THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS),
SIVAKASI – 626 123.
(Affiliated to Madurai Kamaraj University, Re-accredited with A+ Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

DEPARTMENT OF MICROBIOLOGY

UG DEGREE PROGRAMME IN MICROBIOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES	
The Graduates will	
PEO1.	Take up escalating careers as microbiologist in hospitals, industries or pursue higher studies.
PEO2.	Handle scientific instruments, planning, performing laboratory experiment and work with ethical values in utilizing microbes for eco-friendly studies.
PEO3.	Familiarize with new techniques and improve their skills needed for self-employment.

PROGRAMME LEARNING OUTCOMES	
By the Completion B.Sc (Microbiology) programme, the learners will be able to	
PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

COURSE LEARNING OUTCOME

Core Course	
Course Code: 23GYC11	**Course Title:** BASIC MICROBIOLOGY & DIVERSITY
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the historical events and classification of Microorganisms.
CLO2[K3]	identify the structure and functions of prokaryotic cell organelles.
CLO3 K4]	classify the various microbiological techniques involved in culturing microorganisms.
CLO4[K5]	appraise the principles and working mechanism of microscopes.
CLO5[K6]	compile the concept of asepsis, disinfectants and modes of sterilization.

Core Course Lab	
Course Code: 23GYC1L	**Course Title:** PRACTICAL I
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the sterilization methods, preparation of media and their quality control.
CLO2[K3]	apply the methods of streaking to isolate a pure culture.
CLO3 K4]	examine the isolated microbes using differential staining.
CLO4[K5]	evaluate the culture characteristics of microorganisms.
CLO5[K6]	generalize on Microbial Diversity using Hay Infusion Broth-Wet mount.

GENERIC ELECTIVE COURSE		
Course Code: 23GYEG11		**Course Title:** BASIC & CLINICAL BIOCHEMISTRY
On successful completion of the course, the learners should be able to		
CLO1[K2]	explain the structure, classification, biochemical functions and significance of carbohydrates and lipids.	
CLO2[K3]	identify the properties and function of essential and non-essential amino acids.	
CLO3 K4]	infer the role of defective enzymes and Inborn errors related to carbohydrate and lipid metabolism.	
CLO4[K5]	evaluate the pathology of amino acid metabolic disorders.	
CLO5[K6]	compile the imbalances of enzymes in organ function and relate the role of clinical Biochemistry in screening and diagnosis.	

FOUNDATION COURSE		
Course Code: 23GYFC11		**Course Title:** LABORATORY PRACTICES IN MICROBIOLOGY
On successful completion of the course, the learners should be able to		
CLO1[K2]	explain the basic laboratory practices in microbiology.	
CLO2[K3]	identify various method of sterilization technique.	
CLO3 K4]	classify different methods of microbial culture storage.	
CLO4[K5]	assess the biosafety rules in microbiology lab.	
CLO5[K6]	compile the culture media preparation technique.	

CORE COURSE	
Course Code: 23GYC21	**Course Title: MICROBIAL PHYSIOLOGY & METABOLISM**
On successful completion of the course, the learners should be able to	
CLO1[K2]	relate the growth of microorganisms based on nutritional requirement.
CLO2[K3]	identify the concept of factors affecting bacterial growth.
CLO3 K4]	analyze the methods of nutrient uptake.
CLO4[K5]	evaluate the strategies involved in anaerobic and aerobic energy production.
CLO5[K6]	compile the process of bacterial photosynthesis and reproduction.

CORE COURSE	
Course Code: 23GYC2L	**Course Title: PRACTICAL II**
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the method of measuring bacterial growth.
CLO2[K3]	demonstrate the maintenance of pure culture.
CLO3 K4]	examine the size of bacteria and yeast cell.
CLO4[K5]	demonstration of the morphological variations of microbes.
CLO5[K6]	compile on the bacterial identification using biochemical methods.

GENERIC ELECTIVE COURSE	
Course Code: 23GYEG21	**Course Title: BIOINSTRUMENTATION**
On successful completion of the course, the learners should be able to	
CLO1[K2]	gain knowledge about the basics of instrumentation.
CLO2[K3]	exemplify the structure of atoms and molecules by using the principles of spectroscopy.
CLO3 K4]	distinguish the separating and purifying techniques of biomolecules.
CLO4[K5]	assess the need and applications of imaging techniques.
CLO5[K6]	compile the working principle of fluorescence and radiation based technique.

