

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**Programme: MSc (CBCS)
Syllabus with effective from: JUNE-2017**

BOTANY

M. Sc. Botany				
Semester	I	II	III	IV
Core I (4 Credits)	Cell and Molecular Biology (PS01CBOT21)	Biology and Diversity of Lower Plants (Algae, Bryophytes & Pteridophytes) (PS02CBOT21)	Plant Development and Reproduction (PS03CBOT21)	Plant Biotechnology (PS04CBOT21)
Core II (4 Credits)	Bioinstrumentation (PS01CBOT22)	Taxonomy and Diversity of Seed Plants (PS02CBOT22)	Plant Physiology (PS03CBOT22)	Biochemistry and Medical Botany (PS04CBOT22)
Core III (4 Credits)	Genetics, Plant Breeding and Evolution (PS01CBOT23)	Mycology and Plant Pathology (PS02CBOT23)	Environment and Ecological Principles (PS03CBOT23)	Lab I (PS04CBOT23) Practicals based on PS04CBOT21 and PS04CBOT22
Core IV (4 Credits)	Lab I (PS01CBOT24) Practicals based on PS01CBOT21 and PS01CBOT22	Lab I (PS02CBOT24) Practicals based on PS02CBOT21 and PS02CBOT22	Lab I (PS03CBOT24) Practicals based on PS03CBOT21 and PS03CBOT22	Lab II (PS04EBOT21) Practicals based on PS04EBOT2X and PS04EBOT2X
Core V (4 Credits)	Lab II (PS01CBOT25) Practicals based on PS01CBOT23 and PS01EBOT2X	Lab II (PS02CBOT25) Practicals based on PS02CBOT23 and PS02EBOT2X	Lab II (PS03CBOT25) Practicals based on PS03CBOT23 and PS03EBOT2X	Dissertation (PS04EBOT22) (12 Credits)
Elective I (4 Credits)	Biostatistics (PS01EBOT21)	Microtechniques (PS02EBOT21)	Horticulture (PS03EBOT21)	Phytoresource Utilization and conservation (PS04EBOT23)
Elective II (4 Credits)	Biomolecules and Bioenergetics (PS01EBOT22)	Bioinformatics (PS02EBOT22)	Systematic Botany (PS03EBOT22)	Food and Dairy Microbiology (PS04EBOT24)
Elective III (4 Credits)			Omics and Computational Biology (PS03EBOT23)	IPR and Biosafety (PS04EBOT25)

PS01CBOT21: Cell and Molecular Biology

Unit I

An overview of cell organization; Structure of pro-and eukaryotic cell. Experimental approaches for studying cells: Various types of light microscopy, Electron microscopy, fixation and staining, cytochemical methods and cell fractionation (flow cytometry).

Unit II

Cell organization: Structure and functions of membranes, nucleus, Chloroplast, Mitochondria, Endoplasmic reticulum, Golgi complex, ribosomes, lysosomes, peroxisomes and glyoxysomes. The cytoskeleton and cell motility – Microtubules, microfilaments and intermediate filaments. Cell cycle and cell division.

Unit III

Nucleic acids as carriers of genetic information; Physical properties and structure of DNA and RNA. Replication of DNA : Enzyme and proteins involved in replication. DNA repair mechanisms.

Unit IV

Transcription of DNA, post transcriptional modifications of RNA and control of transcription. Genetic code and its properties. Translation of RNA in pro and eukaryotes. Control of translation and protein targeting.

References Books:

- Molecular biology of the cell, 1994 : By Bruce Alberts et al; Garland publishing New York.
- Cell and molecular biology, 1999 : By Gerald Karp, John Wiley, London.
- Cell and molecular biology, 1987 : By DeRobertis and DeRobertis, Lee and Febiger, Washington.
- Molecular cell biology, 2000 : By Lodish et al; W. H. Freeman & Company, Newyork.

PS01CBOT22: Bioinstrumentation

Unit I

Visualization techniques:

Principle of working and applications of bright field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy. Principle and applications of cytophotometry and flow cytometry.

Unit II

Separation techniques:

Basic principle and application of Differential, density and ultracentrifugation
Principle and applications of Native-PAGE, SDS-PAGE, Agarose and 2D gel electrophoresis. Capillary electrophoresis and its applications.
Principle, methodology and applications of gel – filtration, ion –exchange and affinity chromatography; Thin layer and High Performance Thin Layer Chromatography. Gas chromatography, High performance liquid chromatography and FPLC.

Unit III

Spectroscopy

Principle, instrumentation and applications of UV, Visible, IR (including FTIR and ATR), AAS, NMR, fluorescence and CD spectroscopy.

