CVM UNIVERSITY

MASTER OF SCIENCE

(BOTANY)

PROGRAMME

Under Choice Based Credit Scheme

Structure with Effect From: 2020-21

M.Sc. Botany Programme Details

Programme Objectives (POs):

At the time of culmination of the program the under study will have created broad information in different zones of Botany. Through the boost of academic movement and scholarly improvement the program plans to furnish under studies with greatness in instruction and abilities, accordingly empowering the under study to seek after a vocation of his/her decision. By developing abilities and advancing all round character improvement through multi-dimensional instruction a feeling of self-assurance and independence will be injected in the under study. The under study will be ingrained with estimations of expert morals and be prepared to add to society as dependable people.

Programme Specific Outcomes (PSOs):

Toward the finish of the two year program the under study will comprehend and have the option to clarify various parts of Botany. The student will be able to explain about various applications of Botany such as Ecology and Biodiversity, Cell Biology, Systematics of Angiosperms, Plant Reproductive Biology, Development Biology, Molecular Biology, Plant Biotechnology, Genetics and crop improvement and Phytochemistry and Pharmacogonsy. He/she will be able to design and execute experiments related to Basic botany, Plant Taxonomy, Plant Physiology, Molecular Biology, Plant Biotechnology and Phytochemistry and Pharmacogonsy tools will be able to execute a short research project incorporating techniques of Basic and Advanced Botany under supervision. The under study will be prepared to take up a reasonable situation in the scholarly world or industry, and to seek after a vocation in look into if so wanted.

Programme Structure:

The M.Sc. Botany programme is a two-year course divided into four-semesters. A student is required to complete hundred credits for the completion of course and the award of degree. A student has to accumulate twenty-five credits in each of the four semesters.

PART ONE	FIRST YEAR	SEMESTER I	SEMESTER II
PART TWO	SECOND YEAR	SEMESTER III	SEMESTER IV

Course Credit Scheme

SEMESTER – I

Course Type	Course Code	Name of Course	T/P	Credit	Exam Duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	PG01CBOT01	Ecology and Biodiversity	T	04	03	30/10	70/28	100/40
	PG01CBOT02	Bioanalytical Techniques and Instrumentation	T	04	03	30/10	70/28	100/40
	PG01CBOT03	Cell Biology	T	04	03	30/10	70/28	100/40
	PG01CBOT04	Practicals based on PS01CBOT01 and PS01CBOT02	P	04	03	30/10	70/28	100/40
	PG01CBOT05	Practicals based on PS01CBOT03 and PS01EBOT2X	P	04	03	30/10	70/28	100/40
	PG01CBOT06	Comprehensive Viva- Voce	P	01			50/20	50/20
Elective Course	PGO1EBOT01	Fundamental of Biochemistry and Bioenergetics	T	04	03	30/10	70/28	100/40
	PGO1EBOT02	Cytogenetic and Genetics	T	04	03	30/10	70/28	100/40
	PGO1EBOT03	Food Microbiology	T	04	03	30/10	70/28	100/40
	PGO1EBOT04	Virology	T	04	03	30/10	70/28	100/40
Total Credits				**25**				**650**

SEMESTER – II

Course Type	Course Code	Name of Course	T/P	Credit	Exam Duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	PG02CBOT01	Systematics of Angiosperms	T	04	03	30/10	70/28	100/40
	PG02CBOT02	Plant Reproductive Biology	T	04	03	30/10	70/28	100/40
	PG02CBOT03	Plant Physiology	T	04	03	30/10	70/28	100/40
	PG02CBOT04	Practicals based on PG01CBOT01and PG02CBOT02	P	04	03	30/10	70/28	100/40
	PG02CBOT05	Practicals based on PG02CBOT03 and PG01EBOTX	P	04	03	30/10	70/28	100/40
	PG02CBOT06	Comprehensive Viva- Voce	P	01			50/20	50/20
Elective Course	PGO2EBOT01	Biostatistics	T	04	03	30/10	70/28	100/40
	PGO2EBOT02	Microtechniques	T	04	03	30/10	70/28	100/40
	PGO2EBOT03	Omics and Computational Biology	T	04	03	30/10	70/28	100/40
	PGO2EBOT04	Plant Tissue Culture	T	04	03	30/10	70/28	100/40
Total Credits				**25**				**650**

Course Wise Content Details for M.Sc. (Botany) Programme

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SEMESTER I
M. Sc BOTANY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PG01CBOT01: Ecology and Biodiversity

Course objective:

The aim is to achieve deeper knowledge on ecology and biodiversity and the services that ecosystems provide to human societies, the connection between biodiversity and ecosystem services, and how human societies depend on these services.

Course Learning Outcomes:

Unit 1: Be able to outline different concepts of ecology and discuss the biosphere, biomes and biogeography aspect of ecology.

Unit 2: Be able to explain the basic of population dynamics concept and role and also discuss the modular organisms population regulation, population size regulators and patterns in population dynamics community structure.

Unit 3: Be able to outline different concepts of biodiversity and discuss the uses, values, loss of biodiversity.

Unit 4: Be able to outline and apply different perspectives and questions within conservation biology related to biodiversity and discuss the environmental education.

Contents

Unit – 1

Biosphere, biomes and Biogeography

The Biosphere: Biotic Environment: Types of interaction, Intra-specific relationships, Interspecific relationships, Biotic and Abiotic Interactions: Complexity, Pathogens & climate, Abiotic effects on competition. Habitats & Niches: Habitats, Niches – Determining niches, Exclusion principle; Species coexistence – Size ratios, Niche overlap, Fundamental & raised

niches, Resource partitioning, Character displacement, Inter-specific competition Biomes: Terrestrial biomes, Wetland & freshwater biomes, Coastal & marine biomes Biogeography: Species distribution, Historic effects of plate tectonics - Past continental movements, Patterns of biogeography

Unit – 2

Population Dynamics

Population Dynamics: Populations & population change, Dispersal, Dormancy, Study of populations – Basic equation, Age structure, Fate of cohort, Age at Death, Long-term population studies; Demographic data – Life tables, Population pyramids, Survivorship curves, Evolutionary strategies – r & K-strategies; Modular organisms Population Regulation: Population growth – Exponential, Logistic growth curve; Population size regulators – Types, Space, Food & water, Territories, Harbivores & Predators, Weather & climate, Parasites & diseases, Natural disasters, Self-regulation & stress; Patterns in population dynamics Community Structure (Succession): Vegetation changes, Types & Causes of succession, Processes - Primary seres (Xeroseres, Hydroseres, Heterotrophic), Patterns of succession – Variation, Termination, Diversion, Human influence on succession, Climax.

Unit – 3
Biodiversity and Uses, Values, Loss

Biodiversity (General): Types of Biodiversity (Genetic, Species, Ecosystem), Global Biodiversity, Mega-diversity Countries of World, Endemism & Hotspots of Biological Diversity, Biodiversity of India, Hotspots of Indian Biodiversity, Goals of Biodiversity Conservation Biodiversity (Uses, Values, Loss): Biodiversity Values, Uses & Values of Biodiversity, Major Causes for Loss of Biodiversity, Listing of Threatened Biodiversity, IUCN Red Data Books, Endangered Flora and Fauna of India.

Unit – 4
Biodiversity Conservation and Environmental Education

Biodiversity (Conservation): Ex-situ Conservation: Cryo-preservation, Botanical Gardens, Seed Banks, Gene Banks, Germplasm Reserves, In-situ Conservation: Social Forestry, Agro-forestry, National Parks & Sanctuaries, Biosphere Reserves. Environmental Education: Introduction, Definition, Goals, Objectives, Guiding principles of environmental education, Environmental education programmes, Environmental education in India (Formal & Non-formal), Environmental information, Environmental organizations & agencies.

