Shivaji University, Kolhapur

Name of Department: Biochemistry

Name of Programme: M. Sc. in Env. Biotechnology

Vision
Craft a Competent human resource for research in Clinical Biochemistry and Bioinformatics.
Mission
Nurture the department to be a center of excellence in the new era of Biochemical Sciences by grooming youth at par with global competence.
Program Outcomes
1. Students should have gain knowledge in fundamental concepts Environmental Biotechnology. The graduate should also get sufficient knowledge of environemt related subjects like Ecology, Ecotoxicology, Ecochemistry, Environmental pollution control, Environmental Biotechnology, Biodiversity, IPR and Bioethics, etc. 2. Student should become well versed with the qualitative and quantitative evaluation of various biomolecules, enzyme assays, isolation, purification and characterization of biologically important proteins along with various techniques like PCR, gene cloning and transformation used in the field of Environmental Biotechnology, Biodiversity and Biosafety. 3. Aspirant should gain capability of handling independent Environmental related problems and should able to analyze the data obtained using modern technological tools to solve small, medium and large scale enterprises.
Program Specific Outcomes
1. Produce a manpower having fundamental knowledge of Environemntal Biotechnology and its applications in the field of i) Environmental pollution control; ii) Bioremediation; iii) Tool and Techniques in Biosciences; iv) Genetic Engineering; v) IPR and vi) Agribiotechnology. 2. Crafting of confident human resources capable of utilizing their skills in monitoring environmental pollution control and allied research areas in industries as well as reputed institutes. 3. Developing a candidate with a confidence of being successful in various competitive examinations like NET, SET, GATE, GRE, TOFEL etc. and proceed for a research career. Groom and encourage the students to be entrepreneur in environmental risk assessment.

Course Outcomes		
Part-I Semester-I		
LS 141 A (CBCS)	Cell Biochemistry & Nucleic Acids	1. Be able to define the structure and colligative properties of water, concept of pH, physiologically important buffer system and its regulation. 2. Relate to the concepts of various types of bonds, bond length, bond energy and generation and utilization of energy rich molecules like ATP. Chemical foundation of life. 3. Be able to analyze Gibbs free energy enthalpy and entropy, applications of laws of thermodynamics in living systems. 4. Describe basics of evolution of biomolecules with reference to Miller's experiment, evolution of prokaryotes and eukaryotes. 5. Describe cell biology with special reference to cell organization of prokaryotic and eukaryotic cells. Structural and functional capitalization of cell-mitochondria, chloroplast, lysozymes, Golgi bodies, plasma membrane and cytoskeleton, cell wall and nucleus, cell cycle and cell division, chromosome and genetic information storage. 6. Understand and explain details of Nucleic acid structure and metabolism.
LS 141 B (CBCS)	Cell Biology, Microbiology and Virology	1. Classify the prokaryotic and eukaryotic cell and define functions of each and every cell organelle. 2. Study the cell cycle in details. 3. Study the structure, classification and general characteristics of bacteria and viruses. 4. Study different methods in microbiology. 5. Experiment with microbial growth dynamics.
BC 142	Proteins:	1. Describe general metabolism scheme of

	Structure and Functions	amino acids, proteins and urea cycle 2. Evaluate techniques for studying primary sequence of proteins, experimental methods, end group analysis. 3. Explain dynamics of protein folding and role of molecular chaperones. 4. Demonstrate chemical synthesis of peptides/ solid phase automated synthesis. 5. Interpret protein evolution, convergent and divergent trees and illustrate Protein turnover 6. Describe vitamins as coenzymes and cofactors, sources, requirements, functions and deficiency symptoms of water soluble vitamins, structure and biochemical role.
BC 142	Biomolecules	1. Be able to demonstrate the structural and functionalrole of biomoleculesessential for cellular reactions. 2. Illustrate the catalytic mechanisms involved in synthesis of chemical energy from biomolecules. 3. Explain the physiological significance of anabolic and catabolic pathways used to drive cellular functions. 4. Enlist the chemical and biologicaldifferencesbetween DNA, RNA and theirrole in cellular behavior. 5. Summarize the central dogma of molecular biology and how mutations in DNA can alter cell performance.
BSI 141 (CBCS)	Biostatistics and Bioinformatics with Computer Orientation	1. Describe measures of central tendency and dispersion. 2. Apply probability and distribution. 3. Analyse bivariate data, hypothesis testing. Describebasics of computers, programming languages and application software. 4. Be able to relate to bioinformatics, databases, databank search, data mining,