Unit IV

Principle and applications of tracer technique in biology:

Radioactive Isotopes and half-life of isotopes; Effect of radiation on biological system; autoradiography; cerenkov radiation; radiation dosimetry; ionization and scintillation based detection and quantification of radioactivity.

Biosensors: Principle, types and applications.

Principle of biophysical methods used for analysis of biopolymer structure: X ray diffraction and mass spectrometry.

References:

1. Instrumental method of chemical analysis: Sharma B K
2. Instrumental methods of analysis: D A Skoog
3. An introduction to practical Biochemistry: Plummer
4. Instrumentation: Chatwal and Anand
5. Modern experimental Biology: Boyer

PS01CBOT23: Genetics, Plant Breeding & Evolution

Unit I

Fundamentals of Genetics: Mendelian analysis, Mendel's Laws of Inheritance, The principle of segregation, Test cross and back cross; The principle of Independent assortment, pedigree analysis. Chromosome structure and function; Probability & Statistics in Genetics: Probability in genetic analysis; probability of combination of events, mutually exclusive events, use of binomial distribution in Genetics; The Chi-square goodness of fit test and its use in Genetics.

Interaction of genes: Incomplete dominance, co-dominance, lethal genes, epistasis, pleiotropy polygenic traits and quantitative inheritance.

Unit II

Sex chromosomes and sex-linked inheritance: Transmission of sex-linked traits, sex determination; Linkage and chromosome mapping and its significance: Linkage, Crossing over- two point crosses, three-point crosses tetrad analysis, chromosome maps. 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; Alterations in chromosome number and structure: Ploidy: Aneuploidy and euploidy, polyploidy and its significance: alteration in chromosome structure: Deletions, duplications, inversions and translocations; Mutations: Types of mutations, mutagens, molecular basis of mutations; transposable elements; Reverse mutations & suppressor mutations.

Unit III

Plant Breeding:

History, methods and objectives of plant breeding; Present status and future prospects; Origin, domestication and introduction of crop plants; Modes of reproduction – asexual and sexual reproduction, determination of mode of reproduction in a species, modes of pollination, mechanism of pollination control, self-incompatibility, male sterility; Breeding in self-pollinated crops; Hybridization: History, objectives and procedures in hybridization, consequences of hybridization; Polyploidy in plant breeding; application of polyploidy in crop improvement and its limitations.

Unit IV

Evolution:

Introduction, Fundamental Evolutionary process. The elemental forces of Evolution. The sources of variation. The role of Natural Selection, Evidence of organic Evolution & theories of organic evolution. Result of evolution adaptive; Evolutionary divergence : Plant diversity as a result of evolution, Isolating mechanisms.

Reference Books:

- Strickberger M. W. Genetics. Third Edition. Macmillan Publishing co. New York.
- Robert Weaber & Philip W. Hedrick. Basic Genetics, Second Edition. W. M. C. Brown Publishers Dubuque lowq.
- Anna C. Pal & Helen M. Roberts. Genetics – its concepts & implications, Prentic – Hall Inc. Engle cliffs, New Jersey. USA
- Edmund W. Sinnott, L. C. Dunn & T. Dobzhansky, Principles of Genetics. McGraw Hill Book company Inc. New York, USA.
- M. Sr & R. W. Owen. General Genetics, W. H. Freeman & Company, Sanfrancisco.
- P. K. Gupta, Genetics. Rastogi Publications. Shivaji Road Meerut, India.

- Stebbins G. L. Variation & Evolution in plant.
- G. Ledyard Stebbins. Process of organic Evolution.
- Jay M. Savage. Evolution
- Edward O. Dodson. Evolution : Process & Product.
- Paul Amos Moody. Introduction to Evolution.

PS01CBOT24: Lab I Practicals based on PS01CBOT21 and PS01CBOT22

PS01CBOT25: Lab II Practicals based on PS01CBOT23 and PS01EBOT2X

PS01EBOT21: Biostatistics

Unit - I

Definition of Biostatistics

Data Collection:

Types of Biological Data:

Qualitative (Categorical) Data: Nominal and Ordinal Data

Quantitative (Numerical) Data: Discrete and Continuous Data

Methods of Collecting Data:

Survey Method: Concept of a statistical population and sample from a population; Methods of drawing sample from the population, Simple Random Sampling (SRS), Stratified Random Sampling, Cluster Sampling; Experimental Method

Presentation:

Construction of frequency distribution (Simple or Discrete and Grouped): Rules for constructing Grouped frequency distribution

Diagrammatic Presentation: Bar Diagram (Chart), Simple, Sub – divided (Component), Percentage, Multiple, Pie Chart

Graphical Presentation: Line Graph, Histogram (For uniform class width only), Frequency Polygon, Frequency Curve, Ogives or Cumulative Frequency Curves

Descriptive Statistics:

Measures of Central Tendency (Averages): Mean or Arithmetic Mean, Median, Mode, Partition Values (For Raw and Grouped Data), Quartiles, Deciles, Percentile, Partition values using graphs (Ogives).