REFERENC BOOKS

1. Ecology - Principles and Applications by J.L. Chapman & M.J. Reiss. (2008) (2nd Ed.) Cambridge University Press, U.K. (ISBN: 978-0-521-68920-5)

2. Ecology and Environment by P.D. Sharma. (2010). (10th Ed.) Rastogi Publications, Meerut (India). (ISBN: 978-81-7133-905-1)

3. Economic Zoology by G.S. Shukla & V.B. Upadhyay. (2000). (4th Ed.) Rastogi Publications, Meerut (India). (ISBN: 81-7133-434-2)

4. Elements of Ecology by Thomas Smith & Robert Smith. (2007) (6th Ed.) Dorling Kindersley Press. (South Asia). (ISBN: 81-317-1557-4)

5. Environmental Science: Practical and Field Manual by Jitendra Pandey and Madhu Sudan Sharma. (2003). Yash Publishing House, Bikaner (India). (ISBN: 81-8688209-X)

6. Fundamentals of Ecology by Eugene Odum & Gray Barrett. (2009) (5th Ed.) Cengage Learning & Nelson Education Press. (ISBN: 978-81-315-0020-0)

7. Practical Statistics for Field Biology by Jim Flower, Lou Cohen & Phil Jarvis. (2006) (2nd Ed.) John Wiley & Sons Ltd., England. (ISBN: 978-0-471-98296-8)

8. Principles of Conservation Biology by Martha Groom, Gary Meffe & Ronald Carroll. (2006) (3rd Ed.) Sinauer Associates, Inc., Sunderland, USA. (ISBN: 978-0-87893-518-5)

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PG01CBOT02: Bioanalytical Techniques and Instrumentation

Course objective:

The course will enable the students to understand the principle and working of visualization techniques, separation techniques, spectroscopic techniques for analysis of the samples and principles and applications of tracer techniques in biology. Principles and applications of differenttypes of microscopy, principle & application of cytophotometry and flow cytometry, centrifugation, electrophoresis chromatography, spectroscopy, radioactivity, radiation counters, x-ray diffraction will be known to the students.

Course Learning Outcomes:

Unit 1: Deals with the knowledge of different types of microscopes such as Light microscope, Compound microscope, Dark field, Bright field, Stereo microscope, Confocal, Phase contrast microscope, Fluorescent microscope, Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). It also deals with the principle and application of cytophotometry and flow cytometry.

Unit 2: Enrich the concept and application for separation of molecules by different types of centrifugation techniques. Knowledgeof separation by horizontal and vertical gel electrophoresis is also anticipated. The separation of molecules by different types of chromatographic techniques will be learnt.

Unit 3: Explore the consideration of principle and analysis of samples by different spectroscopic techniques such as UV, Visible, IR (including FTIR and ATR), AAS, NMR, Mass, MALDI-TOF, fluorescence, CD spectroscopy etc. will be learnt.

Unit 4: Gather the concept of radioactivity autoradiography, different types of counters used to trace the radiation will be studied. The principle and application of x-ray diffraction methods to study the structure of biopolymer will be known.

Contents

Unit I
Visualization techniques:

Principle of working and applications of bright field & dark 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 analytical and preparative centrifugation, settling time & velocity, types of rotor, sedimentation coefficient, relative centrifugal force (RCF) differential, density and ultracentrifugation.

Principle and applications agarose and 2D gel electrophoresis. Capillary electrophoresis and its applications. Native-PAGE, SDS-PAGE

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

Spectropscopy

Basic principle of electromagnetic radiation, instrumentation and applications of UV, Visible, IR (including FTIR and ATR), AAS, NMR, Mass, MALDI-TOF, fluorescence and CD spectroscopy.

Unit IV

Principle and applications of tracer technique in biology:

Concept of radioactivity, rate of radioactive decay; units of radioactivity- uses of radioisotopes in life sciences and biotechnology; autoradiography; cerenkov radiation; radiation dosimetry; ionization andscintillation based detection of radioactivity.

Principle of biophysical methods used for analysis of biopolymer structure: X-ray diffraction.

Reference Books:

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
6. Freifelder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd ed., W.H. Freeman, 1982.
7. Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5th ed. Cambridge Univ. Press, 2000.
8. West & Todd. Biochemistry. 4th ed. Oxford and IBH.
9. Horst Friebolin. Basic One and Two-dimensional spectroscopy. VCH Publ, 1991.

10. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st ed. Wiley-Liss, 2001.
11. R. Marimuthu – Microscopy and Microtechnique, MJP Publishers, 2015.

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PG01CBOT03: Cell Biology

Course objective:

The major objective of this paper is to develop clear understanding of various aspects of cell biology along with diverse metabolic pathways existing at cellular level in relation to survival and propagation. This course enablesthe students tounderstand the structure and function of cell organelles, protein transport mechanism, intracellular signalling mechanism and acquainted with cell cycle, its regulation and apoptosis.

Course Learning Outcomes:

Unit 1: The students will understand theevolution of the cell, Cell as a unit of living organisms. They will learn structural details of prokaryotic and eukaryotic cells, their cell wall, cell membrane and other outer appendages.

Unit 2:The students can gain knowledge for molecular organization of Mitochondria, Chloroplast. Will know the ultrastructure and functions of Nucleus, Endoplasmic reticulum, Golgi complex, Lysosomes and other microbodies. They will also gain the knowledge of Protein sorting: organelle biogenesis and protein secretion, synthesis and its intracellular traffic, vesicular traffic in the secretary pathways.

Unit 3: Will get the information for cytoskeleton topography which include the role of Microtubule and its dynamics, motor proteins,Microfilament and its functions, Intermediate filaments and their functions, Cilia and centrioles.

Unit 4: Will be acquainted with overview of the Cell cycle and its control, the molecular mechanisms for regulating mitotic events, checkpoints in cell cycle regulation and signalling pathways which regulate apoptosis process.

Contents

Unit I

- The origin and Evolution of cells, Evolution of metabolism, Diversity of cell size and shapes, Structure of Prokaryotic and Eukaryotic cells, Single cell to multicellular organism

- The Structure of cell membrane: The fluid Mosaic Model, Membrane lipids and Proteins,The Glycocalyx, Transport across plasma membrane.
- Endocytosis: Phagocytosis and Receptor mediated endocytosis)
- Cell walls and extracellular matrix & Cell Matrix Interactions
- Cell-Cell interactions: Adhesion protein, Tight junctions, gap junctions and plasmodesmata.

Unit II

- Cell Organelles: Molecular organization of Mitochondria, Chloroplast, Ultrastructure and Functions of Nucleus
- Molecular Organization and functions of Endoplasmic reticulum, Golgi complex, Lysosomes(Protein sorting and transport, Types of vesicular transport and their functions), Microbodies: Peroxisomes, Ribosomes.

Unit III

- The cytoskeleton,the nature of cytoskeleton, Intermediate filaments, Microtubules: Organization of tubules, assembly and organization within the cells, microtubule motors and movements, cilia and flagella: structure and function.
- Cell signalling: Signalling molecules and their receptors, Functions of cell surface receptors, pathways of intracellular signal transduction, signal transduction and cytoskeleton.