CORE COURSE	
Course Code: 23GYC31	**Course Title: MOL. BIO. & MICROBIAL GENETICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the method of measuring bacterial growth.
CLO2[K3]	demonstrate the maintenance of pure culture.
CLO3 K4]	examine the size of bacteria and yeast cell.
CLO4[K5]	demonstration of the morphological variations of microbes.
CLO5[K6]	compile on the bacterial identification using biochemical methods.

CORE COURSE	
Course Code: 23GYC3L	**Course Title:** PRACTICAL III
On successful completion of the course, the learners should be able to	
CLO1[K2]	illustrate different types of DNA and RNA.
CLO2[K3]	utilize hands-on training in isolation of genomic and plasmid DNA.
CLO3 K4]	analyze importance of experimental microbial genetics.
CLO4[K5]	interpret the techniques of separating and visualizing protein.
CLO5[K6]	propose the method for isolating Phages.

GENERIC ELECTIVE COURSE	
Course Code: 23GYEG31	**Course Title:** CLINICAL LABORATORY TECHNOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the characteristics of laboratory and medical laboratory personnel.
CLO2[K3]	identify the principles and practices of clinical study design, implementation, and dissemination of results.
CLO3 K4]	recognize the histological appearance of affected tissues.
CLO4[K5]	assess the Laboratory methods used in the investigation of Hematological disorders.
CLO5[K6]	compile the guidelines relevant to governmental and non-governmental agencies.

SKILL ENHANCEMENT COURSE	
Course Code: 23GYDS31	**Course Title: BIOINFORMATICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the basic principles that underpin bioinformatics analyses.
CLO2[K3]	identify the biological data using a variety of bioinformatics tools.
CLO3 K4]	classify biological database and coherently report the findings.
CLO4[K5]	assess output software tool for considerable predictions.
CLO5[K6]	compile data sources for DNA and Protein.

SKILL ENHANCEMENT COURSE	
Course Code: 23GYES31	**Course Title: AQUACULTURE AND ORGANIC FARMING**
On successful completion of the course, the learners should be able to	
CLO1[K2]	illustrate the types and construction of aquaculture ponds.
CLO2[K3]	identify species suitable for aquaculture in a particular environment.
CLO3 K4]	analyze the advantages of widely used biofertilizers.
CLO4[K5]	assess the suitable method of organic farming in urban areas with knowledge on compost.
CLO5[K6]	become an Entrepreneur with wide knowledge on aquaculture and organic farming.

CORE COURSE	
Course Code: 23GYC41	**Course Title: IMMUNOLOGY AND IMMUNOTECHNOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	indicate the fundamental concepts of immunity and immunological principles.
CLO2[K3]	identify the components and functions of the immune system.
CLO3 K4]	infer the methods of Immunoassay and Immuno techniques.
CLO4[K5]	assess the immunologic processes governing graft rejection and responses against tumour antigen.
CLO5[K6]	integrate the overreaction of immune system leading to hypersensitivity.

CORE COURSE	
Course Code: 23GYC4L	**Course Title: PRACTICAL IV**
On successful completion of the course, the learners should be able to	
CLO1[K2]	classify the blood group and typing.
CLO2[K3]	perform serological diagnostic tests such as RF, ASO, CRP.
CLO3 K4]	categorize the antigen antibody reactions in gel.
CLO4[K5]	interpret the difference between antigens and antibodies in electrophoresis.
CLO5[K6]	conduct ELISA for detecting Hepatitis and HIV infections accurately and record the results.

GENERIC ELECTIVE COURSE	
Course Code: 23GYEG41	**Course Title: FOOD PROCESSING TECHNOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the fundamental concepts of food preservation.
CLO2[K3]	identify the methods used in quality assessment of meat and fish.
CLO3 K4]	analyze the processing of milk and milk quality.
CLO4[K5]	assess the importance of fats and oils.
CLO5[K6]	propose the strategies of food safety and adulteration.

PART-IV COURSE	
Course Code: 23GEVS41	**Course Title: ENVIRONMENTAL STUDIES**
On successful completion of the course, the learners should be able to	
CLO1[K2]	recognize the importance of environment and role of individual in its protection.
CLO2[K3]	utilize the methods for the sustainable use of natural resources.
CLO3 K4]	compare the structure and functions of ecosystems in the context of human-environmental interactions.
CLO4[K5]	formulate an action plan for sustainable alternatives that integrate science, humanist and social perspectives.
CLO5[K6]	acquaint with their own environment and strengthen the bond with it.

