Shivaji University, Kolhapur

Name of Department: Department of Microbiology

Name of Programme: M.Sc. Pharmaceutical Microbiology

Vision
Lead the world towards healthy practices
Mission
Enhance the scope of the department in order to cater to the needs of the community and society by laying a major emphasis on praxis, utility and applicability of microbial systems.
Program Outcomes
1) This course is based on competitive development of students in learning interdisciplinary subjects such as Biochemistry, Quantitative Biology, Genetics, Microbiology, Biostatistics, Bioinformatics with computer orientation and Biophysical techniques. 2) The program intends students to read, understand original publications and envisage significant inputs in laboratory work, communication skills, creativity, planning, execution and critical evaluation of the studies undertaken. 3) Students will gain knowledge about classification and identification of microorganisms with different molecular techniques in detail at the molecular level. 4) Students are able to well verse about various aspects of microbial ecology, immunology, fermentation technology, bioinformatics and medical microbiology. 5) Student will be able to execute knowledge for the development of business strategies in the field of pharmaceuticals.
Program Specific Outcomes
1. Produce skilled manpower required for various pharmaceutical industries, as well as academic and research institutes. 2. Students can make their future as a good entrepreneur in different areas of applied life sciences and health sectors. 3. Improve confidence level of students for the preparation of various eligibility (GATE, NET, SET, ICMR, ICAR, BET) and competitive examinations.

Course Outcomes		
Part-I Semester-I		
CC-101B	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.
CC-101A	Cell Biochemistry and Nucleic acid	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. Illustrate and relate to the detailed physiology of i) Digestive system; ii) Liver; iii) Heart and iv) Kidney. 6. 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. 7. Understand and explain details of Nucleic acid structure and metabolism.
CC-102	Proteins: Structure and Functions	1. Describe general metabolism scheme of 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.
CC-103	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 biological differences between DNA, RNA and their role in cellular behavior. 5. Summarize the central dogma of molecular biology and how mutations in DNA can alter cell performance.
CC-104A	Basics of Physiology and Endocrinology	1. Illustrate and relate to the detailed physiology of i) Digestive system; ii) Liver; iii) Heart and iv) Kidney. 2. Understand structure and functions of brain, brain cells, CNS and peripheral nervous system. 3. Understand and elaborate on biochemistry of vision with special reference to rod and cone cells, visual cycle and regulation of colour vision. 4. Illustrate mechanism of muscle contraction through interaction between actin and myosin and role of calcium in it. 5. Classify hormones on the basis of their structure and function. 6. Detailed study of pituitary, sex, thyroid (T3 & T4) and adrenal hormones.
CC-104B	Biostatistics and Computer Applications	1. Describe measures of central tendency and dispersion. 2. Apply probability and distribution. 3. Analyse bivariate data, hypothesis testing. 4. Describebasics of computers, programming languages and application software. 5. Be able to relate to bioinformatics, databases, databank search, data mining, data management and interpretation. 6. Summarise genomics and proteomics.

CCPR-105	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 6. Able to demonstrate isolation of proteins from various sources 7. Able to demonstrate isolation of polysaccharides from various sources 8. Able to demonstrate isolation of cholesterol and lecithin from egg 9. Capable to check quality of oil using various quantitative methods 10. Capable to detect amino acids
Part-I Semester-II		
CC-201	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.
CC-202	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.
CC-203	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
CC-204	Tools and Techniques in Bioscience	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.
CCPR-205	Laboratory Course-II	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. 6. Capable to carry out enzyme activity of various enzymes such as amylase, invertase, amyloglucosidase, alkaline phosphatase etc. 7. Able to determine specific activity of enzyme 8. Be able to analyze enzyme kinetics of various enzymes 9. Capable to isolate different enzymes from various sources 10. Capable to co-relate different parameters for application of enzymes
Part-II Semester-III		
CC-301	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
CCS-302	Microbial Diversity and Extremophiles	1. Students will understand basic microbial ecological principles 2. Capacity to build understanding life cycle and physicochemical characters of Microbial groups including Algae, Fungi, Viruses, Viroids, prions and protozoa.

