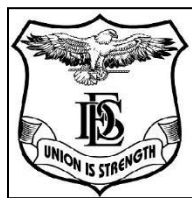


Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)



Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for

Program: Bachelor of Science

Course: F.Y.Bsc

Subject: **Biotechnology**

Choice Based Credit System (CBCS)

with effect from

Academic Year 2024-2025

Semester	Course Code	Course Title	Vertical	Credit
I	24BTMJ111	Fundamentals of Biotechnology-I	Major	2
	24BTMJ112	Molecular Biology and Genetics -2	Major	2
	24BTMJ111	Practical-1(Fundamentals of Biotechnology+Molecular Biology and genetics)	Major	2
	24BTOE131	Food Technology	OE	2
	24BTVC141	Wine Technology	VSC	2
	24BTSC151	Microbial Culture Techniques	SEC	2
II	24BTMJ211	Fundamentals of Biotechnology-2	Major	2
	24BTMJ212	Cell biology Physiology and Immunology	Major	2
	24BTMJ211	Practical-2 (Fundamentals of biotechnology-2 +Cell biology, physiology, immunology)	Major	2
	24BTMRC221/ 24BTMRM221/ 24BTMRL221	Chemistry-I/ Microbiology-I/ Life Science-I	Minor	2
	24BTVC241	Analytical Instrumentation Techniques	VSC	2
	KU23USBTSC251	Crop improvement strategies, Composting and Solid waste management	SEC	2

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in Science Program will be able to	
PO1	Understand scope and applications of Biotechnology and its interdisciplinary approach.
PO2	Understand Fundamentals of Biotechnology. Acquire and Demonstrate Comprehensive knowledge and good experimental and Laboratory skills in Biotechnology
PO3	Build strong Knowledge and conceptual learning through systematic thinking and self -study.
PO4	Understand and apply appropriate tools and techniques in Biotechnology Acquire the knowledge of upcoming fields of Biotechnology, make the learner competent to pursue higher studies.
PO5	Acquire an ability to analyze and scientific problems and develop scientific research ability
PO6	Learn appropriate skills in conduction of Biotechnological experiments learn good oral and written communication skills as well as nurturing creativity
PO7	Employee skill and knowledge in environmental management and sustainable development Impart skills and Knowledge in designing entrepreneurial courses in the field of biotechnology.

Course Code	MAJOR-I SEM – I	Credits	Lectures/ Week
24BTMJ111	Paper I Fundamentals of biotechnology-1	2	2
Course Outcomes: After successful completion of this course, students would be able to • To acquaint students with various fields of Biotechnology and their applications • To Understand the applications of biotechnology in the field of agriculture, health care, Human welfare, fermentation industry and Environment • To analyse Scope of the Biotechnology in different industry.			
Unit	Topics	No of Lectures	
I	Scope and Introduction to Biotechnology Biotechnology –an interdisciplinary biological science; Biotechnology – definition; History & Introduction to Biotechnology; Traditional and Modern Biotechnology; Scope and importance of biotechnology; World of Biotechnology- Pharmaceutical Biotechnology, Plant Biotechnology, Industrial Biotechnology, Marine Biotechnology, Animal Biotechnology, Medical Biotechnology, Environmental Biotechnology. Biotechnology in India – bio-business in India, booming biotech market, success story of biotech market, policy initiatives; and global trends; Biotechnology research in India; Potential of modern biotechnology Achievement of biotechnology; Prevention of misuse of biotechnology; Biotechnology Institutions in India (Public and Private Sector); Public Perception of Biotechnology. Case study: Serum Institute of India and its products	15	

II	Applications of Biotechnology and fermentation technology 1.Agriculture –GM fruits GM papaya, GM tomato Insect resistant transgenic plants – Bt cotton, Btbrinjal Modifications in nutrient quality – starch, oil, seed protein, golden rice 2.Human welfare Cloned genes for production of -Insulin; recombinant vaccine for Hepatitis B virus. Molecular farming Edible vaccines and their advantages Case study: Genetically modified microbes for bioremediation of oil spills in marine environment Introduction: Marine Biotechnology introduction Introduction to fermentation processes Screening: Definition Primary screening and its methods Secondary screening and its methods Fermenter design: Definition of a fermenter Aerated stirred tank batch fermenter-Typical design Construction materials used, aeration and agitation Temperature control Foam production and control pH measurement and control CO₂ and O₂ control Fermentation medium: Basic requirements of industrial media Criteria for use of raw materials in media Examples of raw materials used Growth factors Water Carbohydrate sources Protein sources	15
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Textbooks:

- A Textbook of Biotechnology by R Chaubey 4th edition
- Advanced Biotechnology by R C Dubey 1st edition
- Biotechnology, Expanding Horizons by B D Singh, 4th edition
- Microbial Technology Microbial Process Volume I PepplerPeriman second Edition
- Springer Book of Marine Biotechnology

Additional References:

- Stanbury and whitaker 3rd ed
- Screening- Casida
- Fermenter Design- Nduka Okafor 1sted

Course Code	MAJOR-II SEM – I	Credits	Lectures/ Week
24BTMJ112	Paper II Molecular Biology and Genetics	2	2
Course Outcomes: After successful completion of this course, students would be able to • Memorize the structure of a chromosome, including centromeres, telomeres, and sister chromatids. • Interpret diagrams or models illustrating the structure of DNA, chromosomes, and chromatin. • Apply understanding of mutation types to analyze genetic diseases or evolutionary processes. • Evaluate genetic experiments and identify sources of error.			
Unit	Topics	No of Lectures	
I	DNA Composition, Chromosome, DNA structure and packing: The Composition and structure of DNA and RNA: Nucleotide and Nucleoside, Structure of nucleotides. Structure of DNA. DNA double helix – Watson and Crick’s Model. Structure of RNA. Types of RNA. Organization of DNA in chromosome: Prokaryotic Chromosomes. Eukaryotic Chromosomes. Histone and Non-histone proteins. Nucleosome Structure. Packaging of DNA into chromosomes. Euchromatin and Heterochromatin. Centromeres and Telomeres	15	

II	DNA replication and Mutation and repair and fundamentals of genetics: DNA Replication in Prokaryotes Evidence of Semi-conservative DNA replication- Meselson and Stahl's experiment DNA Polymerases and its role, E. coli Chromosome Replication, DNA Replication in Eukaryotes Enzymes and proteins involved in DNA replication DNA REPAIR Photo reversal, Base Excision Repair, Mismatch Repair. Genetics: Basic Terminologies in genetics Mendelian Genetics: Monohybrid Crosses and Mendel's Principle of Segregation. Representing crosses with a Branch Diagram. Principle of Segregation: The use of Test crosses. Dihybrid crosses and Mendel's Principle of Independent Assortment. Extensions of and Deviations from Mendelian Genetic Principles: Multiple Alleles - ABO Blood groups Modifications of Dominance Relationships: Incomplete Dominance and Codominance.	15
Textbooks: • iGenetics – A molecular approach Peter J Russell 3rd edition • 2.Biochemistry - U Satyanarayana U.Chakrapani, (2013) 4th edition • 3.Principles of Genetics. E J Gardner, M J Simmons & D Peter Snustad. 8th edition • 4. A Textbook of Biotechnology By R.C. Dube • 5.iGenetics – A molecular approach Peter J Russell 3rd edition. Additional References: • Cell and Molecular Biology 5th edition by Gerald Karp (John Wiley and sons publications) • Genetics, (2006) Strickberger MW - (Prentice Hall, India) (recombination repair)		

Course Code	Practical of Major	Credits	Lectures/ Week
24BTMJ111	Paper II Molecular Biology and Genetics	2	4
Course Outcomes: After successful completion of this course, students would be able to ● To learn the concepts and principles of various laboratory and aseptic techniques. ● To acquaint students with various microbial culture techniques. ● To understand the concept of Genetics and to apply it in various analytical techniques.			
Topics 1. Sterilization of Laboratory Glassware and Media using Autoclave and Hot air oven 2. Preparation of media- Nutrient broth and Agar, MacConkey Agar, Sabouraud's Agar 3. Isolation and characterization of food fermenting organism from idli batter (Using Bergey's Manual) 4. Isolation of Yeasts from the natural environment. 5. Study of morphology and colony characteristics of yeasts. 6. Estimation of DNA by DPA method. 7. Estimation of RNA by Orcinol method 8. Qualitative analysis of DNA 9. Study of Blood groups ABO in humans. 10. Construction of Pedigree charts and Analysis of Human Genetic trait using Pedigree analysis. 11. Problems based on Mendelian genetics 12. Study of Microscope			