Unit IV

- Cell growth and division, Overview of the Cell cycle and its control, the molecular mechanisms for regulating mitotic events, Cell cycle control in mammalian cells, Checkpoints in cell cycle regulation, regulators of cell cycle progression-MPF, cyclins and CDKs, Inhibitors of cell cycle progression; M-phase and cytokinesis.
- Programmed Cell Death: Difference between necrosis, apoptosis and necroptosis, Caspases, Central regulators of apoptosis (Bcl-2 family), signalling pathways that regulate apoptosis.

References:

- The cell: A molecular approach-Geoffrey M Cooper and Robert E. Hausman
- Cell Biology-Karp
- Molecular Biology of the cell- Alberts
- Molecular Cell Biology-Lodish et al.

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PGO1EBOT1: Fundamental of Biochemistry and Bioenergetics

Course objective:

The major objective of this paper is to develop clear understanding of various aspects of biochemistry which includes properties of biomolecules, their metabolism and regulation. This course content enables students to better understand concept of bioenergetics and its importance in cellular metabolism. Moreover, useful to understand key role of water in metabolism which maintain acid base equilibrium at cellular level as well as an importance of physiological buffers.

Course Learning Outcomes:

Unit 1: Will have learnt carbohydrates, their types and properties. Further, will be acquainted with central metabolic pathways for carbon metabolism in bacteria enlisting differences with eukaryotic systems and their regulation in diverse physiological conditions.

Unit 2: Understands types of amino acids and their properties. Moreover, will have gathered understanding of inorganic and organic nitrogen assimilation and its regulation. Also knows role of glutathione in cellular redox regulation and biochemistry of glutamate overproducing strains.Will understand biochemical basis of nucleotides and its metabolism.

Unit 3: Will understand details of lipid, its metabolismand regulation along with biochemical basis of lipid accumulation at cellular level.

Unit 4: Will have learnt basic concepts of bioenergetics and its importance in cellular metabolism. The students will be aware with different electron carriers compounds and their role in ATP generation. Moreover, gain in depth knowledge of Water and Acid-Base Equilibrium.

Contents

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).

Carbohydrate metabolism: Glycolysis, Gluconeogenesis, PP Pathway,Citric acid cycle- steps involved, amphibolic nature,anaplerotic reactions, Coordinated regulation of glycolysis and gluconeogenesis, Glycogen synthesis.

Unit II

Amino acids: Structure of amino acids, physical, chemical and optical properties of amino acids, Classification of amino acids, Peptides and Proteins, Secondary, tertiary and Quaternary structure of proteins.

Protein metabolism: Nitrogen metabolism,Biosynthesis of amino acids, molecules derived from the amino acids, amino acid oxidation and production of urea.

Nucleotides and Nucleic acids: Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry – UV absorption, effect of acid and alkali on DNA.

Nucleotides metabolism: Biosynthesis and Degradation of Nucleotides,

Unit III

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.

Lipid Metabolism: Biosynthesis of fatty acids, Triacylglycerol, membrane lipids and cholesterol, Fatty acid catabolism.

Unit IV

Bioenergetics: The laws of thermodynamics, concept of entropy and free energy; ATP synthesis and hydrolysis, Biological oxidation: 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, ATP- synthetase complex, Chemiosmotic theory of Energy Coupling, Inhibitors of ETC.

Water and Acid-Base Equilibrium: Ionization of Water, Weak Acids, and Weak Bases, buffering against pH Changes in BiologicalSystems: Henderson and Hassebach equation, Buffers and their importance, pKa of amino acid and their relevance, Importance of discontinuous buffer system used in SDS PAGE, Water as a Reactant

References:

- Lehninger's Principles of Biochemistry: D. L. Nelson and M. M. Cox, Macmillan, Worth Pub. Inc., NY.
- Chemistry of Biomolecules by S. P. Bhutani, Ane Books Pvt. Ltd. CRC Press
- Biochemistry: LubertStryer 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.

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PGO1EBOT02: Cytogenetic and Genetics

Course objective:

The students are learning the basic knowledge of mendelian and non-mendelian inheritance, genome organization and cell division. Recombination in eukaryotes learns the linkage and crossing over the different method and mechanism. Basic concept of mutation and different type discuss and and their application. Basic concept of chromosome and different techniques of chromosome study and their application discuss.

Course Learning Outcomes:

Unit1: Be able to outline the concepts of mendelian, non-mendelian inheritance, genetic interactions and organelle inheritance. Also understand the eukaryotic genome.

Unit 2: Understand the recombination in eukaryotes, different maps and molecular mechanism of recombination and QTL mapping.

Unit 3: Basic concept of mutation and different types of mutation and molecular basis of mutations discuss. Students learned the concept of developmental genetics.

Unit 4: Be able to understand the basic of cytogenetics and role of chromosomal aberrations in crop evolution. Also learn the different techniques of molecular cytogenetics and their application.

Contents

Unit-1

Mendelian and Non-Mendelian Inheritance: Meiosis; Chromosome theory of inheritance; Mendelian laws; Gene interactions; Organelle inheritance.

Eukaryotic Genome: Evolution, structure and organization; Gene regulation.

Unit-2

Recombination in Eukaryotes: Linkage and crossing over: basic concepts, linkage maps, correlation of genetic and physical maps, molecular markers and construction of linkage maps; Molecular mechanism of recombination; QTL mapping.

Unit-3

Mutation: Basic concept, spontaneous and induced mutations, allele theory, physical and chemical mutagens; Molecular basis of mutations; Transposons and their use in mutagenesis and gene tagging in plant systems.

Concepts in: Developmental genetics; Behavioral genetics; Population genetics and Quantitative genetics.

Unit-4

Cytogenetics: Chromosome: Structure and nomenclature, centromere and telomere; Sex determination: mechanisms, sex chromosomes; Chromosomal aberrations: Duplications, deficiencies/deletions, inversions, interchanges/translocations; Role of chromosomal aberrations in crop evolution; Genome analysis in crop plants; Molecular Cytogenetics: FISH, GISH, FIBER-FISH, Flow Cytogenetics, Flow karyotyping, Applications of molecular cytogenetics

REFERENC BOOKS

1. Acquaah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.

2. Allard RW (1999). Principles of Plant Breeding (2nd Edition), John Wiley and Sons.

3.Hartl DL and Jones EW (2007). Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers.

4. Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC (2006). Genetics – From Genes to Genomes, 3rd edition, McGraw Hill.

5. Lewin B (2008). Genes IX, Jones and Barlett Publishers.

6. Singh RJ (2002). Plant Cytogenetics, 2nd edition, CRC Press.

7.Smartt J and Simmonds NW (1995). Evolution of Crop Plants (2nd Edition) Longman.

8. Strickberger MW (2008). Genetics, 3rd Edition, Pearson (Prentice Hall).

9. Weising K, Nybom H, Wolff K and Kahl G (2005) DNA Fingerprinting in Plants: Principles,

10. Methods and Applications, 2nd ed. Taylor and Francis Group, Boca Raton, FL.

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PGO1EBOT03: Food Microbiology

Course objective:

The course will enable students to understand the taxonomical classification, phenotypic andbiochemical identification of food associated molds, yeasts, yeast-like fungi and bacteria. The course will teach the strategies to develop fermented and non-fermented milk products, fermented plant-based products, malt beverages, distilled liquors, etc. The role of microbes in food spoilage, preservation and various foodborne diseases can be discussed.

Course Learning Outcomes:

Unit 1: Will know about production and evaluation of the quality of starter cultures and fermentedmilk products. They will understand the role of microbes in food spoilage and how different factors affect this process.