Measures of Dispersion (Variation): Range, Quartile Deviation (Q.D), Inter Quartile Range (IQR), Standard Deviation (SD) and Variance, Coefficient of Variation (C.V), Box – and – Whisker Plot.

Measures of Skewness and Kurtosis: Karl – Pearson's Coeff. of Skewness, Bowley's Coeff. Of Skewness, Kurtosis (Definition Only).

Unit - II

Probability and Probability Distributions:

Elements of Probability theory: Concept, Classical definition of Probability, Laws of Probabilities (Statements Only), Conditional Probability, Examples

Probability Distributions: Binomial Distribution. Definition, Conditions for applicability of Binomial Distribution, Examples applicable in the field of Biosciences; **Normal Distribution**, Definition (Normal and Standard Normal Distribution), Properties of Normal Distribution, Examples applicable in the field of Biosciences

Unit - III

Correlation and Regression Analysis:

Correlation: Meaning, Types of Correlation, Positive, Negative, Non – Sense or Spurious, Methods of studying correlation, Scatter Plot (diagram) method, Karl-Pearson's Correlation Coefficient (Product Moment) Method; Properties of Correlation Coefficient

Coefficient of determination and its meaning: Spearman's Rank Correlation Coefficient; Properties of Rank Correlation Coefficient

Regression: Meaning, Properties of Regression Coefficients, Applications in the field of Biosciences

Testing Of Hypothesis: Contingency tables, Goodness of Fit

Unit - IV

Large Sample Test: Z - test for (Single) population proportion; Z - test for difference between two population proportions; Z - test for (Single) population mean; Z - test for difference between two population means

Small Sample Test: t – test for (Single) Population Mean, t – test for difference between two population means (Unpaired t-test), t – test for difference between two population means (Paired t-test)

Analysis Of Variance (ANOVA) : One – Way Classification , Two – Way Classification

References:

- Fundamentals of statistics by S.C. Gupta
- Principles of Biostatistics by Marcello Pagano and Kimberlee Gaurea
- Biostatistics : A Foundation For Analysis in the Health Sciences by Daniel, Wayne(Seventh Edition), Wiley India Pub.

PS01EBOT22: Biomolecules and Bioenergetics

Unit I

Carbohydrates and glycobiology : Monosaccharide - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars. Formation of disaccharides, reducing and nonreducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides). Carbohydrates as informational molecules, working with carbohydrates, Industrial importance of carbohydrate.

Unit II

Amino acids: Structure and classification, physical, chemical and optical properties of amino acids, Classification of amino acids, Protein sequencing and alignment

Building blocks of lipids - fatty acids, glycerol, ceramide. Storage lipids - triacyl glycerol and waxes, Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Lipids as signals, cofactors and pigments

Nucleic acids: Structure of major species of RNA - mRNA, tRNA and rRNA.

Nucleic acid chemistry – UV absorption, effect of acid and alkali on DNA.

Unit III

Acid-Base Equilibrium & Henderson and Hassebach equation, Buffers and their importance, pKa of amino acid and their relevance, Importance of discontinuous buffer system used in SDS PAGE.

Common reaction mechanism in biological reaction: Peptide bond formation, oligonucleotide and oligosaccharide synthesis, disulphide bond, group-specific chemical modification for amino acid

Unit IV

Bioenergetics: The laws of thermodynamics, concept of entropy and free energy; ATP synthesis and hydrolysis, Biological oxidations—oxygenases, hydrolases, dehydrogenases, free energy changes and redox potentials, Gibbs energy,

The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization (Animals, Plants, and Bacteria), ATP- synthetase complex, Chemiosmotic theory of Energy Coupling, Inhibitors of ETC, Regulation of body temperature

References:

- Chemistry of Biomolecules by S. P. Bhutani, Ane Books Pvt. Ltd. CRC Press
- Lehninger's Principles of Biochemistry: D. L. Nelson and M. M. Cox, Macmillan, Worth Pub. Inc., NY.
- Biochemistry: Lubert Stryer WH Freeman & Co., NY.
- Harper's Biochemistry: R. K. Murray and others. Appleton and Lange, Stanford.
- Text book of Biochemistry with clinical correlations by Delvin.