Course Code	OPEN ELECTIVE SEM – I Food Technology	Credits	Lectures/ Week
24BTOE131	Paper I Food Technology	2	2
Course Outcomes: After successful completion of this course, students would be able to ● Recall the basic principles of fermentation and its significance in food production ● Discuss the nutritional benefits of fermented foods. ● Apply appropriate food preservation methods based on the characteristics of specific food products and desired outcomes. ● Evaluate the effectiveness of different food preservation techniques in extending shelf life and maintaining product quality.			
Unit	Topics	No of Lectures	
I	Introduction To Food Biotechnology, its applications, Fermented Food Products History of microorganisms in food science and key developments. Applications of biotechnology in fermented food products - Introduction to Unit Operations and Processes, Food processing & packaging (canning & bottling), Production of cultures. Fermented food products – Bread, Vinegar, Sauerkraut, Single Cell Protein (SCP), Probiotics	15	
II	Food spoilage, Food Preservation, Quality and safety Food spoilage, food deterioration and contamination. Methods of food preservation Indicators of Food Microbial Quality & Safety, FSSAI & FDA	15	

Textbooks:

- Food Microbiology, 5 th edition, William C. Frazier, Dennis C. Westhoff, N.M. Vanitha, McGraw Hill Education, India.
- Fundamentals of Food Biotechnology, 2 nd edition, Byong H. Lee, Wiley Blackwell
- Modern Food Microbiology, 7 th edition, James M. Jay, Martin J. Loessner, David A. Golden, Food Science Texts Series
- Prescott's Microbiology, 9 th edition, Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw-Hill, USA.
- Industrial Microbiology, A. H. Patel

Additional References:

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=15>

Course Code	VOCATIONAL SKILL COURSE SEM – I - Wine Technology	Credits	Lectures/ Week
24BTVC141	Paper I Wine Technology Practical	2	4
Course Outcomes: After successful completion of this course, students would be able to ● To impart the knowledge of Wine and Fermentation ● Categorize Wines and the microorganisms based on various growth conditions. ● Differentiate between the Processes of development of Different wines. ● To Identify, formulate, and solve complex problems related to viticulture by applying principles of Biotechnology			
Topics 1) Wine Technology laboratory instruments: Refractometer, Hydrometer Colorimeter Distillation Unit 2) Identification of grape & wine varieties(To study the different types of varieties of grapes suitable for the production of wine) 3) Different types of wines and Types of wine glasses 4) To study threshold detection of acid taste 5) To study threshold detection of sweet taste. 6) To study threshold detection of bitter taste. 7) Alcohol estimation in wine 8) Sensory evaluation of white wine & red wine. 9) Effect of the serving temperature on wine 10) Interaction of sweet, acid and bitter taste			

Course Code	SKILL ENHANCEMENT COURSE SEM – I - Microbial Culture Techniques	Credits	Lectures/ Week
24BTSC151	Paper I Microbial Culture Techniques Practical	2	4
Course Outcomes: After successful completion of this course, students would be able to ● Impart the knowledge of growth of microorganisms. ● Categorize microorganisms based on various characteristics. ● Differentiate between various media used for culturing microorganisms and decide which one is appropriate for the microorganism used in the experiment.			
Topics 1) Study of Baker's Yeast and Wine's Yeast. 2) Identification and isolation of the fungus of Bread 3) Identification and isolation of the fungus of Turmeric 4) Identification and isolation of the fungus of Rice 5) Identification of gram positive and gram negative bacteria by Gram staining technique. 6) Aerogravimetric analysis of microorganism. 7) To identify the microorganisms present in the Sea water Sample 8) Breed's count. 9) Measurement of cell mass microscopic count (Direct and indirect enumeration methods).			