Unit 2: Gathers information regarding microbes causing food intoxications and food-borneinfections. The students will learn different diagnostics methods and preventive measures.

Unit 3: Knows traditional food preservation techniques including drying, salting, refrigeration, vacuum packaging, canning/bottling, chemical preservation and irradiation. The students will alsolearn use of modern techniques viz. high-pressure processing (HHP), bacteriocins,manosonication (MS), etc.They will be aware of fermentation protocols of different food products and understands the use and production of probiotics, prebiotics and nutraceuticals.

Unit 4: Gains knowledge about conventional methods for food quality analysis and is able to usethe most recent and non-invasive techniques of quantification and detection of food bornemicrobes. Understands the relevance of microbial standards for food safety, quality assuranceprograms that revolutionize food safety.

Contents

Unit I: Microbiology of food

Microorganisms important in food microbiology

a) Food associated bacteria, yeastsandmolds. Microbiome of food material.
b) Factors influencing microbial growth in food.

Microbial spoilage of foods

a) Spoilage of cereals and its products,vegetables, fruits, meat and meat products, milk and milk products,canned and sugar products,fish, seafood and poultry

b) Study of microbes responsible for spoilage and brief insights into chemical and physical spoilage of foods.

Unit II:

Food borne infections

a) Bacterial food borne infections and intoxications-*Brucella, Campylobacter, Clostridium, Escherichia* (ETEC/EHEC/EPEC/EAEC), *Salmonella, Shigella, Listeria, Vibrio, and Yersinia.*

b) Non- bacterial food borne infections and intoxications- Nematodes, protozoa, algae, fungi, and viruses.

c) General methods for diagnosis of infections, intoxications and preventive measures.

Unit III:

Food preservation

General principles of food preservation – Classical, Physical, chemical and biological food preservation methods

Fermentativefood products

Starter cultures for fermented foods,Fermented milk products: Yogurt, Cheese, Kefir, etc

Oriental fermented foods: Shoyu, Temph, Kimchi, etc,Fermented vegetables – Sauerkraut

Food beverages: Malt beverages, wines, vinegar.

Role of Probiotics, prebiotics and nutraceuticals

Unit IV:

Molecular techniques in detection of food pathogens and GM foods. Biosensors in food

Food research organizations/institutes in India

Food sanitation – Microbiology of food plant sanitation, water and milk testing

Food laws and quality control – HACCP, Codex alimentarius, PFA, FPO, MFPO, BIS, AGMARK.

Books recommended

1. Food Microbiology by W.C. Frazier, D.C. Westhoff , K.N. Vanitha. 5th edition. McGraw Hill Education. 2013.

2. Fundamental Food Microbiology by B. Rayand A. Bhunia. 5th edition. CRC press. 2013.

3. Food Microbiology by M. R. Adams, M. O. Moss, P. McClure. 4th edition. Royal Society of Chemistry. 2015.

4. Food Microbiology: Fundamentals and Frontiers by M. P. Doyle, L. R. Beuchat. 3rd Edition

5. Dairy Microbiology by Robinson. Volume II and I.

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PGO1EBOT04: Virology

Course objective:

The main objective of the course is to make students to understand the taxonomical classification, phenotypic and biochemical identification of various viruses. The course will teach the strategies to develop isolation and preservation of viruses and their life cycle for development of antiviral compounds for the viral infections and the role of various viruses in the development of vaccines etc.

Course Learning Outcomes:

Unit 1: Student will be able to describe the defining viral attributes, the general properties of viruses, and steps in virus infection cycle. The principles of virus classification, list the virus families, and describe methods of study virus infection. General overview of viral genomes and their types as well as isolation and preservation of viruses.

Unit 2: Student will be able to receive information regarding various bacteriophages life cycles, which are model viruses for the study. Applications of phages in therapy; Concern over phage contamination in food & fermentation industry.

Unit 3: Students will be able to know various plant and animal viruses and their isolation, preservation and classifications. Student willbe able to describe host defense against virus infectionand able to describe general characteristics of acute viral infections, pathogenesis of Influenza virus, Polio virus, Measles virus, and Rotavirusinfection. Student will be able to describe general characteristics of chronic, persistent, latentinfections

Unit 4: Student will be able to describe how different antiviral drugs and their mode of action of viruses, student knows how live viral vaccines are made, how inactivatedviral vaccines are made, Polio vaccine and story of polio eradication. Student is able to describe antiviral drug discovery process, mechanism of drug resistance and use of interferons for viral infections.

Contents

Unit – I: Prokaryotic Viruses

- Discovery of bacteriophages, Structure and composition of bacteriophages, Classification
- system of Baltimore& ICTV
- Phage biodiversity, Genome diversity and host- specific interactions
- Isolation and purification by filtration, ultracentrifugation and affinity chromatography
- Plaque assays

- One step growth, single burst and eclipse experiments

Unit – II:

- Life cycle of model bacteriophages infecting *E coli* – λ (lytic lysogenic)
- 7. Life cycle of model bacteriophages: ϕ X 174, M13
- 8. Life cycle of model bacteriophages: T4, T7
- 9. Life cycle of model bacteriophages: Qß, Mu
- 10. Applications of phages - therapy; Concern over phage contamination in industry (dairy)

Unit –III : Eukaryotic Viruses

- Discovery and classification of plant and animal viruses, structure of viruses, viroids, virusoids
- Classification of viruses – ICTV and Baltimore classifications
- Host – viruses interactions, permissive/non – permissive hosts; Cytopathic effects
- Isolation and purification of viruses, Cultivation and propagation
- Assay methods – pock assay, hemagglutination assay, transformation assay.
- Structure, Life cycle and Pathogenicity of Gemini virus
- Structure, Life cycle and Pathogenicity of TMV
- Structure, Life cycle and Pathogenicity of Adenovirus
- Structure, Life cycle and Pathogenicity of Rotavirus
- Structure, Life cycle and Pathogenicity of Rubella, Influenza and Measles viruses
- Structure, Life cycle and Pathogenicity of HIV and Hepatitis B Virus

Unit –IV: Prevention & control of viral diseases

- Antiviral compounds and their mode of action,
- Interferon and their mode of action.
- General principles of viral vaccination
- **Applications of Virology:**
- Use of viral vectors in cloning and expression, Gene therapy and Phage display

References:

1. Principles of Virology, (Vol I & II) Flint SJ, Enquist LW, Racaniello VR, Skalka AM Pub ASN Press
2. Introduction to Modern Virology – Dimmock
3. Basic Virology – Wagner
4. Virology – Saravanan
5. Virology – Maharajan
6. Molecular Virology – A. J. Cann
7. An introduction to Viruses – Biswas

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SEMESTER I
M. Sc BOTANY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21

COURSE CODE: PS01CBOT04 (Practicals based on PS01CBOT01 and PS01CBOT02)

Based on Ecology and Biodiversity and Bioanalytical Techniques and Instrumentation

List of practicals:

1. Introductory Aspects of Ecology
2. To determine the Minimum Size of Quadrate by Species-Area-Curve Method
3. To determine the Minimum Number of Quadrate
4. To Study Community Structure/characteristics – Frequency, Density and Abundance of Species by Quadrates (Random Sampling Method)
5. To Study Community Structure/characteristics – Frequency, Density and Abundance of Species by Line Transect Method
6. To Study Community Structure/characteristics – Frequency, Density and Abundance of Species by Belt Transect Method
7. To study various stages ecosystem succession and its role in community assemblance.
8. To study the Vegetation by Point-Frame Method
9. To study the Vegetation by Physiognomic Method (Biological Spectrum Method)
10. Field Visit to Protected Area (National Park / Sanctuary) or Natural Habitat / Ecosystem of Gujarat State (Compulsory)
11. Introduction to pH, buffer preparation, molar, normal and % solutions.
12. Calculations for making stock solution
13. Separation of amino acids by TLC
14. Separation of cells by density gradient centrifugation
15. Determination of partition coefficient