CORE COURSE	
Course Code: 23GYC51	**Course Title: BACTERIOLOGY AND MYCOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	summarize the importance of normal flora of human body and acquire knowledge on the process of infectious disease.
CLO2[K3]	identify the various bacterial pathological events during the progression of an infectious disease.
CLO3 K4]	analyze a list of disease-causing bacteria and compare their modes of infection, and treatment.
CLO4[K5]	assess human-fungal interaction, and the mechanism behind the disease process.
CLO5[K6]	integrate the impacts of mycoses and mycotoxins in human health.

CORE COURSE	
Course Code: 23GYC52	**Course Title: VIROLOGY AND PARASITOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the structure and properties of viruses, cultivation methods and diagnosis of viral diseases.
CLO2[K3]	identify the basic and general concepts of causation of disease by the pathogenic microorganisms and the methods of diagnosis.
CLO3 K4]	categorize the epidemiology, prevention, and control strategies for viral and parasitic diseases.
CLO4[K5]	interpret the importance of protozoans in the intestine.
CLO5[K6]	develop the strategies for diagnosis and prevention of infection caused by Nematodes.

CORE COURSE	
Course Code: 23GYC5L	**Course Title: PRACTICAL V**
On successful completion of the course, the learners should be able to	
CLO1[K2]	indicate the methods to observe and measure microorganisms by standard microbiological techniques.
CLO2[K3]	identify pathogenic microorganisms in the laboratory set-up and their sensitivity towards commonly administered antibiotics.
CLO3 K4]	cultivate and characterize clinically important pathogen.
CLO4[K5]	assess the clinically important fungi.
CLO5[K6]	investigate the medically important parasite from clinical specimens.

PART B	
Course Code: 23GYC53	**Course Title: PROJECT WITH VIVA-VOCE**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the various methods and techniques used in microbiological research and analysis.
CLO2[K3]	apply theoretical knowledge to design and execute experiments related to microbiology.
CLO3 K4]	analyze effective interpersonal skills and contribute to a positive and productive team environment.
CLO4[K5]	assess and address potential limitations, biases, and ethical considerations in microbiological research.
CLO5[K6]	develop and implement appropriate methodologies for investigating microbiological phenomena.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE51	**Course Title: RECOMBINANT DNA TECHNOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the steps involved in introduction and expression of foreign DNA into bacteria, animal and plants cells and their screening.
CLO2[K3]	identify the various cloning vectors and their applications.
CLO3 K4]	analyze the usage and advantages of molecular tools.
CLO4[K5]	assess plant and animal tissue culture protocols and gene transfer mechanism.
CLO5[K6]	compile various applications of genetic engineering and gene therapy.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE52	**Course Title: HERBAL & COSMETIC MICROBIOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the applications of Indian medicinal plants in treating diseases.
CLO2[K3]	identify and authenticate herbal plants.
CLO3 K4]	evaluate the antimicrobial activity of medicinal plants.
CLO4[K5]	assess the role of microorganisms and their metabolites in the preparation of cosmetics.
CLO5[K6]	compile procedures and biosafety measures in the mass production of cosmetics.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE53	**Course Title: BIOSAFETY& BIOETHICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	understand the control measures of laboratory hazards and to practice safety strategies and personal protective equipment.
CLO2[K3]	identify strategies for the use of genetically modified organisms and hazardous materials.
CLO3 K4]	analysis critical ethical skills of contemporary moral problems in medicine and health care.
CLO4[K5]	interpret the ethical issues involved in implementation of biotechnology for the needs of society.
CLO5[K6]	pave the way for the students to catch up Intellectual Property(IP) as a career option in research and entrepreneurial job.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE53	**Course Title: BIOSAFETY& BIOETHICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the characteristics, distribution and scope of microalgal technology.
CLO2[K3]	identify the methods of algal cultivation and harvesting.
CLO3 K4]	infer and recommend the use of microalgae as food, feed and fodder.
CLO4[K5]	recommend microalgae in phytoremediation.
CLO5[K6]	compile the application of microalgae in recent applied research.

PART IV COURSE	
Course Code: 23GYIN51	**Course Title:** INTERNSHIP
On successful completion of the course, the learners should be able to	
CLO1[K2]	relate the class room theory with work place practice.
CLO2[K3]	apply the procedures observed in real time working environment.
CLO3 K4]	analyse the workflow and communication flow prevailing in the institution/industry.
CLO4[K5]	assess interests and abilities in their field of study.
CLO5[K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations

CORE COURSE	
Course Code: 23GYC61	**Course Title:** ENVIRONMENTAL & AGRI. MICROBIOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the structure and function of ecosystems and the role of microbes in various environments.
CLO2[K3]	determine the methods involved in the production of bio fertilizers and bio pesticides.
CLO3 K4]	distinguish the process of waste water treatment and microbial remediation process.
CLO4[K5]	assess the various interaction of microbes with environment and plants.
CLO5[K6]	compile the diseases caused by microbes in plants.

