	<p><b>MICROBIOLOGY:</b>  Discovery of Microorganisms, Structure and classification of microbes, Systematic position of microorganisms in biological world; classification of microorganisms and characteristic features of different groups.  Methods in Microbiology: Basic principles of staining of Bacteria and Fungi, sterilization methods, culture media, pure culture methods, methods for population estimation, growth determination.</p>	
2	<p><b>VIRUSES AND BACTERIA:</b>  Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).  Bacteria: Discovery, general characteristics; Types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).</p>	
3	<p><b>CYANOPHYTA:</b>  General characters, Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and classification of cyanophycean algae, Heterocysts, Nitrogen fixation by blue green algae, Culturing of algae, Algal bloom.</p>	
4	<p><b>PHYCOLOGY-AN OVER-VIEW:</b>  General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food ,flagella; methods of reproduction; Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.</p>	

**SARDAR PATEL UNIVERSITY**  
**Programme: B. Sc. (BOTANY)**  
**Semester: V**  
**Paper Code: US05CBOT22 (T)**  
**Title of Paper: GENETICS AND MOLECULAR BIOLOGY**  
**Total Credit: 4 (Four Lectures per week)**  
**(Total Marks 100, Internal-30 marks, External 70-marks)**  
**Syllabus with effect from: June 2020**

Learning outcome: The student will be able to

- Have knowledge of genetics, history, and lifecycle of genetically important organisms.
- Understand the significance of linkage and crossing over.
- Basics of molecular biology

US05CBOT22 (T)		4 CREDIT
GENETICS AND MOLECULAR BIOLOGY		
UNIT	CONTENT	
1	Genetics: Introduction: Definition, scope, branches and application of genetics, selection of genetic material, Profiles of some geneticists and molecular biologists, Life cycle of some genetically important organisms like Bacteriophage, E. Coli, Yeast, Neurospora, Chlamydomonas, Maize and Arabidopsis.	
2	Genetics: Linkage-Definition, History, Kinds, Linkage groups and significance. Crossing Over-Definition, Types, Mechanism, Kinds and significance. Maternal effects and cytoplasmic inheritance: Maternal effects in snails, Streptomycin resistance in Chlamydomonas, mitochondrial mutations in yeast, Kappa particles in paramecium, plastid inheritance in Mirabilis jalapa, male sterility in plants.	
3	Molecular Biology: Nucleic acids as carries of genetic information; Physical properties and structure of DNA and RNA. Replication of DNA: Enzyme and proteins involved in replication. Various models of DNA replication, including rolling circle, $\theta$ (theta) mode of replication, DNA repair mechanisms.	
4	Molecular Biology: Transcription of DNA, post transcriptional modifications of RNA and control of transcription. Genetic code and its properties. Translation: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.	

**SARDAR PATEL UNIVERSITY**

**Programme: B. Sc. (BOTANY)**

**Semester: V**

**Paper Code: US05CBOT23 (T)**

**Title of Paper: PLANT ECOLOGY AND PHYTOGEOGRAPHY**

**Total Credit: 4 (Four Lectures per week)**

**(Total Marks 100, Internal-30 marks, External 70-marks)**

**Syllabus with effect from: June 2020**

Learning Outcome: the students will be able to

- Understand ecological concepts, with significance of its interrelationships.
- Do analysis of various components of ecosystems.
- Learn the concepts of phytogeography at large scale.

US05CBOT23		4 CREDIT
Plant Ecology and Phytogeography		
UNIT	CONTENT	
1	<b>Plant Ecology:</b> 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.	
2	<b>Water:</b> 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.	
3	<b>Biotic interactions:</b> 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.	
4	<b>Phytogeography:</b> Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India.	

**SARDAR PATEL UNIVERSITY**  
**Programme: B. Sc. (BOTANY)**  
**Semester: V**  
**Paper Code: US05CBOT24 (T)**  
**Title of Paper: ANGIOSPERM PLANT SYSTEMATICS**  
**Total Credit: 4 (Four Lectures per week)**  
**(Total Marks 100, Internal-30 marks, External 70-marks)**  
**Syllabus with effect from: June 2020**

Learning outcome: the students will be able to

- Understand the significance of angiosperm plant Systematics with their taxonomic hierarchy.
- Learn nomenclature, systems of classification and phylogeny of angiosperm plants.

US05CBOT24		4 CREDIT
Angiosperm Plant Systematics		
UNIT	CONTENT	
1	<p><b>Significance of Plant systematics:</b>            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.</p>	
2	<p><b>Taxonomic hierarchy:</b>            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.</p>	
3	<p><b>Systems of classification:</b>            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).</p>	
4	<p><b>Phylogeny of Angiosperms:</b>            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).</p>	

## SARDAR PATEL UNIVERSITY

### B. Sc. (BOTANY) Semester: V

#### Suggested readings:

##### US05CBOT21 (T)

1. Lee, R. E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley J M, Sherwood L M and Woolverton C J. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H. D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N. A., Reece J. B., Urry L. A., Cain M. L., Wasserman S. A. Minorsky P. V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
7. Pelczar, M. J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
8. Singh, Pande and Jain, A text book of Botany.
9. Botany for degree students-Algae: B.R.Vashistha

##### US05CBOT22 (T)

1. Watson J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W. S., Cummings, M. R., Spencer, C. A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
6. Genetics, Verma and Agarwal, 9th edition

##### US05CBOT23 (T)

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.

