Department of Microbiology.
Course objectives and Outcomes

F.Y.B.Sc.

Sem.-I		
Paper	**Objectives**	**Outcome**
MB -101 : Microbial Diversity	To acquaint students with basic concepts of microbial diversity and how the microbe concept emerged	After successful completion of this course students are expected to: Understand the basic microbial structure and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea Know general bacteriology and microbial aspects pertinent to bacteria, fungi and algae How the subject emerge as new branch of biology Learn ancient view about life continuity and concept of experiment Aware about historical developments and their applications as technology Cognizant about contribution of various pioneers of microbiology Aware about diversity of microorganism Impact of microbes on earth atmosphere, health and

		technology development Recognise the scope of microbiology in all spheres of life and industrial sector Ways to classify the living system Understand the taxonomy(identification, binomial nomenclature, and Classifications schemes/keys) and comprehend the various approaches of microbial taxonomy.
MB -102 : Microscopy and Basic Bacteriology	To complement the students with the basic knowledge about microbial growth and microscopy	After successful completion of this course students are expected to: Demonstrate theory in microscopy and their handling techniques and staining procedures Know various Culture media and their applications and also understand various physical and chemical means of sterilization Know general bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae Learn aseptic techniques and be able to perform routine culture handling tasks safely and effectively Comprehend the various methods for identification of unknown microorganisms Understand the modes of nutrition in microbial metabolism and able to classify the bacteria based on nutrition Know the various Physical

		and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.
MB 103: Microbiology Practical Paper - I (Practical)	To introduce various microorganisms present in the ecosystem and acquaint with Common equipment used in routine microbiology laboratory	After successful completion of this course students are expected to: Inculcate the ability to apply the process of science Demonstrate ability to formulate hypotheses and design experiments based on the scientific method. Analyse and interpret results from a variety of microbiological methods and apply these methods to analogous situations. Develop ability to use quantitative reasoning to solve problems in microbiology Communicate and collaborate with other disciplines Effectively communicate fundamental concepts of microbiology in written and oral format. Identify credible scientific sources and interpret and evaluate the information therein. Understand the relationship between science and society Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures Understand the basic microbial practices and

		study the comparative characteristics of prokaryotes and eukaryotes Comprehend the various methods for identification of microorganisms adopted in Bergey's manual and able to classify the bacteria Know the various Physical growth requirements of bacteria Prepare and view specimens using microscopy (bright field microscope). Aware and train in aseptic handling of microbial specimens. Practice safe microbiology, using appropriate protective and emergency procedures. Use appropriate microbiological and molecular lab equipment and methods. Document and report on experimental protocols, results and conclusions
Sem.-II		
MB -201 : Basic Biochemistry and Cytology	To acquaint students with basic concepts in biochemistry and familiarize with cellular architecture	After successful completion of this course students are expected to: Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural architecture and differences among bacteria/archaea Know basic knowledge

		pertinent to cell biomolecules as such
MB -202 : Microbial Techniques	To complement the students with cultivation and control of microbe with physical and chemical approach	After successful completion of this course students are expected to: Know general bacteriology and introduce microbial techniques for isolation of pure cultures of bacteria, fungi, algae and virus Demonstrate theory and practical skills in handling microbial culture Know various bacteria based on nutritional needs and also understand various physical and chemical means of sterilization Discern knowledge about sterility assessment of sterilizing agents
MB 203: Microbiology Practical -II (Practical)	To instil practical skills about methods of isolation, characterization, control of Microbes and familiarize with fundamental aspect of cellular chemistry	After successful completion of this course students are expected to: Inculcate scientific thinking student can adapt the ability to apply the process of science Demonstrate an ability to formulate hypotheses and design experiments based on the scientific method Analyze and interpret results from a variety of microbiological methods and apply these methods to analogous situations Adapt quantitative reasoning and graphing skills to solve problems in microbiology Introduce microbiology Laboratory Skills Perform advanced staining

		methods Use pure culture and selective techniques to enrich and isolate microorganisms. Use appropriate methods to identify microorganisms (media-based) Estimate the number of microorganisms in a sample Become conversant in basic biochemistry methods and biochemical methods in microbiology Demonstrate practical skills in microscopy and their handling techniques and staining procedures Understand the bacterial growth and comprehend various physical and chemical means of sterilization Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae Practice aseptic techniques and able to perform routine culture handling tasks safely and effectively Understand preparation of standard solutions required in various assays.

S.Y.B.Sc.

