

Annual Teaching Plan
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
PG- Department of Biotechnology
Academic Year 2025-26

Name of the teacher: Mr. A.L. Upadhye

M.Sc. – I Biotechnology Semester: I

Course code & Title: Environmental Biotechnology and Ecology

Subject Code- DSE21MBT11 and Practical: DSC21MBT19 Techniques in Microbial Technology

Month June 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Introduction to the environment: pollution and its types	Air pollution: Primary and secondary pollutants, Global Warming, Ozone hole Water pollution: Introduction, causes, hardness, and its types BOD, COD, wastewater treatment Soil pollution and its types and control Environmental Toxicology Definition, classification and concept, Pesticide Toxicity – Classification (Organic and Inorganic), Mode of action of toxicants (Metals, organophosphates, carbamates and mutagens), Bioconcentration, Bioaccumulation, Biomagnification.
15	03	18		
Month July 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Bioremediation Techniques	Definition, Principle, Insitu and Exsitu Bioremediation, Bioremediation of waste waters (MSW, BSW and ISW), Activated Sludge Process, Lagoons, Oxidation ponds, Trickling filter. Solid Waste Treatment [Plastics and Aromatics], Slurry Phase Treatment, Agricultural Bioremediation- Microbial Composting, Biogas Land Farming and pest Control, Bioremediation of Industrial wastes, Xenobiotics, Bioaugmentation and Biofiltration.
15	03	18		
Month August 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Ecosystem- Concept, structure, function.	Productivity- Kinds of productivity. Food chain- types of food chain, food web, concept of trophic Ecological pyramids- concepts and types. Energy flow in ecosystem –concept of energy, unit of energy, Biogeochemical cycle: Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus cycle Concept - Habitat and Niche
15	03	18		
Month September 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Population Ecology	Introduction, population characteristics, Natality, Mortality, survivor ship curves, age structure, age Evolution: - Theories of evolution-Lamarckism, Darwinism, Modern synthetic theory and Mutational theory. Evidences of evolution and Adaptive radiation and Adaptive conversation. Concept of species and speciation. Hardy-Weinberg law and Equation
15	03	18		

M.Sc. – I Biotechnology Semester: II
Subject Code- DSE21MBT21 Molecular Biology

Month December 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Properties and Function of DNA:	Experimental Evidences for DNA as a genetic material: Griffith's Exp., Avery, Macleod, McCarty Exp., Blender Exp., RNA As a genetic material Gierer and Schram expt. Tm, Cot Curve, Purity of DNA, Acid- Base Nature, Buoyant Density Concept of Gene, Unit of Gene (Cistron, Recon, and Muton), Fine Structure of gene, One gene One Polypeptide Hypothesis, interrupted gene. Organization of genome:-Viral (Lambda, T4), Bacteria (E. coli), Eukaryote, Typical Structure of chromosome (Euchromatin & Heterochromatin), Packaging of DNA (Nucleosome, Solenoid Model).
15	03	18		
Month January 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Nucleic Acid biosyntheses	De novo synthesis of Purine and Pyrimidine ring, Salvage Pathway, Feedback inhibition. DNA Replication- Semi conservative model of replication (M.S Expt.). Direction of replication (Unidirectional and Bidirectional). Prokaryotic and eukaryotic replication- Enzymes involved in replication, initiation, elongation and termination. Rolling circle model and telomere replication. DNA Damage:- Mutation and its Types, Chemical damage of DNA by: Base Analogue, 5 Bromo uracil, 2Amino purine, Nitrous Acid, Nitrosoguanidine, Methly sulphonate, EMS, Intercalating Agent (EtBr), DNA damage by UV Radation DNA Repair: - Photo reactivation Repair of pyrimidine dimers, Direct repair, Excision repair (Nucleotide and Base), Mismatch repair, SOS repair, Recombination repair, Repair of double strand DNA break.
15	03	18		
Month February 2026			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Transcription in prokaryote and Eukaryote	Mechanism of transcription-Enzyme involved, initiation, elongation and termination. Inhibitors of transcription, Post transcriptional modification, Transcriptional control by hormones. Genetic Code Properties of genetic code. Assignment of codons with Unknown sequences a) Polyuridylic b) Acid Copolymers method. Assignment of codons with known sequences a) Binding technique b) Repetitive seq. technique. Wobble Hypothesis, Variation in genetic code.
15	03	18		
Month March 2026			Module/Unit:	Sub-units planned