##### US05CBOT24 (T)

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.
6. B. P. Pandey, A text book of botany-Angiosperms.
7. Heywood (ed.) Modern Methods in Plant Taxonomy.
8. Jeffery, C. An Introduction to Plant Taxonomy.
9. Jones, S.B., Luchsinger, A.L. 1987. Plant Systematics
10. Judd, W.S; Campbell, C.S., Kellogg, E.A; Stevens, P.F. 1999. Plant Systematics: A Phylogenetic approach.
11. Lawrence, G.H.M. Vascular Plant Systematics.
12. Gurucharn Singh, (1999), Plant Systematics; Oxford & IBH pub. New Delhi

**SARDAR PATEL UNIVERSITY**  
**Programme: B. Sc. (BOTANY)**  
**Semester: V**  
**Paper Code: US05CBOT25 (P)**  
**Title of Paper: BOTANY PRACTICAL**  
**Total Credit: 6 (Twelve Lectures per week)**  
**(Total Marks 150, Internal-45 marks, External 105-marks)**  
**Syllabus with effect from: June 2020**

US05CBOT25-(P)	4 CREDIT
Botany Practical	
<b>PART-1 Microbiology and Phycology</b>	
1.	Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
2.	Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3.	Gram staining: Endospore staining with malachite green using the (endospores taken from soil bacteria).
4.	Phycology: Study of vegetative and reproductive structures of <i>Blue green algae</i> , <i>Green algae</i> , <i>Brown algae</i> and <i>Red algae</i> through electron micrographs, temporary preparations and permanent slides.
<b>PART-2 Ecology</b>	
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>Orobanche</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.

US05CBOT25 (P)	continued
Botany Practical	
	<b>PART-3 Genetics and Plant systematics</b>
1.	Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
2.	Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
3.	Establishing nucleic acid as genetic material through photographs/charts/models (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
4.	Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
5.	Morphological studies of the representatives of angiosperm families growing in the college campus.
6.	Learn the how to identify taxa using local/regional Flora as reference.
7.	Preparation of the report of the assigned project.



**SARDAR PATEL UNIVERSITY**

**Programme: B. Sc. (BOTANY)**

**Semester: V**

**Paper Code: US05DBOT26 (T)**

**Title of Paper: Taxonomy and Conservation Of Angiosperms**

**Total Credit: 2 (Two Lectures per week)**

**(Total Marks 50, External marks 50)**

**Syllabus with effect from: June 2020**

Learning outcome: Students will be able to

- Describe and identify plants.
- Know various organizational setup working for the conservation of botanical wealth.
- Learn preservation and documentation techniques.

US05DBOT26		2 CREDIT
Taxonomy and Conservation Of Angiosperms		
UNIT	CONTENT	
1	<b>Indian Organizations as stake holder for Botanical wealth.</b> Objectives, organizational set up, Regional Circles of Botanical survey of India, The central National Herbarium, The Indian Botanical Gardens, The Central Botanical Laboratory. Conservations of the Biological Diversity, Environmental impact studies and Future Strategies.	
2	<b>Herbarium Techniques:</b> Field Equipments, Collection of Plant Specimens, Pressing of Specimens, Drying of Specimens, Mounting of Specimens, Herbarium Labels and Filing of Herbarium Sheets.	
3	<b>Basic Plant morphology and preservation techniques:</b> Morphology of Leaf (types, shape, margins and aestivation), Inflorescence (racemose, cymose and special), flower (morphology of all floral parts, with floral diagram and floral formula) and Types of fruit. Preservation techniques for fruits, seeds and plant parts as museum specimen.	
4	<b>Selected Family:</b> Ranunculaceae, Capparidaceae, Rutaceae, Umbelliferae, Sapotaceae, Boraginaceae, Convolvulaceae, Poaceae.	

Suggested Readings:

1. Singh, Pandey and Jain, A text book of Botany-Angiosperms.
2. B.P.Pandey, A text book of Botany-Angiosperms.
3. A.C. Datta, Botany for degree students.
4. Gurucharn Singh, Plant systematics

**SARDAR PATEL UNIVERSITY**  
**Programme: B. Sc. (BOTANY)**  
**Semester: V**  
**Paper Code: US05DBOT27 (T)**  
**Title of Paper: Bioinstrumentation**  
**Total Credit: 2 (Two Lectures per week)**  
**(Total Marks 50, External marks 50)**  
**Syllabus with effect from: June 2020**

Learning Outcome: Students will be able to

- Know about basic principles and various separation techniques used in biological research.

US05DBOT27		2CREDIT
Bioinstrumentation		
UNIT	CONTENT	
1	SPECTROPHOTOMETRY: Basic principles-Preparations of standard graph-deviation from Beer's law-Absorption spectrum-Instrumentation for colorimeter and spectrophotometer.	
2	CENTRIFUGATION: Basic principle-RCF-Instrumentation-Desktop centrifuge-High speed Centrifuge-Ultracentrifuge-Analytical Centrifuge-Fixed angle rotors-vertical tube rotors-Swinging bucket rotors	
3	CHROMATOGRAPHY: Basic principle, Instrumentation and applications of Paper chromatography-Thin layer chromatography ,Gas Chromatography and HPLC	
4	ELECTROPHORESIS: Migration of ion in electric field-Factors affecting Electrophoretic mobility-Types –Paper Electrophoresis-PAGE-Agarose gel electrophoresis.	

Suggested readings:

1. An introduction to practical Biochemistry: Plummer
2. Instrumentation: Chatwal and Anand
3. Modern experimental Biology: Boyer
4. Biophysical Chemistry-Principles and techniques by Upadhyay, Upadhyay and Nath