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

COURSE CODE: PS01CBOT05 (Practicals based on PS01CBOT03and PS01EBOT01)

Based on Cell biology and Fundamentals of Biochemistry& Bioenergetics

List of Practicals

1. Estimation of Reducing Sugar in Jaggeryby Cole's Method
2. Estimation of Protein by Folin-Lowry Method
3. Estimation of Reducing Sugar by DNS Method
4. Total Sugar Estimation by Phenol Sulphuric method
5. Estimation of RNA by Orcinol Method
6. Localization of Cell Organelle and Determination of Chlorophyll and Carotenoids
7. Estimation of Amino Acid (Proline)
8. Estimation of Amino Acid (Methionine from Food Grains)
9. Study of Cell structure (Eukaryotic & Prokaryotic)
10. Study of Meiosis and Mitosis

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PG02CBOT01: Systematics of Angiosperms

Course objective:

This course aims to give comprehensive understanding in angiosperm taxonomy as well as its practice and applications. The ultimate aim of taxonomy is to understand the evolution at work.

Course Learning Outcomes:

Unit 1: The students are learning the basic knowledge of plants taxonomy with IUCN Red data list and its conservation priorities and its application. Also learn the floras and monograph preparation and literature in taxonomic studies and resources.

Unit 2: Be able to learn the naming of the plant through plant nomenclature.

Unit 3: Understanding the classification through different cladistics methods like UPGMA, NJ etc and their use and utility.

Unit 4: Students learn the phylogeny and classification of angiosperms of system their use and utility. Salient features of vegetational aspects and study of ten dominates family of flora of Gujarat state.

Contents

Unit 1

Plant taxonomy: Definition, Principles and golas, historical development, scope and importance; taxonomy as a synthetic discipline; applications - IUCN Red List, Conservation priorities.
Taxonomy Tools: Herbarium, floras, Monographs, Botanical gardens, GPS, GIS.

Unit 2

Nomenclature: Purpose, Principles, and overall knowledge of International Code of Nomenclature for algae, fungi, and plants (ICN) and articles pertaining to typification, publication, priority, author citation and their application.
Cladistics: Introduction – advantages and problems; classical taxonomy as base for molecular systematics; systematics and phylogenetics classifications – use and utility. The choice of molecules in systematics – Nucleic acids, proteins and amino acids.

Unit 3

Cladistics (Phylogeny) – concepts, parsimony, cladograms and trees; characters: apomorphic and plesiomorphic characters, homologous vs analogous; character states, binary and multistate characters, characters transformations; morphometric vs molecular characters. Trees - monophly, polyphyly and paraphyly; rooted and unrooted.

Unit 4

Sequences – finding homologous sequences and alignment; local vs global alignment; pairwaise and multiple sequence alignment. Tree construction – algorithmic (UPGMA and Neighbour Joining) and tree-searching (Parsimony, Maximum Liklihood and Bayesian). Phylogenomics as the modern trend in plant taxonomy.

Flora of Gujarat State: Salient features of vegetational aspects and study of ten dominates family of flora of Gujarat state.

REFERENC BOOKS

1.Barry G. Hall, 2011. Phylogenetic Trees Made Easy: A How-To Manual. Fourth Edition.Sinauer Associates, Inc., Publishers, Sunderland, USA.

2. Davis, P.H. and V.M. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, Edinburgh.

3..Douglas Soltis, Pamela Soltis, Peter Endress, Mark Chase, Steven Manchester, Walter Judd, Lucas Majure, and Evgeny Mavrodiev, 2017. Phylogeny and Evolution of Angiosperms. University of Chicago Press: 1427 E. 60th Street Chicago, IL 60637 USA.

6.Ian J. Kitching, Peter L. Forey, Christopher J. Humphries and David M. Williams, 1998. Cladistics: The Theory and Practice of Parsimony analysis (2nd Ed.). The Oxford University Press.

7.Jain, S.K. and R.R. Rao. 1977. A handbook of Field and Herbarium methods. Today and Tomorrow Printers and Publishers, New Delhi.

8. Jones, S.B. and A.E. Luchsinger. 1987. Plant Systematics (2nd Ed.) McGrawHill Book Company. New York.

10. Lawrence, G.H.M. 1951. Taxonomy of Vascular. Plants. Oxford & IBH Publishing Co.

11. Michael George Simpson, 2010. Plant systematic (2nd Edition). Academic Press.

11. Nei, M. and S. Kumar, 2000. Molecular Evolution and Phylogenetics. Oxford University Press Inc.

12. Peter Skelton and Andrew Smith, 2002. Cladistics: A Practical Primer on CD-ROM with accompanying booklet by Neale Monks.Cambridge University Press.

13.Quicke, D.L.J. 1993. Principles and Techniques of Contemporary Taxonomy. Blackie Academic & Professional.

14.Salemi, M. and A.-M. Vandamme, 2003.The Phylogenetic Handbook. A Practical Approach to DNA and Protein Phylogeny.Cambridge University Press.

15. Singh, G. 2010. Plant systematics: an integrated approach (Third Edition). CRC Press.

16. Sivarajan, V.V. 1991. (2nd ed.). Introduction to the Principles of Plant Taxonomy (Ed. N S K Robson). Oxford & IBH publishing Co. Pvt. Ltd.

17. Stace, C.A. 1989 (2nd ed.). Plant Taxonomy and Biosystematics. Edward Arnold.

18. Stuessy, Tod F., 2009. Plant taxonomy: the systematic evaluation of comparative data (2nd ed.). New York: Columbia University Press.

19. Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, Michael J. Donoghue, 2015. Plant Systematics: A Phylogenetic Approach, Fourth Edition.Sinauer Associates, Inc., Publishers, Sunderland, USA.

20. Shah. G.L. 1978. Flora of Gujarat. Vol.1 and 2. Sardar Patel University, Vallabh Vidyanagar,

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PG02CBOT02: Plant Reproductive Biology

Course objective:

This course aims to give comprehensive understanding the embryogenesis, development of flower and seed development process. Students also lean the developmental biology of male and female gametophytes and pollen –pistil interaction.

Course Learning Outcomes:

Unit 1: Be able to outline the concepts of development of flower with suitable flower examples and gender expression in monoecious and dioecious plants.

Unit 2: Outline of the developmental biology of male and female gametophytes and male sterility- mechanisms and applications.

Unit 3: Students learn the pollen-pistil interaction and their self-compatibility mechanisms.

Unit 4: Basic idea of embryogenesis and seed development process and apomixis, polyembryony, somatic embryogenesis.

Contents

Unit-I

Development of flower: Transition to flowering - vegetative to reproductive evocation, floral homeotic mutations in Arabidopsis, Antirrhinum and Petunia, axis development in flower, gender expression in monoecious and dioecious plants.

Unit-2

Developmental biology of male and female gametophytes: Regulation of anther and ovule development, microsporogenesis and microgametogenesis, megasporogenesis and megagametogenesis, male sterility- mechanisms and applications, pollen embryogenesis.