Sem.-III		
MB - 301: Basic Microbial Enzyme and	To acquaint students with basic concepts of enzymology and	After successful completion of this course, students are

Metabolism	microbial metabolism.	expected to: Understand the basic of microbial enzymology, nature of enzyme, their nomenclature, working mechanism, classification based on their action etc. Know how about different parameters affecting the activity of enzyme. Learn about nutrient uptake by microbes, various mechanism used to transport ions and molecules in microbial cells. Aware about concept of metabolism and its basic types. Cognizant about various pathways used by microbes to break down molecule and generate ATP as a source of energy. Aware about the regulations and energetics of various pathways. Understand aerobic, anaerobic respiration and fermentation.
MB - 302: Microscopy and Microbial Ecology	To complement the students with the basic knowledge about microscopy and microbial ecology.	After successful completion of this course, the students are expected to: Demonstrate theory in microscopy and acquaint with advanced microscopy. Know the basic concepts of microbial ecology such as biotic and abiotic factors, microbial interactions etc. Learn the establishment of symbiosis, some positive and negative interactions. Comprehend the various

		symbiotic interactions of microbes with plants, animals and other microbes. Understand the microbial interactions in extreme habitats. Know the detail concept of biotopes.
MB - 303: Practical Paper-III	To introduce the students to various structural, biochemical, environmental and microscopic aspects of microorganisms along with study of extremophiles	After successful completion of this course, students are expected to: Learn proper handling of micropipette, pH meter, graduated pipette and volumetric flask along with their calibrations. Perform specific staining techniques and acquired skill of handling microscope while observing stained preparations. Able to demonstrate basic biochemical characteristics of bacteria. Able to check potability of water. Know characteristics and significance of extremophiles. Different environmental aspects of microorganisms.
MB SEC- I: Microbiological Analysis of Air, Water and Soil	To highlight the number and range of pathogens that may be found in air, water and soil. To describe some of the key preventative and monitoring actions which maintain and improve microbiological quality of water, air and soil. To introduce the concept and use of indicator bacteria specially in water quality monitoring.	After successful completion of this course, the students are expected to: Competently explain various aspects of environmental microbiology Aware about the pollution, Water and air-borne diseases and their transmission, methods of determination of sanitary quality of water and sewage treatment methods

	To describe the principal indicator bacteria used and their key characteristics which make them suitable for use as indicators. To emphasize the value of *E. coli* and thermotolerant fecal coliforms as routine indicators	employed in waste water treatment. Appreciate the diversity of microorganisms and learn the abundance, distribution and significance of microorganism in the environment such as bioremediation and Plant microbe interactions understand various biogeochemical cycles - microbes involved and biochemical mechanisms of Carbon, Nitrogen, Phosphorus cycles etc.
Sem.-IV		
MB - 401: Genetics and Immunology	To acquaint students with basic concepts of microbial Genetics and Immunology	After successful completion of this course, the students are expected to: Understand the basic of microbial enzymology, nature of enzyme, their nomenclature, working mechanism, classification based on their action etc. Understand the concepts like gene, chromosome, Structural organization of chromosome, extra chromosome: plasmid and its types Know general terms used in genetics Aware about genetic code Learn mutation, type, agent causing mutation and their mechanism, test to detect mutation etc. Learn about infection: mode and source.

		Understand antigen, antibody and their role in immunity and immune response. Know about antibody diversity. Understand blood grouping system. Cognizant about vaccine, anti-sera and toxoid
MB - 402: Basic Industrial Microbiology	To acquaint students with basic concepts of industrial microbiology.	After successful completion of this course, the students are expected to: Understand the basics of fermentation technology, screening techniques, microbial culture preservation techniques etc. Know the concepts of inoculum development and media sterilization for fermentation process. Learn about the typical structure of fermenter and its parts, types of fermentation processes and synchronous growth. Aware about the detail downstream process of fermentation of important microbial products.
MB - 403: Practical Paper - IV	To enhance practical skills of students in concern with Genetics, Industrial microbiology and enzymology.	After successful completion of this course students are expected to: Structure and functions of nucleus and volutin granules. Able to carry out titrations skillfully. Understand structure, working principle and significance of each and every part of fermenter.