		3. Ability to understand Positive and Negative interactions among microorganism, plant and animals. 4. Capacity to assess role of extremophiles and microbial interaction with abiotic factors 5. Determine the worth of microorganism in environmental sustainability and petrochemical recovery
CCS-303	Pharmaceutical Microbiology	1. Students will define pathogenesis of diseases 2. Ability to understand chain of infection and indentify causative agent of disease 3. Evaluate role of chemotherapeutic agents in control of infection and its mechanism of action 4. Ability to analyze spoilage of pharmaceutical products 5. Explain different methods of preservation of pharmaceutical products
DSE-304	Immunology	1. Students will define immune system, identify role of organ system in development of immune response against pathogens 2. Capacity to build understanding of fundamentals and anatomy of immune system 3. Ability to apply principles of antigen-antibody interaction for diagnosis of diseases 4. Capacity to assess role of antigen processing and presentation for activation of cell mediated immunity 5. Determine the efficacy of vaccine to prevent infectious diseases in population.
CCPR-305	Laboratory Course-III	1. Capacity to understand methodology and strategies to isolate various types of microorganism having versatile activities like

		antibiotic production. 2. Execution of experimental protocol for the isolation of various enzyme producing microorganism and vitamin producing microorganism etc.. 3. Capacity to understand physiology of extremophilic microorganism by isolating and studying them at various extreme conditions. 4. Expertise in enumeration and identification of microorganism based on cultural and staining methodologies. 5. Impact assessment abilities on water food and other samples by using preservatives and disinfectant on microorganisms. 6. Ability to designing experiments for fermentative production different valuable products like organic acid, wine etc.. 7. Understanding protocols of different environmental monitoring experiments with the help of different instrument. 8. Studying different microbiological assay useful in pharma sector like ELISA, Widal, blotting techniques etc. 9. Ability to design and perform different gene transformation experimentations. 10. Capacity to monitor rapid identification of microbial culture isolated from various sources.
Part-II semester-IV		
CC-401	Quality Management and IPR	1. Define GMP with respect to manufacture of drugs, Packaging material, Personnel, hygiene, sanitation, waste and disposal 2. Describe quality assurance for manufacturing of drug

		3. Explain quality control of raw material, processes and finished products 4. Implement industrial safety aspects 5. Evaluate rational drug design and identify intellectual property rights
CCS-402	Fermentation Technology and Process Designing	1. Students will able to understand some useful Microbial fermentation process like microbial Growth and its measurement, fermentation media Understanding of concept strain isolation , preservation and improvement. 2. Ability to understand various parameters of fermentation like types of fermenter, media, gas diffusion and medium rheology. 3. Capacity to evaluate fermentation yield and biomass production by understanding kinetic parameter of fermentation 4. Ability to analyze various industrially important processes like industrially important microbial stain isolation, its improvement, preservation and scale up downstream processing and industrial effluent treatment. 5. Determine efficacy of modern fermentation technology by understanding various aspects of fermentation, command controls and control option including KBS, ANN and GA. 6. Understanding various fermentation process through the examples of different industrial production like; organic acids, Microbial Enzymes, antibiotics, and pigment.
CCS-403	Bioinformatics	1. Classifyprotein sequence information, composition and properties and describe types of sequence alignments, gap-penalties, scoring matrices. 2. Illustrate various BLAST programmes and their uses. 3. Describe homology modeling, prediction of protein structure from sequences. 4. Explain Human Genome project, approaches to gene identification using structural biology, molecular modeling methods. 5. Describe molecular docking, molecular dynamics simulations, phylogenetic analysis and software 6. Describe concept of microarrays, techniques and applications of microarray technology.
DSE-404	Medical Microbiology	1. Students will define progress of disease caused by bacteria, fungi, viruses and protozoa

		2. Ability to understand story of disease cycle 3. Capacity to evaluate epidemiology of disease, to apply control measures 4. Capacity to analyze various specimens and apply various molecular methods for pathogen identification 5. Determine efficacy of chemotherapeutic agent and understanding the mechanism of action
CCPR-405	Laboratory Course -IV (Project work)	1. Training for Environmental monitoring, enumeration, identification and testing of different samples. 2. Ability to design experimental protocol for antibiotic bioassay, food adulteration and milk quality by platform test. 3. Create abilities, of sampling of various pharma products to determine microbial contamination. 4. Understanding various platforms of bioinformatics for protein and nucleic acid sequencing. 5. Determination of 3D structures by construction of model and use of molecular modelling in drug discoveries and other studies. 6. Understanding importance of research problem and hypothesis. 7. Able to design aims and objective for the research problem based on literature review. 8. Able to design the experimentations for them. 9. Ability to analyse the results with comprehensive discussion. 10. Capable to make conclusion based on obtaining results.