Semester II

Course Code	MAJOR I SEM – II	Credits	Lectures/Week
24BTMJ211	Paper I Fundamentals of Biotechnology-2	2	2
Course Outcomes: After successful completion of this course, students would be able to - Identify common techniques used in medical biotechnology and immunotechnology, such as PCR, ELISA, and monoclonal antibody production. - Explain the principles behind medical biotechnology applications, such as the use of genetically engineered proteins for therapeutic purposes. - Utilize bioinformatics tools to analyze genomic data and identify potential drug targets or biomarkers for disease. - Evaluate the immune response to pathogens or therapeutic interventions in terms of immunological parameters and clinical outcomes.			
Unit	Topics	No of Lectures	
I	Medical biotechnology and Immunotechnology Introduction to Medical Biotechnology Vaccines Types of vaccines General vaccine production Large scale production of vaccine Trends in Vaccines Research Issues related to vaccine research Organ transplant cloning Stem cells -Sources and applications	15	

II	Genetic engineering rDNA technology –Definitionanddevelopments What is genetic engineering? What is gene cloning? Strategy for cloning – How to clone a gene? How to construct rDNA? Source DNA [insert] Isolation of DNA from bacterial cell Enzymes in rDNA – 1. restriction endonuclease; 2. DNA ligase; . Enzymes to modify ends of DNA molecules - Exonuclease,endonuclease reverse transcriptase; terminal deoxynucleotidyl transferase Vectors – Role as agents of transfer Features of plasmid vectors Plasmid vectors - pBR322 Introducing insert into cloning vector Host cells – E. coli; Introducing vector into host – Prokaryote Identification of recombinant clones	15
Textbooks: ● Food Microbiology, 5th edition, William C. Frazier, Dennis C. Westhoff, N.M. Vanitha, McGraw Hill Education, India ● Fundamentals of Food Biotechnology, 2nd edition, Byong H. Lee, Wiley Blackwell ● Prescott's Microbiology, 9th edition, Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw-Hill, USA Additional References: ● Industrial Microbiology, A. H. Patel ● Biotechnology Fundamentals by Dr. FirdosAlam Khan ● Medical Biotechnology Glick 1st edition		

Course Code	MAJOR II SEM – II	Credits	Lectures/ Week
24BTMJ212	Paper II Cell Biology Physiology and Immunology	2	2
Course Outcomes: After successful completion of this course, students would be able to - Remember the basic functions of these organelles. - Explain the significance of the differences in ultrastructure between prokaryotic and eukaryotic cells. - Apply understanding of immune responses to explain the effectiveness of different vaccination strategies. - Compare and contrast different types of immune responses, such as cellular vs. humoral immunity.			
Unit	Topics	No of Lectures	
I	Ultrastructure of Prokaryotic and eukaryotic cells and physiology Ultrastructure of Prokaryotic Cell: Concept of Cell shape, size, and arrangement Bacterial structures external to cell wall - Flagella, Pilli, Cell Wall(Gram Positive and Negative); Ultrastructure of Eukaryotic Cell: Cell wall; Plasma membrane, Cytoplasmic Matrix, Nucleus –Nuclear Structure, nuclear envelope, nucleoplasm, Nucleolus; cytoplasmic structures – cytoplasmic inclusions, cytoplasmic organelles - Endoplasmic Reticulum; Golgi Apparatus; Mitochondria; Chloroplasts; Ribosomes; Lysosome - Endocytosis, Phagocytosis, Autophagy; Peroxisomes. Microfilaments, Intermediate Filaments, and Microtubules External Cell Coverings: Cilia And Flagella Comparison of Prokaryotic And Eukaryotic Cells Photosynthesis. Light Reactions, Cyclic and Non-Cyclic Photo induced Electron Flow, Energetics of Photosynthesis, Introduction to physiology. Concept of Homeostasis Respiratory system: Phases of Respiration, Principle of gaseous exchange Excretion – Organs of excretion. Types of excretory products.	15	