CORE COURSE		
Course Code: 23GYC62		**Course Title: FOOD, DAIRY & PROBIOTIC MICROBIOLOGY**
On successful completion of the course, the learners should be able to		
CLO1[K2]	outline the principles and application of different types of food spoilage and preservation technique.	
CLO2[K3]	identify the food borne diseases, testing methods and preventive technique.	
CLO3 K4]	analyze the spoilage of milk and its products.	
CLO4[K5]	assess the quality of various fermented products.	
CLO5[K6]	compile the impacts of probiotics, prebiotics and functional dairy foods on human health.	

CORE LAB	
Course Code: 23GYC6L	**Course Title: PRACTICAL VI**
On successful completion of the course, the learners should be able to	
CLO1[K2]	demonstrate the microbial quality of water and relate the experimental results to the prescribed standards by the statutory bodies.
CLO2[K3]	determine the quality of milk and enumerate bacteria in milk by standard plate count method.
CLO3 K4]	analyze extracellular enzyme producing and nitrogen fixing microorganism from soil to prepare a biofertilizer.
CLO4[K5]	assess the various plant pathogenic bacteria.
CLO5[K6]	compile the benefits of microbial food products.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE61	**Course Title:** PHARMACEUTICAL MICROBIOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	learn the fundamentals of chemotherapy and action of antibiotics.
CLO2[K3]	apply the methods of the microbiological assay using antibiotics.
CLO3 K4]	analyze Microbiological standardization and sterility testing of pharmaceutical products.
CLO4[K5]	evaluate the new strategies for rational drug designing.
CLO5[K6]	propose the Regulatory guidelines for pharmaceuticals product.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE62	**Course Title:** NANOBIOTECHNOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe various branches of nanobiotechnology.
CLO2[K3]	identify various applications of nanomaterials in the field of medicine and environment.
CLO3 K4]	examine the prospects and significance of nanobiotechnology.
CLO4[K5]	assess the recent advances in nanoscience.
CLO5[K6]	design non-toxic nanoparticles for targeted drug delivery.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23GYDE63	**Course Title:** ENTREPRENEURSHIP AND BIOBUSINESS
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe several entrepreneurial ideas and business theories in practical framework.
CLO2[K3]	identify the elements of success of entrepreneurial ventures and implementation of different entrepreneurial strategies.
CLO3 K4]	analyze the mass production of microbial inoculants used as Biofertilizers and Bioinsecticides in response with field application and crop response.
CLO4[K5]	assess the application and commercial production of Monoclonal antibodies, cytokines, TPH and teaching kits.
CLO5[K6]	integrate and apply knowledge of the regulation of biotechnology industries, utilize effective team work skills within an effective management.

DISIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 3GYDE64	**Course Title:** TOXINOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	perceive the adverse effects of toxin and its potential role in research.
CLO2[K3]	identify the toxicity and properties of toxins from various biological sources.
CLO3 K4]	analyze the mode of actions and their biological significance.
CLO4[K5]	evaluate the toxicity level with the help of advanced techniques.
CLO5[K6]	compile the various application of toxic substances.

DISIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 3GYDE64	**Course Title:** TOXINOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	perceive the adverse effects of toxin and its potential role in research.
CLO2[K3]	identify the toxicity and properties of toxins from various biological sources.
CLO3 K4]	analyze the mode of actions and their biological significance.
CLO4[K5]	evaluate the toxicity level with the help of advanced techniques.
CLO5[K6]	compile the various application of toxic substances.

SKILL ENHANCEMENT COURSE- NON MAJOR ELECTIVE 1	
Course Code: 23GYNE11	**Course Title:** SOCIAL AND PREVENTIVE MEDICINE
On successful completion of the course, the learners should be able to	
CLO1[K2]	discuss the concepts of health and disease.
CLO2[K3]	choose the appropriate health care services.
CLO3 K4]	classify various factors in health management system.
CLO4[K5]	appraise the role of preventive medicine in community.
CLO5[K6]	propose the usage of alternate medicine during outbreaks.