Lectures 15	Practical 03	Total 18	Translation in prokaryote and Eukaryote	Structure and role of ribosome in translation, Amino acid t-RNA complex formation, Initiation, Elongation, termination of translation, Inhibitors of translation. Post-translational modifications (Protein folding, Removal of Leader sequences, Phosphorylation, Glycosylation). Regulation of gene expression in prokaryotes and eukaryote. Regulation of gene expression in prokaryotes: a) Lac operon b) Tryptophan operon c) Arabinose operon. Regulation of gene expression at transcriptional and translational levels.
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M.Sc. – II Biotechnology Semester: III

Course code & Title: Advances in Gene Technology DSC21MBT31

Subject Code- Advances in Gene Technology DSC21MBT31

Month December 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Enzymes and Vectors Used in Gene Cloning	Restriction enzymes and its types, T4 and E coli DNA polymerases, Reverse transcriptase, Terminal transferase, Alkaline phosphatase, Polynucleotide kinase, Ligase, DNases, RNases, and Topoisomerase. Plasmids Vectors: pUC18 and pBR322, Bacteriophages; Lambda phage, M13 phage, lambda Insertion and Replacement vectors, phagemid vectors, Cosmids: Artificial chromosome vectors (YACs; BACs); plant based vectors: Ti and Ri plasmid, yeast vectors, shuttle vectors. TA cloning Vectors.
15	03	18		
Month January 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Nucleic Acid Hybridization and Sequencing	Probe Preparations and designing, methods of probe labelling, radiolabeling, and non-radio labelling. Application of probes in cloning. Sequencing methods: enzymatic DNA sequencing; chemical sequencing of DNA; automated DNA sequencing
15	03	18		
Month February 2026			Module/Unit:	Sub-units planned
Lectures	Practical	Total	Principle of PCR and its use in Genetic engineering	Principles of PCR: primer design; fidelity of thermo stable enzymes; DNA polymerases; types of PCR – multiplex, nested; reverse-transcription PCR, real time PCR, touchdown PCR, hot start PCR, colony PCR, asymmetric PCR, cloning of PCR products; proof reading enzymes; PCR based site specific mutagenesis; PCR in molecular diagnostics; viral and bacterial detection. Principles of PCR: primer design; fidelity of thermo stable enzymes; DNA polymerases; types of PCR – multiplex, nested; reverse-transcription PCR, real
15	03	18		

				time PCR, touchdown PCR, hot start PCR, colony PCR, asymmetric PCR, cloning of PCR products; proof reading enzymes; PCR based site specific mutagenesis; PCR in molecular diagnostics; viral and bacterial detection.
Month March 2026			Module/Unit:	Sub-units planned
Lectures 15	Practical 03	Total 18	Applications of Genetic Engineering	Insertion of foreign DNA into host cells; transformation, electroporation, transfection; construction of libraries: cDNA and genomic DNA libraries, isolation of mRNA and total RNA, construction of microarrays – genomic arrays, cDNA arrays and oligo arrays; Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; gene knockouts and gene therapy; creation of transgenic plants;

M.Sc. – ~~IT~~ Biotechnology Semester: ~~IV~~

Course code & Title: Bioinformatics Subject Code- DSE21MBT41 Bioinformatics

Month December 2025			Module/Unit:	Sub-units planned
Lectures 15	Practical 03	Total 18	Introduction to Bioinformatics	History of bioinformatics: Multidisciplinary approach of bioinformatics, Computers in Biology and Medicines, Internet, and related programs; Networking HTTP, HTML, WAN, LAN, MAN, applications in communication. Introduction to Genomics: Introduction, Databases, Data, Nucleic acid sequence database, Gene Bank, EMBL, DDBJ. Sequence retrieval system (SRS): Entrez, DBGet. Human Genome Project (HGP), Goal and applications, final draft of HGP (complete information resources covered).
Month January 2025			Module/Unit:	Sub-units planned
Lectures 15	Practical 03	Total 18	Literature Database & Introduction to Proteomics	Literature Database: Pub Med and Pub Med central Introduction to Proteomics: Primary Protein sequences databases, Secondary sequences Databases, Structural Databases related to proteins (PDB, MMDB, CATH, SCOP)
Month February 2026			Module/Unit:	Sub-units planned
Lectures 15	Practical 03	Total 18	Sequence Alignment and Phylogenetic analysis	Sequence Alignment: Pair wise sequence alignment, Multiple sequence alignment, Local and Global sequence alignment. Phylogenetic analysis: Introduction: Definition of phylogenetic tree, nodes, internodes, root, tree, styles; cladogram, phenogram, curvogram0, Steps involved in construction of phylogenetic tree

Vivekanand College, Kolhapur (An Empowered Autonomous Institute)