		Know chromatography techniques. Students can be able to detect blood groups and perform cross-matching. Understand concept of stock solutions and can prepare required stock concentration by proper dilutions. Get knowledge about enzymes; successfully detect various enzymes produced by microorganisms.
SEC-II: Biofertilizers and Biopesticides	To aware the students to the adverse effects of plant production and protection of chemicals on the biotic and abiotic components of environment. To familiarize students with the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers	After successful completion of this course students are expected to: Completion of the course will give an overview of relevant use of microbial biofertilizers and biopesticides. The students will become familiar with the vast reserves of available microbial biodiversity that provide abundant opportunities to harness the ability of micro - organisms and their chemical constituents To sustainably minimize damage from pests or increase agricultural productivity and production.

T.Y.B.Sc

Sem.-V		
MB-501 Microbial Genetics	To introduce the concepts in Microbial Genetics	After completion of this course, students will be

	To acquaint with molecular techniques To update applied knowledge in the field of microbial genetics	able to: Acquaint with the concepts of Gene transfer and its Central Dogma Able to learn the principles and applications of various molecular techniques Have the basic knowledge of operon and rDNA technology
MB-502 Bioprocess Technology	To introduce with concepts related to bioreactors and their types To acquaint with concepts strain improvement and scale up To make aware regarding processes involved in fermentation	After completion of this course, students will be able to: Know a bioreactor, its parts and types Get knowledge about the significant processes in a bioreactor like strain improvement, inoculums development sterilization and scale-up
MB-503 Metabolism	To acquaint with the principles of Bioenergetics To understand the concept of thermodynamics and Electron Transport Chain To define the types of anabolic and catabolic pathways and the mechanisms involved therein	After completion of this course, students will be able to: Get well versed with the catabolic and anabolic pathways Understand the concept of ETC and principles of thermodynamics Apply the principles of metabolism in various bacteria
MB-504 Basic Immunology	To study the concepts related to antigen and antibody To study the various immune cells and organs functional in a body To get knowledge about MHC and Antigen Presentation	After completion of this course, students will be able to: Get acquainted with Antigenicity and Immunogenicity Know about the role of immune cells and organs and the functional mechanisms of each

		Understand the structure and role of MHC and APC
MB-505 Medical Microbiology-I	To introduce the conceptsin Medical Microbiology To enrich knowledge about various diseases with respect to diagnosis, prevention, control and role chemotherapy To understand the human anatomy with functions	After completion of this course, students will be able to: Get a clear vision about various aspects of infectious diseases Understand the principles of immunological phenomena associated with the infectious diseases. Carry out fundamental or applied research in the field of Medical Microbiology
MB-506(A) Food Microbiology	To understand concepts in milk microbiology To complement the students with the basic knowledge of food microbiology To acquaint the students with food preservation techniques	After completion of this course, students will be able to: Know the concepts related to popular milk products, milk examination and spoilage. Comprehend knowledge regarding fermented food products, food spoilage and infection Understand diverse strategies for food preservation
MB-506(B) Pharmaceutical Quality Control and Quality Assurance	To develop practical skills involved in interpretation of biological materials and data To promote development of entrepreneurship and build up Professionals in Pharmaceutical Analysis, teaching and R&D work Develop a scientific attitude to make students open minded, critical and curious about scope, functioning and the future of pharmaceutical	After completion of this course, students will be able to: Understand microbial spoilage and preservation of pharmaceutical formulations during production and in products. Get hands-on knowledge of disinfection, sterilization, microbial assays, pharmacopoeia standards and antimicrobial agents.

	Microbiology	Acquire knowledge of GMP practice, CGMP, FDA, GLP and Pharmacopeia.
MB-507 Methods in Medical Microbiology-I	To acquaint with microbial isolation techniques from various clinical samples Gain knowledge about diagnostic tests for diseases To train to determine potency of antibiotics using various standard methods	After completion of this course, students will be able to: Achieve skill in pure culture techniques Learn principles underlying diagnostic tests and handle kits for diagnosis of diseases Know various stages involved in malarial and diarrhoeal infections
MB-508 Methods in Industrial Microbiology-I	To acquaint the learner with various fermentation processes To apply the concept of these processes for commercially valuable products To correlate this knowledge with the industrial fermentation process	After completion of this course, students will be able to: Understand the fermentation processes involved for various products and investigate the applications of sterilization techniques for fermentation products Inculcate the salient features of quality management and regulatory processes Use computer for data generation and maintenance
MB-509 Methods in Applied Microbiology-I	To learn the isolation of agriculturally important microorganisms causing food poisoning & microbes responsible for food fermentation To understand the principle and methods of microbiological examination of milk and sewage	After completion of this course, students will be able to: Isolate and identify agriculturally important microbes like *Azotobacter* and cellulolytic microbes Detect food poisoning causing microbes and perform the tests to