SKILL ENHANCEMENT COURSE 1- NON MAJOR ELECTIVE-II	
Course Code: 23GYNE21	**Course Title:** NUTRITION & HEALTH HYGIENE
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the importance of nutrition for a healthy life.
CLO2[K3]	identify the nutritive value of food.
CLO3 K4]	focus the health care programmes of India.
CLO4[K5]	assess the importance of community and personal health and hygiene measures.
CLO5[K6]	create awareness on community health and hygiene.

SELF EMPLOYMENT COURSE	
Course Code: 23GSE47	**Course Title:** CATERING TECH. & HOTEL MANAGEMENT
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the basics of culinary and professional standards of kitchen brigade.
CLO2[K3]	identify various types and cuts of vegetables, non-vegetable and their culinary uses, tools & equipment's used in cooking.
CLO3 K4]	classify the various Food and Beverage service areas in the Hotel.
CLO4[K5]	assess the diverse types of guests, types of guestroom, meal plans and room tariff.
CLO5[K6]	compile pre-planning and order of service in cooking.

SELF EMPLOYMENT COURSE	
Course Code: 23GSE47L	**Course Title: CATERING TECH. & HOTEL MANAGEMENT PRACTICAL**
On successful completion of the course, the learners should be able to	
CLO1[K2]	demonstrate the cooking method with several nutritious ingredients.
CLO2[K3]	make use of different kinds of cuisines.
CLO3 K4]	categorize different styles of service
CLO4[K5]	assess the quality of product and service provided
CLO5[K6]	formulate skills on financial budging and stock taking.

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS),
SIVAKASI – 626 123.
(Affiliated to Madurai Kamaraj University, Re-accredited with A+ Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

DEPARTMENT OF MICROBIOLOGY

PG DEGREE PROGRAMME IN MICROBIOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES The Graduates will	
PEO1.	expertise in various microbial techniques to pursue higher studies and elevate them progressive careers in industries.
PEO2.	unique in designing innovative solutions for medical complications using novel drug development and follow the ethical principles in research finding for employing microbes in welfare of society and nation.
PEO3.	acclimatize novel technologies and promote their skills to be a successful entrepreneur.

PROGRAMME LEARNING OUTCOMES By the Completion M.Sc., Microbiology programme, the learners will be able to	
PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

COURSE LEARNING OUTCOME

CORE COURSE	
Course Code: 23PYC11	**Course Title: GENERAL MICROBIOLOGY AND DIVERSITY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	classify various microbes employing the microscopic techniques and measure the size of microbes.
CLO2[K3]	identify the anatomy and growth of microbes for different environmental conditions.
CLO3 K4]	analyze the morphology of algae and propagate depending on its economic importance
CLO4[K5]	assess aseptic conditions by following good laboratory practices.
CLO5[K6]	cultivate a variety of extremophiles following standard protocols for industrial applications.

CORE COURSE	
Course Code: 23PYC12	**Course Title: IMMUNOLOGY AND MICROBIAL GENETICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	classify the immune response to a variety of antigens and immune cells involved in immunity.
CLO2[K3]	organize the significance of MHC molecules in immune response and antibody production.
CLO3 K4]	inspect antibodies and examine immunological assays in patient samples.
CLO4[K5]	assess the genomic DNA of prokaryotes and eukaryotes.
CLO5[K6]	integrate gene transfer mechanisms for experimental study.

CORE LAB	
Course Code: 23PYC1L	**Course Title:** PRACTICAL I
On successful completion of the course, the learners should be able to	
CLO1[K2]	demonstrate microscopic techniques and staining methods for the identification and differentiation of microbes.
CLO2[K3]	apply the knowledge on the preparation of media by different methods and measurement of cell growth.
CLO3 K4]	distinguish different types of immunological reactions to aid diagnosis.
CLO4[K5]	assess the level of lymphocytes in a blood sample.
CLO5[K6]	acquaint the methods involved in DNA extraction

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE11	**Course Title: FORENSIC SCIENCE**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the scope and need of forensic science in the present scenario.
CLO2[K3]	plan for the organizational setup and functioning of forensic science laboratories.
CLO3 K4]	analyze the biological samples found at the crime scene.
CLO4[K5]	interpret methods of extraction and identification of DNA obtained from body fluids.
CLO5[K6]	compile the concept of forensic toxicology.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE12	**Course Title: HEALTH AND HYGIENE**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the factors affecting health and health habits.
CLO2[K3]	identify laws for food safety and hygiene.
CLO3 K4]	distinguish personal hygienic measures to avoid diseases.
CLO4[K5]	evaluate Mental hygiene to maintain emotional stability.
CLO5[K6]	propose various health education programmes.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE13	**Course Title: BIOINSTRUMENTATION**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the working mechanism of the laboratory instruments used in various field of biology.
CLO2[K3]	apply chromatography techniques in the separation of biomolecules.
CLO3 K4]	analyze the techniques involved in detection of biomolecules.
CLO4[K5]	categorize the methods involved in quantifying biomolecules using spectroscopic techniques.
CLO5[K6]	compile the applications of techniques involved in separation and labeling of biomolecules.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE14	**Course Title: LABORATORY MANAGEMENT & BIOSAFTEY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	extend skills on laboratory safety to avoid laboratory accidents.
CLO2[K3]	determine and prevent laboratory hazards by practicing safety strategies.
CLO3 K4]	categorize various first aid procedures followed during laboratory accidents.
CLO4[K5]	assess the biosafety strategies in laboratory.
CLO5[K6]	compile the importance of biosafety guidelines.