Unit-3

Pollen-pistil interaction: In vivo and in vitro pollen germination, pollen tube growth and guidance, double fertilization, self-compatibility mechanisms, incongruity.

Unit-4

Embryogenesis and seed development: Polarity during embryogenesis, pattern mutants, in vitro fertilization, endosperm development, apomixis, polyembryony, somatic embryogenesis.

REFERENC BOOKS

1. Fosket DE. (1994) Plant, Growth and Development: A Molecular Approach, Academic Press.
2.Hopkins WG. (2006). The Green World: Plant Development, Chelsea House Publication
3.Howell SH. (1998) Molecular Genetics of Plant Development, Cambridge University Press.
4.Leyser O and Day S (2003) Mechanism of Plant Development, Blackwell Press
5.Mauseth JD (1988). Plant Anatomy, The Benjamin/ Cummings Publisher, USA
6.Nair MNB (1998). Wood Anatomy and Major Uses of Wood, Faculty of Forestry, University of Putra Malaysia, Malaysia.
7. Parihar NS (1993) An Introduction to Embryophyta: Vol I – Bryophyta, Vol II – Pteridophyta, Central Book Dept. Allahabad.
8.Raghavan V (2000) Developmental Biology of Flowering Plants, Springer, Netherlands
9.Raghavan V (1997). Molecular Embryology of Flowering Plants. Cambridge. University Press.
10. Richards AJ (1986) Plant Breeding System, George Allen and Unwin.
11.Shivanna KR (2003) Pollen Biology and Biotechnology, Science Publishers.

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PG02CBOT03: Plant Physiology

Course objective:

This course teaches processes of various plant functions such as plant water relationship, mechanism of water absorption, transpiration, ascent of sap, plant movement and absorption of mineral salts, photosynthesis with emphasis on mechanism of abiotic stresses at physiological and molecular level with reference to crop productivity.

Course Learning Outcomes:

Unit 1: The students are learning the basic knowledge of plant absorption of water and minerals, transpiration and ascent of sap and their cell activity and its application.

Unit 2: Be able to learn the photosynthesis activity, their different mechanism and its application crop productivity. Students learn the role of different growth hormones and their application in plant growth and development process.

Unit 3: Be able to learn the photoperiodism and vernalization for crop cultivation and their utility.

Unit 4: This course also learns the plant movement and stress physiology and their molecular mechanisms.

Contents

UNIT-1

Absorption of water, transpiration and ascent of sap:

- Water – structure, physical properties and significance to plant life
- Movement of materials into and out of cells – diffusion, osmosis, osmotic pressure, plant cell as osmotic systems, significance of osmosis in plants
- Plasmolysis, its advantages and imbibition.
- Mechanism of water absorption - Active (osmotic and non osmotic) and passive absorption. External factors affecting water absorption.
- Transpiration – kinds of transpiration, mechanism of stomatal transpiration and its significance & factors affecting the rate of transpiration, antitranspirants.

- Ascent of Sap, Path of Ascent Sap. Vital theories, root pressure theory, physical forces theory, transpiration pull and cohesion of water theory
- Absorption of mineral salts: - Mechanism of mineral salt absorption – ion-exchange, passive and active absorption, the carrier concept theory.

UNIT-2

Photosynthesis: Photosynthetic apparatus, Photosynthetic pigments and absorption of light energy.

- Excited states of atoms or molecules – Fluorescence, Phosphorescence, Quantum requirement and quantum yield
- Red drop and Emerson's enhancement effect. Photosynthetic units – the Quantosomes, action spectrum.
- Mechanism of photosynthesis : Light reaction (Hill reaction) and Dark reaction (Calvin cycle), Blackman's law of limiting factors, factors affecting photosynthesis, significance of photosynthesis to mankind

UNIT-3

Growth & Growth Hormones: Growth, Kinetics of growth (Growth curve or sigmoid curve). Natural growth hormones - Auxins, Gibberellins, kinetin & cytokinins, ethylene, abscisic acid (ABA) (Discovery, Chemical nature, physiological effects and practical applications).

- **Photoperiodism and Vernalization** – Classification of plants on the basis of photoperiods, importance of photoperiodism. Vernalization – conditions necessary for vernalization, mechanism of vernalization, practical utility of vernalization

UNIT-4

Plant Movements and Stress physiology.

- Movements of locomotion – Autonomic and Paratonic (tactic)
- Movements of curvature – Autonomic and paratonic (tropic) growth movements, Paratonic Variation movements (Nastic movements) and hygroscopic movements.

- Stress physiology – Introduction, water deficit and drought resistance, salt stress and salt resistance, cold injury and cold resistance, chilling injury and chilling resistance, freezing injury (frost) and freezing resistance, high temperature(heat) stress and high temperature(heat) resistance, heavy metal stress and heavy metal resistance.

REFERENCE BOOKS

1. Jain, V.K. (2007) Fundamentals of plant physiology (10^{th} Edition) S. Chand and Co., New Delhi, India. ISBN; 81 - 219 – 0462 – 5, Code; 03 020.
2. S.N. Pandey & B.K.Sinha (2008) Plant Physiology (4^{th} Edition) Vikas Publishing House Pvt. Ltd., A-22, Sector-4, Noida (UP), ISBN : 81-259-1879-5.

3. S. Mukherji & A. K. Ghosh (2006) Plant physiology, New Central Book Agency (P) Ltd.,8/1 Chintamony Das Lane, Kolkata-700 009 India. ISBN: 81-7381-478-3

4. Salisbury, F.B. and Ross, C.W. (1992) Plant physiology (4th Edition), Wadsworth Publishing Co., California, USA. ISBN : 10 : 0534151620.

5. Mohr, H. and Sehopfer, P. (1995) Plant physiology, Springer-Verlag, Berlin, Germany. ISBN : 3-540-58016-6.

6. S. K. Verma and Mohit Verma, A text book of Plant physiology, Biochemistry and Biotechnology, S. Chand & Co., New Delhi, India. ISBN; 81-219-0627- Code; 03A 202.

7. Devlin and Witham, Plant physiology

8. Noggle and Fritz, Introduction to Plant physiology, Printice Hall, India.

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PGO2EBOT01: Biostatistics

Course objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Learning Outcomes:

Unit 1: Student will be able to know about basic terms and use in biostatistics. They will understand types of data, their organisation and various graphical representation methods to represent data, and will enable students to understand the basic statistics and its importance in research.

Unit 2: Student will be able to calculate various measures of central tendencies, measure of dispersion and measure of kurtosis and skewness and its importance.

Unit 3: To understand the exact method of data analysis for the problem under investigation. Student will be able to perform various hypothesis testing like T-test, F-test, and chi square tests and its application in biological sciences.

Unit 4: Understanding for drawing valid inferences and to plan for future investigations. Student will be able to perform Correlation & regression calculations and its application in Biological sciences. Student will able to perform ANOVA testing.

Contents

Unit I:

Data Collection and Presentation
Types of Biological Data: Qualitative Data -Nominal, Ordinal, Ranked; Quantitative Data: Discrete and Continuous.
Understanding of Population and sample
Methods of Collection of Data: (i) Experimental Data and (ii) Survey Data- Simple random Sample (with and without replacement), stratified sampling and cluster sampling.
Tables: Frequency Distributions, Relative Frequencies.
Graphical Presentation: Bar charts, Histograms, Frequency Polygons, One way scatter plots, Box plots, two-way scatter plots, line graphs.