II	Immunology Introduction to Immunology: Overview of Immune Systems, Innate Immunity, Mechanisms of innate immunity, Acquired Immunity, Local and Herd Immunity, Humoral and Cellular Immunity - Factors Influencing and Mechanisms of each. Introduction to Immuno-technology	15
Textbooks: ● Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Verma and Agarwal ● Cell and Molecular Biology by Karp, 6th Ed ● The Cell by Cooper and Hausman, 4th Ed ● 4. Leininger Principles of Biochemistry, 5th Edition- Nelson D. L., and Cox M. M. (2008) W H Freeman and Company ● 5. A textbook of plant physiology and biochemistry by S K. Verma (S Chand publications) part1- physiology- (photosynthesis) ● 6. Plant Physiology: Theory and Applications, 2e- S. L. Kochhar and Sukhbir Kaur Gujral , Cambridge University Advanced Biotechnology By R C Dube Additional References: ● Microbiology Stanier 5th ed ● Pelczar Ried and Chan		

Course Code	MAJOR SEM – II – Practical	Credits	Lectures/ Week
24BTMJ211	Paper II Cell Biology Physiology and Immunology	2	4
Course Outcomes: After successful completion of this course, students would be able to • To impart the knowledge of Physiology and Immunological Techniques. • To learn about different analytical techniques and apply that knowledge to different concepts. • To understand various separation techniques such as Chromatography.			
Topics			
1. Sterility Checking of Vaccines. 2. Isolation and Enumeration of microorganisms- Serial dilution, Surface spread method. 3. Isolation and Enumeration of microorganisms- Serial dilution, Pour plate method. 4. Problems on Restriction digestion. 5. Monochrome staining, Differential Staining, Special and Fungal Staining. 6. Study of growth curve of <i>E.coli</i>. 7. Isolation techniques: T-streak, polygon method 8. Colony Characteristics of Microorganisms. 9. Solvent extraction of plant pigments and study the absorption spectra of pigments Study of Hill's reaction. 10. Separation of Carotenoids by thin layer chromatography 11. Study of human blood count (RBC and WBC) using Haemocytometer 12. Study of Antigen antibody interaction by Ouchterlony method			

Minor Papers

Course Code	Minor SEM II – Chemistry - I	Credits	Lectures/ Week
24BTMR221	Basic Chemistry and Biomolecules-1	2	2
Course Outcome: After successful completion of this course, students would be able to ● To impart knowledge of Titrimetric and Volumetric Estimations and handling of basic Analytical Techniques like Chromatography and Colorimetry ● Identify isomers of molecules. ● Explain the types of chemical bonds. ● Interpret the results based on the understanding of titration end points. ● To impart hands-on skills in preparation of Buffers and Solutions ● To impart the knowledge of Classification, Structure and Characterization of Biomolecules ● Use the acquired knowledge in preparation of buffers and solutions. ● Differentiate between various types of carbohydrates and lipids. ● Explain the characteristics and functions of carbohydrates and lipids.			
Unit	Topics	No of Lectures	
I	Nomenclature, Chemical bonds and Titrimetric analysis Classification and Systematic Nomenclature of organic compounds. Chemical Bonds: Types and transition between the main types of bonding. Ionic Bond: Nature of Ionic Bond, factors influencing the formation of Ionic Bond. Structure of NaCl and CsCl. Covalent Bond: Nature of Covalent Bond, Types of covalent bond (Polar and Coordinate covalent bonds). Hydrogen Bond: Theory of Hydrogen Bonding and Types of Hydrogen Bonding Titrimetric Analysis: Titration, Titrant, Titrand, End Point, Equivalence Point, Titration Error, Indicator, Primary and Secondary Standards, Characteristics, and examples. Types of Titrations – Acid –Base, Redox. Precipitation,	15	