CORE COURSE	
Course Code: 23PYC21	**Course Title: MEDICAL BACTERIOLOGY AND MYCOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the collection, transportation and processing of various kinds of clinicalspecimens.
CLO2[K3]	identify various treatment methods for bacterial and fungal disease.
CLO3 K4]	analyze bacteria and fungi based on morphology and pathogenesis.
CLO4[K5]	choose the suitable diagnostic methods to detect pathogens in clinical samples.
CLO5[K6]	effective communication skills in presenting and discussing microbiological concepts, laboratory findings, and case studies.

CORE COURSE	
Course Code: 23PYC22	**Course Title: MEDICAL VIROLOGY AND PARASITOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the lifecycle and pathogenesis of specific viruses and parasites.
CLO2[K3]	apply appropriate infection control measures to prevent the spread of viral andparasitic diseases.
CLO3 K4]	analyze and interpret diagnostic test results for viral and parasitic infections.
CLO4[K5]	educate public about the spread, control and prevention of parasitic diseases.
CLO5[K6]	create educational materials to raise awareness about viral and parasitic infections.

CORE LAB	
Course Code: 23PYC2L	**Course Title: PRACTICAL II**
On successful completion of the course, the learners should be able to	
CLO1[K2]	represent transport and examination of clinical samples.
CLO2[K3]	identify medically important bacteria, fungus and parasites from the clinical samples.
CLO3 K4]	infer the results of laboratory tests in the diagnosis of infectious diseases.
CLO4[K5]	assess antibiotic sensitivity tests and conclude with the standard tests.
CLO5[K6]	invent industrially important microbes for metabolite production.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE21	**Course Title:** BIOINFORMATICS
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the databases that provides information on nucleic acids and proteins.
CLO2[K3]	identify the algorithms for sequence alignment.
CLO3 K4]	categorize the steps in construction of phylogenetic tree.
CLO4[K5]	assess the Prediction of structural proteins.
CLO5[K6]	design drugs by predicting drug ligand interactions and molecular docking.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE22	**Course Title: CLINICAL RESEARCH AND TRIALS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	explain the Drug Development process and different phases of clinical trials.
CLO2[K3]	find the ethics and regulatory perspectives on clinical research trials activities
CLO3 K4]	analyse the clinical trials management concepts and documentation process.
CLO4[K5]	assess the quality assurance and quality control to ensure the protection of humansubjects and the reliability of clinical trial results.
CLO5[K6]	build the skills in recitation to commercial start up and industriousness.

SKILL ENHANCEMENT COURSE		
Course Code: 23PYSE21		**Course Title:** VERMITECHNOLOGY
On successful completion of the course, the learners should be able to		
CLO1[K2]	describe the uses of vermicompost in soil fertility.	
CLO2[K3]	identify different species of earthworms after acquiring knowledge on its biology.	
CLO3 K4]	analyze the process of vermicomposting technique.	
CLO4[K5]	assess the best practices of vermicomposting.	
CLO5[K6]	formulate vermicompost for different types of soils and crops.	

CORE COURSE	
Course Code: 23PYC31	**Course Title:** SOIL & ENVIRONMENTAL MICROBIOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the significant role of soil microbes in biological nitrogen fixation.
CLO2[K3]	identify the microbial interactions required for sustainable agriculture.
CLO3 K4]	categorize the causes of water pollution and its impact on human beings.
CLO4[K5]	assess the different process involved in waste water treatment andbioremediation.
CLO5[K6]	propose a clear approach on environmental issues to control pollution.