Unit II:

Descriptive Statistics
Measures of Central Tendency: Mean, Median and Mode, quartiles, deciles and percentiles (both for raw data and grouped data)
Measures of Dispersion: Range, Interquartile Range, Variance, Standard Deviation and

Coefficient of Variation.
Measures of Skewness and Kurtosis.

Unit III:
Statistical hypotheses: Null and Alternative hypotheses.
Statistical Tests: Acceptance region and Rejection Region. Types of errors and power of the test.
Goodness of fit tests.
Random Variables: Discrete and Continuous. Some examples from biological sciences.
Probability Distributions: General Normal Distribution, Standard Normal Distribution ; Sampling Distributions- t, chi-square and F distributions.
Significance Tests for Normal Distribution: One sample tests for mean – z test and t-test.
Two sample tests for normal distributions: Tests for means (i) when variances are known (ii) when variances are unknown. Tests for equality of variances.
Paired t-test for equality of means.
Confidence Intervals

Unit IV:
Correlation: Covariance, Calculation of covariance, correlation analysis and correlation Coefficient calculated from ungrouped data.
Regression: Simple linear regressions analysis, regression coefficients, Linear regression line or equation
Analysis of Variance: Completely Randomized Design, Randomized Block Design

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.

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PGO2EBOT02: Microtechniques

Course objective:

The course will enable the students to understand the principle of microscopy types of microscopy used to explore the knowledge of microtechniques. The measurement of size of microorganisms, sanctioning of the bigger specimens by using microtome, preparation of temporary and permanent slides of the specimen will be known.

Course Learning Outcomes:

Unit 1: Deals with the concept and principle of microscopy. It provides the understanding of different optical components of microscopy,

Unit 2: Enrich the knowledge of different types of microscopes such as Light microscope, Compound microscope, Dark field, Bright field, Stereo microscope, Confocal, Phase contrast microscope, Fluorescent microscope, Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM).

Unit 3: Explore the need and methods of measurement of microorganisms by micrometry. The calibration and working with the stage and ocular micrometer. Illustrations and concept of photomicrography will also be known.

Unit 4: The concept of killing and fixation agents, dehydration of the specimens, embedding of specimens in paraffin wax, free hand sanctioning, mounting of sanctioned specimen on slide, staining of specimens and different types of staining will be known.

Contents

Unit 1

Principles of microscopy – eyepiece lens and objective lenses; Magnification, Resolving power, numerical aperture. Mechanical components: base, pillar, stage, sub stage, body tube, focusing knobs, nose pieces. Optical components: mirror, objectives, ocular lens, condenser, Focussing slides under low/ high power and oil immersion.

Unit 2

Types of microscopes: Light microscope, Compound microscope, Dark field, Bright field, Interference microscope (Stereo microscope), Confocal, Inverted microscope, Phase contrast

microscope, Fluorescent microscope, Electron microscope: Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM)

Unit 3

Measurement of Microorganisms- Micrometry – Stage micrometer, Ocular micrometer, Calibration and working. Preparation of illustrations using camera lucida, digital camera and photomicrography.

Unit 4

Killing and fixation agents - carnoy's formula, F. A. A.

Dehydration– general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series

Infiltration – paraffin wax method, Embedding

Free hand sectioning- Microtome (Rotary and sledge) serial sectioning and its significance.

Mounting- A brief account on whole mounting, maceration, smears and squash preparation, application of permanent whole mounts, permanent sections.

Staining- Classification: natural dyes, coal tar dyes, double staining, vital staining; simple, Gram staining, negative staining, capsule staining, spore staining, flagellar staining, nuclear staining and acid fast staining, stains: saffranin, hematoxylin, acetocarmine.

References

1. Plant Microtehnique, Johansen D.A. 1940, Mc Graw – Hill Book Company, Inc. New York.
2. Manual of Microbiology – Tools and Techniques, Kanika S. 2007, Ane's student edition.
3. Botanical Microtechnique; principles and Practice, Khasim S.K., 2002, Capital Publishing Company New Delhi.
4. Essentials of botanical microtechnique, Toji T. 2004, Apex Infotec Publ.
5. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st ed. Wiley-Liss, 2001.
6. R. Marimuthu – Microscopy and Microtechnique, MJP Publishers, 2015.

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SYLLABUS EFFECTIVE FROM: JUNE-2020-21

PGO2EBOT03: Omics and Computational Biology

Course objective:

The course will enable the students to understand the concept of genome mapping, genome sequencing, functional genomics, basic concepts of proteomics tools, data mining, basic concepts and tools of lipidomics, glycomics and phosphoproteomics. Storage and retrieval of various types of databases collection and storing of sequence data will be understood by the students. Students will also be able to know the local and global alignment through scoring matrices, gene prediction methods, RNA fold analysis, splice site identification.

Course Learning Outcomes:

Unit 1: Deals with genome, genomics and transcriptomics. The concept and application of physical map, genetic map, genome sequencing, functional genomics, small or large regulatory RNAs and dark matter will be known.

Unit 2: Gathers information regarding concept of proteomics, metabolomics and lipidomics. The the basic tools of proteomics, metabolomics, lipidomics and their applications will be learnt by the students.

Unit 3: Deals with the primary and secondary databases, collection, storage and retrieval of databases, knowledge of freeware, software and hardware. The sequence databases, sequence format, annotation and archival of databases will be understood.

Unit 4: Accords the sequence alignment and applications. The choice of alignment, local alignment, global alignment scoring matrices, codon usages analysis, RNA fold analysis, splice site identification will also be studied by the students.

Contents

Unit 1

Genome, Genomics & Transcriptomics:

Genome mapping: Physical and Genetic Map, Genome Sequencing, Next generation sequencing methods, Genome Annotation, Functional Genomics. Transcription factor binding sites, RNA-Seq, Microarrays, Regulatory RNAs: small or large, Computational prediction of miRNA target genes, RNA Dark matter

Unit 2

Proteomics, Metabolomics &Lipidomics:

Basic concepts, Tools of proteomics- SDS PAGE, 2D PAGE, Liquid chromatography, Mass Spectrometry (ESI and MALDI),Protein identification by peptide mass fingerprinting, Applications of proteomics.

Fundamental concept, data integration and data mining; Tools of metabolomics-Capillary electrophoresis, Gas chromatography, Electrochemical detectors.

Basic concepts and toolsof lipidomics, glycomics and phosphoproteomics.

Unit 3

Biological Literature Information access, storage and retrieval systems- Primary and secondary databases of genomics, trascriptomics, proteomics and metabolomics. Knowledge on freeware and commercial software. Importance of hardware and software creations.

Collecting and Storing Sequence Data: Sequence assembly; Submission of Sequences; Sequence accuracy; Sequence databases; Sequence formats; Annotation and Archival.

Unit 4

Sequence alignment and applications: Uses: Choice to be made for alignment; Scoring matrices; Homology and related concepts; Dot Matrix methods; Dynamic programming methods for global and local alignments tools- FASTA, BLAST, statistical and Biological significance.

Nucleic acid sequence analysis: Reading frames; Codon Usage analysis; Translational and transcriptional signals; Splice site identification; Gene prediction methods; RNA fold analysis

REFERENCES

1. Introduction to Proteomics -Tools for the New Biology by Daniel C. Liebler, Humana Press.
2. Mass Spectrometry for Biotechnology by Gary Siuzdak, Academic Press.
3. Proteomics for Biological Discovery by Timothy Veenstra and John Yates, Wiley.
4. Metabolomics- Methods and Protocols by Wolfram Weckwerth, Humana Press.
5. Lipidomics- Technologies and Applications by Kim Ekroos, Wiley-VCH.
6. Web/Journal Resources.
7. Transcriptomics: Expression Pattern Analysis, Virendra Gomase, Somnath Tagore; VDM Publishing, 2009 – Science.
8. Current Protocols in Bioinformatics, Edited by A.D. Baxevanis et al, Wiley Publishers. 2005.
9. Bioinformatics by David W. Mount, Cold Spring Harbor Laboratory Press. 2001.
10. Fundamental concepts of Bioinformatics by D.E. Krane and M.L Raymer, Pearson Education. 2003.