II	Water, Standard solutions and Buffers, Basics of Carbohydrate Chemistry Structure, Properties, and functions of water Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to Volume ratio, ppb, ppm, millimoles, milliequivalents (Numerical expected). Buffer solutions –Concept of Buffers, Biological buffers: Significance of biological buffers. pH of body fluids like blood and saliva. Blood buffer systems: Eg : Carbonate, Acetate and Phosphate buffers. Carbohydrates: Introduction definition and general formula. Classification of carbohydrates - Monosaccharides - Two Families of Monosaccharides. Aldo series and keto series; (Triose - Glyceraldehyde and Dihydroxyacetone, Tetrose- Erythrose and Erythrulose, Pentose- Xylose, Xylulose, Ribose, Ribulose, Hexose- Glucose, Galactose, Mannose, Heptose- sedoheptose and Sedoheptulose structures to be taught) Concept of Enantiomers, Mutarotation, Anomeric carbon and Epimers of glucose.	15
Textbooks: • A Textbook of Organic Chemistry, 15th edition, Arun Bahl, B S Bahl, S. Chand • Vogel's Textbook of Quantitative Analysis, Fifth Edition • Organic Chemistry, by Solomon and Fryhle • Robert Murray, Daryl G., Peter M., Victor R.; Harper's Illustrated Biochemistry. • Satyanarayana U. and Chakrapani U. (2007). Biochemistry. 3rd Edition. Books and Allied (P) Ltd. • Lehninger PRINCIPLES OF BIOCHEMISTRY by Nelson and Cox Fifth Edition Additional References: • Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet & Judith Voet, John Wiley and Sons, I. USA		

Course Code	Minor SEM II - Paper I-Microbiology-I	Credits	Lectures/ Week
24BTMR222	Microbiology-I	2	2
Course Outcomes: After successful completion of this course, students would be able to • To impart the knowledge of growth of microorganisms. • Categorize microorganisms based on various characteristics. • Experiment with different sterilization techniques. • Differentiate between various staining techniques and decide the appropriate one as per requirement in planned experiments.			
Unit	Topics	No of Lectures	
I	Introduction to microbiology Fundamentals, History and Evolution of Microbiology. Discovery of Microorganisms, Conflict over spontaneous generation. Role of microorganisms in disease Classification: The place of Microorganisms in the living world Classification whittaker's five kingdom classification Introduction to Bergey's Manual Groups of Microorganisms Applications of microbiology in various fields Cultivation and Maintenance of microorganisms,Nutritional categories of microorganisms, methods of isolation. Definition and Scope of Industrial Microbiology	15	

II	Sterilization techniques Microscopy and stains : Sterilization and Disinfection. Microscope- Simple and Compound: General principles of optics; various parts and their functions - objectives – numerical aperture, resolving power, depth of focus, working distance, aberrations; oculars; condensers. Dark Field Microscope; Phase Contrast Microscope and Fluorescent Microscope, TEM, SEM Maintenance of Microscopes Applications of microscopes Stains and Staining Solutions Simple Staining, Differential Staining – Gram staining and Acid Fast Staining with specific examples	15
Textbooks: ● Microbiology by Prescott 5th edition ● Microbiology by Pelczar, Reid and Chan 5th Edition ● Textbook of Microbiology by Ananthanarayan Additional References: ● Fundamental Principles of Bacteriology A J Salle 7th ● Microbiology by Pelczar, Chan and Krieg, 5th Ed		

Course Code	Minor Sem II Life Science - I	Credits	Lectures/ Week				
24BTMRP223	Life Science-I	2	2				
Course Outcomes: After successful completion of this course, students would be able to ● To impart skills in Techniques in Genetic Analysis and Population Genetics ● Explain types of genetic mapping in bacteria. ● Describe the fundamentals in genetics based on mendelian principles. ● Apply the principles learned in genetics in identifying and demonstrating hereditary genetic traits in one's family. (LO apply and analyse)							
<table> <tr> <th data-bbox="175 1770 430 1860">Unit</th><th data-bbox="430 1770 1291 1860">Topics</th><th colspan="2" data-bbox="1291 1770 1445 1860">No of Lectures</th></tr> </table>				Unit	Topics	No of Lectures	
Unit	Topics	No of Lectures					