CORE COURSE	
Course Code: 23PYC32	**Course Title: MOLECULAR BIOLOGY AND R DNA TECH.**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the significant role of soil microbes in biological nitrogen fixation.
CLO2[K3]	investigate various strategies on gene cloning and types of mutation.
CLO3 K4]	analyse, modify and characterize DNA modifying enzymes.
CLO4[K5]	assess the molecular techniques for DNA and protein analysis.
CLO5[K6]	compile the applications of genetic engineering in the field of agriculture and medicine towards scientific research.

CORE LAB	
Course Code: 23PYC3L	**Course Title:** PRACTICAL III
On successful completion of the course, the learners should be able to	
CLO1[K2]	utilize various molecular techniques for gene manipulation and detection of mutants.
CLO2[K3]	undertake novel research with techniques like PCR and blotting analysis.
CLO3 K4]	assess the microbial quality of water and air, and relate the results to standards.
CLO4[K5]	evaluate the efficiency of biofertilizer and microbes in rhizosphere.
CLO5[K6]	identify various plant pathogens.

CORE INDUSTRY MODULE	
Course Code: 23PYCI31	**Course Title:** FERMENTATION & PHARMA MICROBIOLOGY
On successful completion of the course, the learners should be able to	
CLO1[K2]	summarize microbial strains used for fermentation and recovery of products.
CLO2[K3]	identify different types of fermenters according to needs for various products.
CLO3 K4]	analyze the end products of the fermentation process economically.
CLO4[K5]	appraise the knowledge on pharmaceutical microbiology for industrial production.
CLO5[K6]	develop therapeutic products from microbes employing recent technology.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE31	**Course Title:** BIOSAFETY, BIOETHICS AND IPR
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the role of IPR, Patent, Trademarks and its importance.
CLO2[K3]	identify the steps of patent procedure, patent filling and its mapping.
CLO3 K4]	distinguish the duties of Patent attorneys and Patent officers.
CLO4[K5]	assess the relevance of bioethics in GMO, food crops and its biodiversity.
CLO5[K6]	compile the importance of bioethics in research associated with HGP, clinical research and stem cell therapy.

DISCIPLINE SPECIFIC ELECTIVE COURSE	
Course Code: 23PYDE32	**Course Title: WATER CONSERVATION & TREATMENT TECH.**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline the issues of water scarcity, stress and conflict on global population.
CLO2[K3]	identify the multiple approaches to prevent water scarcity and various governmentschemes required for water conservation.
CLO3 K4]	distinguish the importance of water quality for public health.
CLO4[K5]	interpret the standard strategy for successful HWTS implementation.
CLO5[K6]	compile the purpose, principles, operation, and limitation of various modern watertreatment technologies.

CORE COURSE	
Course Code: 23PYIN31	**Course Title:** INTERNSHIP
On successful completion of the course, the learners should be able to	
CLO1[K2]	relate the class room theory with work place practice.
CLO2[K3]	Apply the practices /procedures observed in real time working environment.
CLO3 K4]	analyse the workflow and communication flow prevailing in the institution/industry.
CLO4[K5]	assess interests and abilities in their field of study.
CLO5[K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations.

SKILL ENHANCEMENT COURSE	
Course Code: 23PYSE31	**Course Title:** ORGANIC FARMING
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe the characteristics of bacterial fertilizer.
CLO2[K3]	identify the importance of microbes used as biocontrol agent.
CLO3 K4]	analyze the cultivation of cyanobacterial bio-fertilizers.
CLO4[K5]	assess the utilization of fungal biofertilizer for agriculture.
CLO5[K6]	compile various methods of organic farming.

ADDITIONAL SKILL SUPPORTIVE COURSE	
Course Code: 23PYSS31	**Course Title:** GENERAL SCIENCE & RESEARCH APTITUDE
On successful completion of the course, the learners should be able to	
CLO1[K2]	summarize the statistical method of scientific data analysis.
CLO2[K3]	identify the primary environmental problems and its potential solutions.
CLO3 K4]	categorize the conventions used for environment protection.
CLO4[K5]	assess the strategies used in the conservation of nature.
CLO5[K6]	formulate resourceful technology to develop pollution free environment.

CORE COURSE	
Course Code: 23PYC41	**Course Title: FOOD & DAIRY MICROBIOLOGY**
On successful completion of the course, the learners should be able to	
CLO1[K2]	relate the knowledge on food contamination and spoilage to preserve food.
CLO2[K3]	use the knowledge on food borne disease to protect public health.
CLO3 K4]	classify the various national and international aspects of food safety and qualityassurance.
CLO4[K5]	assess the value of dairy products and perform quality checks.
CLO5[K6]	propose microbiological standards of milk and milk products.