11. Bioinformatics and Functional Genomics by Pevsner, J., John Wiley and Sons, New Jersey, USA. 2003
12. Principles of Genome Analysis and Genomics (3rd Ed.) by Primrose, S.B. and Twyman, R.M., Blackwell Publishing Company, Oxford, UK. 2003.
13. Introduction to proteomics – Tools for the new biology (1st Ed.) by Liebler, D.C., 2002, Human Press Inc., New Jersey, USA.
14. Bioinformatics: Sequence and Genome Analysis by Mount, D., Cold Spring Harbor Laboratory Press, New York. 2004.

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PGO2EBOT04: Plant Tissue Culture

Course objective:

The students will be technically and critically trained with theory and practical exposure to perform the plant tissue culture, which is the at most required in this field of science; skilled candidates are absorbed in well established and commercial tissue culture units. Students learn the tissue culture techniques have the ability to set up their own laboratories for the propagation of the plants which is the need in the society.

Course Learning Outcomes:

Unit 1: Student will be able to know about basic of the plant tissue culture starting from principle, Basic requirements, procedure, Components of culture media and role of plant growth regulators and micropropagation and its application.

Unit 2: Be learning the different techniques and application of the crop improvement varieties development and also somaclonal and gametoclonal variation methods application to improve crop variety.

Unit 3: Students will be learning the Cell culture and production of secondary metabolites from plants.

Unit 4: Be able to learn the different steps of the involved in the production of transgenic plant and role of PTC. Gene insertion through Agrobacterium spp and its application.

Contents

Unit 1

Principles of Plant Tissue Culture: Basic requirements and procedure (media preparation, explants sterilization, inoculation, culture conditions, hardening etc.) Components of culture media and role of plant growth regulators (phytohormones) Basic principle of micropropagation

(totiotency). Difference between direct and indirect organogenesis. Selection of deferent explants and application of PTC.

Unit 2

Detail Techniques and Applications of PTC: Haploid production: Androgenesis and gynogenesis, pollen embryos, pollen embryos, haploid production through distant hybridization, diploidization to raise homozygous diploids, applications. Embryo culture and its applications. Somatic embryogenesis and its application. Method to develop seedless triploid variety through endosperm culture technique. Somaclonal and gametoclonal variation: Principle, method and application to improve crop variety.

Unit 3

Detail Techniques and Applications of PTC : Protoplast culture: Isolation of protoplast, method of somatic hybridization, identification of hybrid protoplast, culture of hybid protoplast, cybrid production and their applications. Virus eradication through apical meristem culture and micrografting methods. Cell culture and production of secondary metabolites.

Unit 4

Gene Insertion and Production of Transgenic Plant: Steps involved in the production of transgenic plant and role of PTC. Types of explants selected and different techniques for gene insertion. Gene insertion through Agrobacterium spp. Process of natural plasmid transformation and limitations, Structure of Ti/Ri plasmids, Construction of binary and cointegrated vectors, Co-culture method, Tri-parental mating. Application of transgenic plants (herbicide resistance, photosynthesis, stress resistance etc.).

REFERENC BOOKS

1.Plant Biotechnology: Practical Manual, C.C. Giri & Archana Giri, IK international, S25, Green park Extension, Uphar Cinema Market, New Delhi-110016.

2. Experiments in Plant tissue culture- John H. Dodds and Lorin W. Robert.

3. Plant tissue culture : Theory and Practice- S.S. Bhojwani and M.K. Razdan (1996) Elsevier, Amsterdam.

4. Plant propagation by tissue culture- George and Sherington.

5. Plant cell, tissue and organ culture- O.L. Gamborg and G.C. Phillips.

6. Plant tissue culture and molecular biology application and prospects-P.S. Srivastava.

7. Micropropagation by plant tissue culture –Reinert and Bajaj.

8. Plant tissue culture- S. Narayanswamy.

9. Intoduction to plant tissue culture- M.K. Razdan.

10. Plant tissue culture: Applications and Limitations- S.S. Bhojwani (1990) Elsevier, Amsterdam.

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COURSE CODE: PS02CBOT04 (Practicals based on PS02CBOT01 and PS02CBOT02)

Based on Ecology and Biodiversity and Bioanalytical Techniques and Instrumentation

List of practicals:

1. Writing of technical descriptions.
2. Construction of keys.
3. Identification of local species using Floras, keys and campus field trips.
4. Identification of 25 families using diagnostic characters; diagnostic characters to be illustrated.
5. Construction of phylogentic tree based on gene sequences available at NCBI database.
6. Study of the stages of pollen and ovule development in the wild and mutant plants using permanent slides, electron micrograph and available phenotypes.
7. Pollen in vitro germination methods: Sitting drop culture, suspension culture, surface culture.
8.Correlation between fertility (stainability), viability (TTC and FDA staining) and germinability (in vitro) of pollen grains.
9. Assessment of stigma receptivity by localizing peroxidases, non-specific esterases and phosphatases.
10. Aniline blue fluorescence method to localize pollen tubes to study different aspects of pollen-pistil interaction.
11. Study of post-fertilization stage with the help of permanent slides and electron micrographs.
12. Dissection of embryo and endosperm.

CHARUTAR VIDYAMANDAL UNIVERSITY
VALLABH VIDHANAGAR
SEMESTER I
M. Sc BOTANY
SYLLABUS EFFECTIVE FROM: JUNE-2020-21
COURSE CODE: PS02CBOT05 (Practicals based on PS02CBOT03 and PS02EBOT01)

Based on Plant Physiology and Biostatistics

List of Practicals

1. Demonstration the phenomenon of osmosis using potato osmoscope.
2. Measurement of diffusion pressure deficit of plant cell.
3. Demonstrate the phenomenon of Imbibitions.
4. Determination of osmotic pressure of cell sap by plasmolytic method.
5. To demonstrate the transpiration by four leaves method.
6. Measurement of root pressure and water lifting power of transpiration.
7. To demonstrate O2 evolved during photosynthesis by inverted funnel method.
8. To compare rate of photosynthesis under different conditions.
9. Demonstration of CO_2 is necessary for photosynthesis (By Moll's half leaf experiment.
10. Separation of Chloroplast pigments by TLC / Paper Chromatography.
11. Demonstration of plant movements.
12. To convert ungrouped data in to grouped data using Sturge's formula.
13. To study representation of data by one dimensional diagram.
14. To study representation of data by two dimensional diagram.
15. To study representation of data by means of graphs. (Histogram & frequency polygon).
16. To study the data representation by graphs (Frequency polygon & frequency curve).
17. To study how to calculate descriptive statistics for the given data. (Mean mode, median, standard deviation and mean deviation).
18. To study the concept of permutation and combination in practical counting problems.
19. To study the concept of normal distribution and apply it to practical problems.
20. To study the concept of estimation (point estimation and interval estimation).
21. To apply the concept of skewness in the field of biosciences.
22. To apply the concept of F- test for biological problems.
23. To apply the concept of χ^2 – test for biological problems.