P.G. Department of Biotechnology

Academic Year 2025-26

M.Sc. I Biotechnology

Name of the teacher: Dr. M. P. Mane

Semester-I

Course code & Title: Research Methodology in Biotechnology Subject Code: RMD14CHE11 and

Practical: DSC21MBT19 Techniques in Environmental Biotechnology & Cell Biology

Month - June 2025			Module/Unit: I	Sub-units planned
Lectures	Practical	Total	Fundamentals of Research Methodology	Meaning, Objective, Motivation and Types of Research • Research Approach • Significance of Research, Research Methods, research and Scientific Methods • Criteria of Good Research. Research Process and steps involved • Hypothesis: Meaning, functions and types of hypothesis; Null/Alternative hypothesis • Literature Survey, Source of information, Review • Ethical issues and intellectual property rights. • Publication Process, Selection of Journal, Citation index, Impact factor, H-index, Journal Cite score, Google scholar index, Research gate, Academia, etc
15	03	18		
Month July -August 2025			Module/Unit: II	Sub-units planned
Lectures	Practical	Total	Interpretation and Report Writing	Meaning of Interpretation, Why Interpretation? Technique of interpretation, Precaution in Interpretation • Significance of Report Writing, Different Steps in Writing Report, Layout of the Report, Types of Report. • Mechanics Writing a research report: Writing preliminaries, Main body of research, reference and bibliography • Precaution for Writing Research Reports • Meaning and Importance of workshop, Seminar, Conference, Symposium etc in research • Plagiarism-Concept and Significance of Plagiarism. • Writing tools: Grammarly, Answer the public, Copyscape, Chatgpt, ginger. • Referencing and citation tools: Endnote, Mendeley, Jabref, Zotero.
15	03	18		
Month September 2025			Module/Unit: III	Sub-units planned
Lectures	Practical	Total	Research Methodology in Biotechnology	Ultraviolet-visible absorption spectroscopy: Principle, Instrumentation and application. • Fluorescence spectrophotometry • Other types (IR, NMR, ESR and MASS) of spectrophotometry. • Elementary idea about X-ray crystallography, API- Electrospray and MALDI TOF, applications.
15	03	18		
Month October 2025			Module/Unit: IV	Sub-units planned
Lectures	Practical	Total	Research Methodology in Biotechnology	Chromatographic techniques: Principles of chromatography (Adsorption and Partition chromatography), Planar chromatography (Paper and Thin- layer chromatography), Electrophoretic techniques: General principles, support media, electrophoresis of proteins (SDS-PAGE, native
15	03	18		

				gels, gradient gels, isoelectric focusing gels and 2D (dimensional gels), electrophoresis of nucleic acids (Agarose, pulse-field and sequencing gels). Radioisotope techniques: Nature of radioactivity, isotopes in biochemistry, measurement of radioactivity
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Semester: II

Course Title: DSC07BTE21 Techniques in Molecular Biology

Month December 2025			Module/Unit:	Sub-units planned
Lectures	Practical	Total		
-	03	03		
Month January 2026			Module/Unit:	Sub-units planned
Lectures	Practical	Total		
-	02	02		
Month February 2026			Module/Unit:	Sub-units planned
Lectures	Practical	Total		
-	03	03		
Month March 2026			Module/Unit:	Sub-units planned
Lectures	Practical	Total		
-	02	02		

Vivekanand College, Kolhapur (An Empowered Autonomous Institute)