	To acquaint the students with the concept of BOD and Nano particles	determine quality control of dairy product (milk) Synthesize nano particles by biological method/s and characterize them using UV-Visible Spectrophotometry
Sem.-VI		
MB-601 Molecular Biology	To get acquainted with the molecular regulatory mechanisms in bacteria To understand the principles underlying techniques used in molecular Biology To study the principle and applications of recombinant DNA technology	After successful completion of this course, students are expected to: Get well versed with the regulatory mechanisms of Lactose and Tryptophan operon Understand the principles and applications of advanced molecular techniques Know the methodology involved in engineering of genes and its practical applications
MB-602 Fermentations	To introduce fermentation processes and their types To provide knowledge about the chronological development in fermentation To acquire knowledge about large scale production of commercially valuable products	After successful completion of this course, students are expected to: Understand fermentation processes involved in the production of various products Get acquainted with the needs of a fermentation industry Know about the large-scale production of various valuable products
MB-603 Enzymology	To understand regulation of enzyme action To get acquainted with enzyme technology To get knowledge about	After successful completion of this course, students are expected to: Know the role of coenzymes in enzyme

	techniques involved in enzyme purification**.**	action Understand the regulation of enzymatic reactions pertaining to allosteric proteins and covalent modification Acquire knowledge about purification of enzymes by various methods, immobilization of enzymes and enzyme engineering techniques
MB-604 Advanced Immunology	To understand various protective mechanisms underlying the human immune system, immunological disorders and tumours To study the principles underlying various immunological techniques To debate the immuno-prophylactic measures against various novel viral infections	After successful completion of this course, students are expected to: Be well versed with protective immunity and tolerance in the body Gain knowledge about the serological tests and their applications Know the path that may help to overcome the challenges in the synthesis of novel vaccines
MB-605 Medical Microbiology-II	To create awareness about the infectious diseases. To create theoretical base for practical approaches To study prognosis of bacterial, viral and other diseases	After successful completion of this course, students are expected to: Become aware about the various types of diseases and their sources Justify the variation between viral, bacterial and other diseases Explain prognosis of diseases and become aware about the role of medical microbiology in public health
MB-606 (A) Agricultural Microbiology	To understand concepts in plant pathology To acquaint the students with basic knowledge of plant	After successful completion of this course, students are expected to: Understand classification of

	disease control To complement the students with the concepts in Agricultural Microbiology	plant pathology with regional plant diseases Know the concepts related to methods of plant disease control Comprehend knowledge regarding Agricultural Microbiology
MB-606 (B) Regulatory Practices and IPR	To promote development of entrepreneurship and know the importance and scope of the IPR in Microbiology To get acquainted with regulatory practices undertaken at commercial level. Develop a scientific attitude to make students open minded, critical and curious about scope, functioning and the future of Commercial Microbiology	After successful completion of this course, students are expected to: Understand role of regulatory practices in Pharmaceutical Industry and become aware of the patents norms Have knowledge pertaining to Intellectual Property Rights and their protection Be endowed with the legislature to be followed during the generation of genetically modified plant and animals.
MB-607 Methods in Medical Microbiology-II	To study pure culture techniques involved in the isolation of pathogens from clinical samples To investigate the normal flora of skin and mouth To handle diagnostic tests involved in detection of STDs	After successful completion of this course, students are expected to: Perform pure culture techniques and apply them for pathogenic bacteria Inculcate the technique involved in collection of mouth and skin samples using swabs for diagnostic purpose Perform diagnostic tests for Syphilis and AIDS
MB-608 Methods in Industrial Microbiology-II	To analyse the potency of an antibiotic by suitable bioassay To study the stoichiometric evaluation of enzyme activity To handle the techniques involved in enzyme	After successful completion of this course, students are expected to: Design bioprocesses for commercially valuable products

	immobilization	Learn techniques for validation of instruments used in fermentation industry Investigate the role of immobilization in enzyme activity and apply it for various purposes
MB-609 Methods in Applied Microbiology-II	To isolate and screen microbes involved in bioremediation processes and significant for crops To analyse the waste water / liquid effluent and emphasize on safety handling of hazardous materials To aware the students about bioenergy, bio fertilizers, biocontrol agents etc**.**	After successful completion of this course, students are expected to: Isolate and screen microbes involved in bioremediation processes like dyes and lignin degradation Isolate and identify rhizospheric microbes important for crops such as phosphate solubilizes, nitrogen fixers etc. Analyse the quality of waste water / liquid effluent and make charts of safety handling of hazardous materials and MSDS