		data management and interpretation. 5. Summarise genomics and proteomics.
LC BC 141	Laboratory Course I	1. Student will able to understand applications of various laboratory instruments like – pH meter, colorimeter, single pan balance, centrifuge etc. 2. Capable to carry out quantitative estimation of proteins. 3. Capable to carry out quantitative estimation of carbohydrates. 4. Capable to carry out quantitative estimation of lipids. 5. Capable to carry out quantitative estimation of nucleic acids.
LC BC 142	Laboratory Course II	1. Able to demonstrate isolation of proteins from various sources. 2. Able to demonstrate isolation of polysaccharides from various sources. 3. Able to demonstrate isolation of cholesterol and lecithin from egg. 4. Capable to check quality of oil using various quantitative methods. 5. Capable to detect amino acids.
Part-I Semester-II		
BC 241	Enzymology	1. Classify of enzymes and explain the structural – functional co-relation of enzymes 2. Illustrate the fundamental mechanism of enzyme activity through activation energy, binding energy and complementarity between enzyme active site and transition state 3. Detailed study of enzyme catalysis which includes factors affecting catalytic efficiency - proximity and orientation effects , distortion or strain, acid – base, nucleophilic catalysis, metal ion catalysis and covalent catalysis 4. Interpret enzyme kinetics including types of enzyme inhibitions and their role in

		chemical modification. 5. Analyze he structure function relations in various enzymes and basics of enzyme regulation. 6. Apply the process and commercial applications of immobilized enzymes.
MB 242	Molecular Biology	1. Explain the structure and organization of genome in the cell. 2. Illustrate characterization of DNA using different techniques. 3. Explain various types of Mutation. 4. Compare and contrast the basic DNA replication/ DNA recombination/ DNA repair process. 5. Illustrate basics of transcription process and transcription regulations. 6. Describe the process of Protein Synthesis and protein transport.
BC 242	Bioenergetics	1. Demonstrate the metabolic processes through which the energy is produced and utilized. 2. Get knowledge of redox couples and redox potentials. 3. Compare oxidative phosphorylation and photophosphorylation at molecular level. 4. Elucidate the inhibition of electron transport chain by various inhibitors. 5. Be able to study chemical nature of different hormones, how they influence biomolecular and cellular functions. 6. Illustrate the process of nitrogen fixation.
TB 241	Tools and Techniques in Biosciences	1. Illustrate the general scheme for purification of bio-components. 2. Describe different methods utilized for isolation of different cell organelles, subcellular fractions and marker enzymes. 3. Demonstrate various chromatography techniques: ion-exchange, gel filtration, partition, affinity, HPLC and reverse

		phase chromatography, gas chromatography, TLC, Paper chromatography, Chromatofocussing. 4. Study of centrifugation technique: Ultracentrifugation - density gradient centrifugation and molecular weight determination. 5. Describe electrophoresis with respect to basic techniques, poly acrylamide/ starch/ agarose gel electrophoresis, use of SDS/urea, isoelectric focusing, capillary electrophoresis. Pulse field gel electrophoresis. 6. Describe principles and applications of tracer techniques in biology, measurement of alpha, beta and gamma radiations, radiation dosimetry, radioactive isotopes and half life of isotopes, autoradiography, cerenkov radiation, liquid scintillation spectrometry. 7. Experiment with study of X-ray diffraction, fluorescence, UV, visible, CD/ORD, ESR, NMR and Mass spectroscopy, atomic absorption spectroscopy, plasma emission spectroscopy and microscopy.
LC BC 241	Laboratory Course III	1. Student will be able to understand various chromatographic techniques. 2. Able to demonstrate separations of proteins using electrophoresis technique. 3. Capable to immobilize enzymes for various applications. 4. Able to demonstrate separations of proteins using molecular sieve chromatography. 5. Able to isolate and characterize glycogen from liver.

LC BC 242	Laboratory Course IV	1. Capable to carry out enzyme activity of various enzymes such as amylase, invertase, amyloglucosidase, alkaline phosphatase etc. 2. Able to determine specific activity of enzyme 3. Be able to analyze enzyme kinetics of various enzymes. 4. Capable to isolate different enzymes from various sources. 5. Capable to co-relate different parameters for application of enzymes.
Part-II Semester-III		
GE 341	Genetic Engineering	1. Explain the function of restriction endonucleases. 2. Analyze the importance of plasmids and viruses in genetic engineering. 3. Be able to apply the techniques of selection and screening of clones. 4. Explain how to construct the DNA libraries and how to screen for clones that contain a desired gene fragment. 5. Describe the process polymerase chain reaction (PCR) and demonstrate its application. 6. Illustrate the applications of recombinant DNA technology.
IC 341	Immuno-chemistry	1. Classify fundamentals and anatomy of immune system. 2. Have clarity about innate immune system, physiological anatomical and cellular components of innate mechanisms – complement fixation, phagocytosis and toll like receptors. 3. Be able to explain genetic basis of antibody structure and generation of antibody diversity. 4. Demonstrate the role of MHC I and MHC II in antigen presentation and the concept of MHC polymorphism