P.G. Department of Biotechnology

Academic Year 2025-26

M.Sc. II Biotechnology Semester-III

Name of the teacher: Dr. M. P. Mane

Semester: III

Course Title: Plant Biotechnology, Subject Code: DSE21MBT31 and

Practical: Techniques in Plant Biotechnology, DSC21MBT39

Month June 2025			Module/Unit: I	Sub-units planned
Lectures	Practical	Total	Plant Protection	Diseases of field, vegetable, orchard and plantation crops of India and their control; causes and classification of plant diseases; principles of plant disease control biological control of diseases; seed health testing, Integrated pest management-concepts and components; host plant resistance biological control of insect pests; genetic manipulation of insects for their control; pesticides, their formulation, classification and safe use; behavioral methods; insect growth regulators; biotechnological approaches in IPM
15	03	18		
Month July-August 2025			Module/Unit: II	Sub-units planned
Lectures	Practical	Total	Secondary Metabolites	Concept of secondary metabolites, their applications in agriculture and health industry, In vitro production of secondary metabolites: introduction to secondary metabolism, significance of cell differentiation, selection, downstream processing, influence of culture conditions on accumulation of secondary metabolites, immobilization of cells for enhanced production of secondary products, biotic and abiotic elicitation. Different techniques involved in isolation, purification and characterization of useful secondary metabolites from cultured cells.
15	03	18		
Month September 2025			Module/Unit: III	Sub-units planned
Lectures	Practical	Total	Transgenic techniques in plant biotechnology	Introduction of foreign gene into plants, basics of tumor formation, hairy root culture and its uses, features of Ti & Ri plasmid, mechanism of DNA transfer, role of virulence gene, use of reporter gene, multiple gene transfers, vector less or direct DNA transfer, particle bombardment, electroporation, microinjection, chloroplast transformation. Applications of plant transformation for enhancing resistance to pests, productivity & performance, nutritional value, modification of ornamental plants, bioengineered food, edible vaccines, plantibodies, bio pharming.
15	03	18		
Month October 2025			Module/Unit: IV	Sub-units planned
Lectures	Practical	Total	Concept of Plant Tissue culture	Laboratory design of plant tissue culture laboratory - Research lab and Commercial Lab, Principle and Working of equipment & instruments required in PTC. Precautions to maintain aseptic conditions in PTC Lab, Media Composition, Different types media used in
15	03	18		

				PTC. Organ culture technique: Introduction, Protocol, factors affecting w.r.t. Root tip culture, Leaf culture, Shoot tip & Meristem culture, Importance of Organ culture. Micro propagation: Concept of differentiation, Dedifferentiation and redifferentiation Different Stages of Micro propagation Applications of Micro propagation. Callus culture technique: Introduction, Types of callus, Factors affecting, protocol, Morphology & internal structure of callus,
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Semester: IV

Course Title: Animal Biotechnology, Subject Code: DSE21MBT41 and

Practical: Techniques in Molecular Cell Biology, Practical Code: DSC21MBT49

Month December 2025			Module/Unit: I	Sub-units planned
Lectures	Practical	Total	Introduction to animal tissue culture	Origin of concept of tissue culture, Cell types and cell lines, Differentiation of stem cells: embryonic, mesenchymal, hematopoietic and pluripotent stem cells, Fetal stem cells and adult stem cells. Culture medium: Natural (Blood plasma, Blood serum, Tissue extracts and serum free medium) and Chemically defined, Functions of the main ingredients of media. Major equipment's required: Laminar Flow Hood, CO2 incubator, Microscope, Autoclave, Water bath, Centrifuge, Culture flasks and plates, Pipettes, Scrapers, Freezer and refrigerator etc.
15	03	18		
Month January 2026			Module/Unit: II	Sub-units planned
Lectures	Practical	Total	Establishment of primary cell culture	Mouse splenocyte culture Handling mammalian cell lines: thawing, culture maintenance and cryopreservation, Cell counting using hemocytometer, Cell viability and proliferation assays: Trypan blue exclusion test, MTT assay, Propidium Iodide staining, CFSC labeling Magnetic approaches to cell separation, Dyna beads, nanoparticle preparations; growth factors and ex-vivo expansion of hematopoietic stem / progenitor cells bioreactors for expansion.
15	03	18		
Month February 2026			Module/Unit: III	Sub-units planned
Lectures	Practical	Total	Applications of animal tissue culture	Generation of chimeric, and knockout mice and their characterization. Gene editing: Gene silencing-CRISPR associated protein-9 nuclease (cas9) technology. Modern categories of vaccines - multivalent vaccines, synthetic peptide vaccines, recombinant vaccines, DNA vaccines, combination vaccines. Commercial preparation of vaccines- cell culture based vaccines, regulatory aspects of vaccination for humans and veterinary use. Livestock improvement: Manipulation of reproduction in animals
15	03	18		
Month March 2026			Module/Unit: IV	Sub-units planned

Lectures 15	Practical 03	Total 18	Applications of cell culture	Applications of cell culture in veterinary (disease diagnosis and its study), Applications of cell culture in medicine; hybridoma technology, recombinant therapeutic protein, living medicines, allergenic molecule drugs Applications of Stem cell therapies: Clinical applications of stem cell therapy: neurodegenerative diseases: Parkinson's disease, Alzheimer's, spinal cord injury, Tissue systems failures: diabetes, cardiomyopathy, kidney failure, lymphoma and leukemic malignancies requiring stem cell therapy. Applications of stem cells in tissue repair and regeneration Biomaterials, nanomaterial, biofabrication, 3D bioprinting, clinical needs and therapeutic solutions.
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Signature of Co-ordinator

DL SC CO-ORDINATOR
DEPARTMENT OF BIOTECHNOLOGY
VISHVAKAM COLLEGE POLYMER
(EMPLOYED AUTHORITY)

Signature of Teacher