I	Microbial genetics and Molecular Biology Genetic analysis in Bacteria: Prototrophs, Auxotrophs. Genetic Mapping in Bacteria by Conjugation: Discovery of Conjugation in E.coli. The sex factor F Genetic mapping in bacteria by Transformation. Genetic mapping in Bacteria by Transduction: Bacteriophages - Lytic and Lysogenic pathway. Karyotype and Idiogram Parameters used in Karyotype preparation- Human Karyotype (Normal) - Male and Female. Definition of Mutations- Classification of mutations Types of Point Mutations, Types of Spontaneous and induced mutations Mutagenesis and types of Mutagens. (Examples of Physical, Chemical and Biological Mutagens)	15
II	Population genetics Genetic Structure of Populations – Hardy- Weinberg Law and its Assumptions Genetic Variations in Populations, Forces responsible for change in gene frequencies in population- Natural Selection. Genetic Drift migration Speciation Role of Population Genetics in Conservation Biology Genetic Polymorphism	15
Textbooks: • iGenetics – A molecular approach Peter J Russell 3rd edition. • Biochemistry - U Satyanarayana U. Chakrapani, (2013) 4th edition • Principles of Genetics. E J Gardner, M J Simmons & D Peter Snustad. 8th edition • A Textbook of Biotechnology By R.C. Dube Additional References: • Cell and Molecular Biology 5th edition by Gerald Karp (John Wiley and sons publications) • Genetics, (2006) Strickberger MW - (Prentice Hall, India)		

Course Code	VOCATIONAL SKILL COURSE SEM – II - Analytical Instrumentation Techniques	Credits	Lectures/ Week
24BTVC241	Paper I Analytical Instrumentation Techniques Practical	2	4
Course Outcomes: After successful completion of this course, students would be able to ● To gain knowledge of the many categories of analytical instruments. ● Demonstrate an understanding of the fundamental theoretical concepts and underlying techniques of microscopy, spectroscopy analysis and chromatography. ● Comply with procedures and prepare samples for chromatographic, electrophoretic, spectroscopic, and microscopy examination. ● Use a variety of analytical instruments while being closely supervised. ● Analyse analytical data to provide quantitative outcomes.			
1) Types of microscopy 2) Different types of staining: Direct staining and Indirect staining 3) Thin layer chromatography. 4) 2D chromatography 5) To Study the Principle and working of colorimeter 6) To Study the principle and working of Spectrophotometer. 7) Electrophoresis: Introduction 8) Agarose Gel electrophoresis . 9) PAGE.			

Course Code	SKILL ENHANCEMENT COURSE SEM – II	Credits	Lectures/ Week
24BTSC251	Paper I Crop Improvement Strategies, omposting and Solid waste management Practical	2	4
Course Outcomes: After successful completion of this course, students would be able to ● Understand basic concepts of Plant Breeding. ● To acquire knowledge about High yielding hybrid crops. ● To discuss different solid waste management techniques ● To understand different Composting methods.			
Topics 1. To Isolate and study the morphology of different types of pollen grains. 2. To study the economic importance of high yielding hybrid crop varieties: Wheat, Rice, Sugarcane, Sorghum, Millets and Roses. 3. To study the effect of colchicine / PDB to induce polyploidy 4. Types of vegetative propagation : Grafting, Budding, Layering, Stem cutting. 5. Study of Plant growth hormone: Auxin, Gibberellin, Absciscic acid 6. Study of hydroponics: its advantages and disadvantages 7. Composting and its types: Indore and Banglore 8. Preparation of bio-enzymes by using house-hold waste. 9. Study of Bacterial, fungal and viral plant pathogens 10. Isolation and growth of <i>Rhizobium</i>, <i>Azotobacter</i>, <i>Nostoc</i>, <i>Azolla</i>			

Evaluation Scheme for First Year (UG) under NEP (2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1) Continuous Internal Assessment(CIA)Assignment - Tutorial/ Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks

2) Continuous Internal Assessment(CIA) ONLINE Unit Test – 10 marks

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hour

Theory question paper pattern: All questions are compulsory.

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weight age of the topic.

III. Practical Examination

- Each core subject carries 50 Marks
- Duration: 2 Hours for each practical course.
- Certified Journal is compulsory for appearing at the time of Practical Exam

NOTE: To pass the examination, attendance is compulsory in both Internal & External (Theory + Practical) Examinations.