		5. CO5: Imbibe the concept of B and T cell maturation and activation and generation of cytokines. 6. Explain the basis of hypersensitivity, immune deficiency and autoimmune diseases. 7. Be able to apply the principles of immunological techniques, viz. immunoprecipitation, immune-electrophoresis, ELISA, RIA, FACS, Western blot, Hybridoma technology, generation and applications of monoclonal antibodies.
EEE 341	Basics of Ecology, Ecotoxicology and Ecochemistry	1. Be able to understand our environment as atmosphere, hydrosphere and lithosphere. 2. Understand concepts and principles of ecosystem, sarata of ecosystem, cybernetics and homeostasis. 3. Be able to understand food chain, food web, decomposition of system, ecological energetic and efficiencies. 4. Analyze fresh water, marine, radiation and space ecology. 5. Be able to understand effect of fate of metabolism and its impact on communities.
FT 341	Fermentation Technology I	1. Be able to demonstrate microbial cell growth, kinetics and Strain improvement by mutation, overproduction of metabolites 2. Describe development of innocula and production media for industrial fermentation. 3. Utilize the process and instrumentation involved in fermentation operations including computer controlled operations. 4. Apply the process of batch, fed-batch and continuous fermentation, scale up and scale down of processes, types of fermenters and economics involved in the process. 5. Detailed description of down-stream

		processing: isolation and purification of various metabolites from fermented media.
LC EBT 341	Laboratory Course V	1. Be able to prepare antibiotic selection medium and competent cells. 2. Isolation of plasmid and quantification of nucleic acids. 3. Understand and perform restriction mapping of DNA using Agarose gel electrophoresis. 4. Perform cloning in plasmid and phagemid vectors. 5. Be able to perform DNA sequencing. 6. Understand and perform gene expression, PCR and reporter gene assay.
LC EBT 342	Laboratory Course VI (Research Project and Training in R & D institutions)	1. Be able to estimate halides in water sample by potentiometer. 2. Be able to estimate metal in water using various analytical techniques. 3. Perform various experiments to determine physicochemical parameters of waste water. 4. Be able to prepare and use vermicompost. 5. Gain on site training in various industries and research institute.
Part-II semester-IV		
EPC 441	Environmental Pollution and Control	1. Be able to monitor different types of pollutions. 2. Analyze pollutions at microleveles using biosensors. 3. Implement physical, chemical and biological treatment method for waste water/ industrial toxic effluents. 4. Understand biological control of insects and pests in view of biopesticides and insecticides. 5. Learn sources of heavy metal pollution, microbial metal resistance, biocorrosion and biofilms.
EB 441	Environmental Biotechnology	1. Opt skill for studying soil micro organisms, different microscopy and staining methods. 2. Analyze standards of potable water in

		relation to public health. 3. Opt skills of aerobic versus anaerobic treatments using bioreactor for solid / liquid wastes 4. Understand the concepts of in situ and ex situ bioremediation of various toxic industrial effluents. 5. Study biotechnology of tannery, paper industry wastes and oil spills.
BIBB 441	Biodiversity, IPR, Biosafety & Bioethics	1. Understand the genetic diversity and molecular taxonomy of living things. 2. Be able to indentify biodiversity hotspots in India and their conservation. 3. Learn the documenting morphological and molecular characterization of biodiversity with special emphasis on endangered species. 4. Acquire the deep knowledge of IPR, bioethics and patenting. 5. Be able to handle social and ethical issues and bio-safety in relation to transgenic research, human health and environment.
FT 441	Fermentation Technology II	1. Be able to demonstrate basics of industrial applications of fermentation technology. 2. Gain the knowledge of fermentation processes involved in pharmaceutical biotechnology ethanolic beverages; organic acids; Amino acids, Extracellular enzymes, Vitamins, Extracellular polysaccharides and Antibiotics 3. Study of the processes involved in production of therapeutic proteins. 4. Describe production of industrially important secondary plant metabolites, bioinsecticides, bioplastics, biogas etc. 5. Apply the role of bioremediation in petroleum industry, Bioleaching / Biomining, Biotechnological applications of extremophiles, Waste treatment, Microbial desulphurisation of coal. 6. Discuss Intellectual Property Rights:

		Patent : Criteria for patentability, Indian patent act, Role of patent in R & D.
LC EBT 441	Laboratory Course VII	1. Understanding of basic microbiological principles. 2. Be able to study various biotransformation reaction involved in detoxification reactions. 3. Be able to understand various bioremediation and biomineralization processes. 4. Understand basics of agrobiotechnology. 5. Learn various methodologies for pollution control.
LC EBT 442	Laboratory Course VIII (Project Work)	1. Demonstrate the basic concept of research, types of research – basic, novel and applied research. 2. Be able to formulate research hypothesis, steps in research design, research aptitude, qualities of a researcher and ethics in research – plagiarism. 3. Understand research culture at various research laboratories of national repute. 4. Be able to undertake independent research problem. 5. Be capable of analyze the research findings of the project and draw meaningful conclusions.