CORE COURSE	
Course Code: 23PYC42	**Course Title: RESEARCH METHODOLOGY & BIOSTATISTICS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	collect and present data suitable to the research design.
CLO2[K3]	identify the strategies for writing research manuscripts and articles for journals.
CLO3 K4]	analyze the utilization of biostatistics tools for analysis of biological data.
CLO4[K5]	justify hypothesis for particular type of scientific research.
CLO5[K6]	compile software tools for interpretation of biological data.

CORE LAB	
Course Code: 23PYC4L	**Course Title:** PRACTICAL IV
On successful completion of the course, the learners should be able to	
CLO1[K2]	estimate the purity of milk based on microbial examination.
CLO2[K3]	identify the milk quality by dye reduction test.
CLO3 K4]	analyze the microbial contamination of fermented food.
CLO4[K5]	deduct the various types of microbes from spoiled food.
CLO5[K6]	predict the enzyme production by bacteria and fungi.

PART A	
Course Code:23PYC4P	**Course Title:** PROJECT WITH VIVA-VOCE
On successful completion of the course, the learners should be able to	
CLO1[K2]	relate the literature survey to chosen field of microbiology.
CLO2[K3]	plan for various stages of research work
CLO3 K4]	examine novel technologies in various fields of Microbiology.
CLO4[K5]	evaluate the role of bioinformatics tools in research.
CLO5[K6]	create the competence to discuss and conclude the research findings emphasizing its benefits to the society.

DISCIPLINE SPECIFIC ELECTIVE COURSE		
Course Code: 23PYDE41		**Course Title: BIOENERGY**
On successful completion of the course, the learners should be able to		
CLO1[K2]	outline the various aspects of biomass production and their implementation	
CLO2[K3]	determine the method of construction of biodiesel plant.	
CLO3 K4]	analyze the process of production of bio fuels.	
CLO4[K5]	assess the technologies and applications in biogas production.	
CLO5[K6]	design, execute and extract bio hydrogen from algae.	

DISCIPLINE SPECIFIC ELECTIVE COURSE		
Course Code:23PYDE42		**Course Title: MARINE MICROBIOLOGY**
On successful completion of the course, the learners should be able to		
CLO1[K2]	explain the interaction of marine microbial communities.	
CLO2[K3]	apply the role of marine microorganisms in biogeochemical cycles.	
CLO3 K4]	categorize the extreme environments in the oceans and the survival mechanisms ofmicroorganisms.	
CLO4[K5]	evaluate the methods used for diagnosis of diseases caused by microbes.	
CLO5[K6]	compile the application of marine microbial products.	

PROFESSIONAL COMPETENCY SKILL ENHANCEMENT COURSE	
Course Code: 23PYSE41	**Course Title: TRAINING FOR COMPETITIVE EXAMS**
On successful completion of the course, the learners should be able to	
CLO1[K2]	validate the knowledge of collective and progressive notions of cellular organization.
CLO2[K3]	apply cognitive abilities to solve quantitative and qualitative problems
CLO3 K4]	analyze the processes of evolution, relate with natural selection, adaptation andspeciation.
CLO4[K5]	assess and describe the importance of inheritance biology.
CLO5[K6]	establish acquaintance and understanding of ecology & Biodiversity in a broader sense.

ADDITIONAL SKILL SUPPORTIVE COURSE	
Course Code:23PYSS41	**Course Title: MICROBIAL QUALITY CONTROL & TESTING**
On successful completion of the course, the learners should be able to	
CLO1[K2]	outline knowledge on quality analysis techniques suitable for industries.
CLO2[K3]	identify methods of water managements, water harvesting and waste treatment.
CLO3 K4]	categorize the steps involved in checking of water quality.
CLO4[K5]	assess various approaches to be followed for prevention of disease.
CLO5[K6]	compile quality control techniques for food and pharma products.

GENERIC ELECTIVE COURSE	
Course Code: 23PYEG21	**Course Title:** BIOENTREPRENEURSHIP
On successful completion of the course, the learners should be able to	
CLO1[K2]	describe several entrepreneurial ideas and business theories in practical framework.
CLO2[K3]	identify the elements of success of entrepreneurial ventures, evaluate the effectiveness of different entrepreneurial strategies.
CLO3 K4]	analyze the mass production of microbial inoculants used as Biofertilizers andBioinsecticides in response with field application and crop response.
CLO4[K5]	assess the application and commercial production of Monoclonal antibodies, cytokines, TPH and teaching kits
CLO5[K6]	integrate and apply knowledge of the regulation of biotechnology industries, utilize effective team work skills within an effective management.