

DEPARTMENT OF MICROBIOLOGY
CH. CHARAN SINGH UNIVERSITY, MEERUT
Program: M.Sc. (SFS)
Program Code: MM
Program (Specific): M.Sc. MEDICAL MICROBIOLOGY
Year of Implementation: 2016-17

Program Outcomes

After successful completion of M.Sc. program, the students would be able

PO1: The increasing incidence of microbial infections worldwide is being compounded by the rapid evolution of drug-resistant variants and opportunistic infections by other organisms. In response to a high level demand of competent medical microbiologists, this three year course of M.Sc. (Medical Microbiology) has been specifically designed for graduates who wish to develop their skills as medical microbiologists

PO2: to integrate interdisciplinary thinking and practice

PO3: to analyse a problem, identify and define the computing requirements with respect to organizational factors appropriate to its solution, and plan strategies for their solution

PO4: to design, implement and evaluate information systems, processes, components, or programs and source cost-benefit efficient alternatives to meet desired needs, goals, and constraints

PO5: to deploy and use effective skills, tools, and techniques required for an R&D/ organization or institute

PO6: to live a life inculcated with higher values which enable them to withstand the challenges of life.

Program Specific Outcomes

PSO1. After successful completion of this program, the students would be able to apply knowledge of Medical Microbiology in all the fields of learning, including higher research and its extensions

PSO2. It provides them comprehensive curriculum to groom the students into qualitative scientific manpower.

PSO3.It makes them able to take up challenges and contribute in to the development of the world.

PSO4. It provides students the insight of microbiology and computational techniques so that they can work as medical professional.

PSO5. It makes them equipped with knowledge to crack lectureship and fellowship exams like UGC/ CSIR – NET, ICMR, GATE and other competitive exams



Deviendra K
16/11

Courses/ Papers and their Outcomes (COs)

Semester	Course Code	Course Title	Course Outcome
I	MM 101	General Microbiology	<p>After completion of this course, the student will be able to</p> <p>CO1. Important historical events and developments in microbiology. Basic as well as advanced knowledge in various microscopes and microscopic techniques used in diagnostic microbiology. Various bio-safety issues including physical and biological containment, universal containment, personal protective equipment for biological agents</p> <p>CO2. Nomenclature, classification and morphology of bacteria as well as other microorganisms. Various types and significance of normal flora of human body in health and disease states.</p> <p>CO3. Requirements for growth and nutrition of bacteria along with bacterial metabolism</p>
	MM 102	Microbiological Tools and Techniques	<p>CO1. This course develops the concepts of methodology involved in studying the different components of microbial cell and various techniques and instruments involved in product analysis.</p> <p>CO2. Ability to use techniques and instruments involved in the study of microorganisms and their products.</p>
	MM 103	Human Anatomy	<p>CO1. Students will learn the terminology, anatomy and physiology, and pathology of each body system and how they interrelate to maintain homeostasis.</p> <p>CO2. Define the main structures composing human body. Tells chemical structure of human body. Explains structure and functions of cell. Relates structure and functions of tissue.</p>
	MM 104	Human Physiology	<p>CO1. Explain properties of digestive and excretory systems. Lists organs of digestive system. Tells importance of excretory system.</p> <p>CO2. Recognizes organs of excretory system.</p> <p>Recognize organs of reproductive system Explains structure of female reproductive organ. Tells structure of male reproductive organ.</p>

	MM-105	Practical	MM-101 to MM-104
II	MM-201	Systematic Bacteriology	<p>CO1. Demonstrate knowledge and skills in various techniques for isolation and identification of bacteria</p> <p>CO2. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major bacterial pathogens of medical importance given below</p> <p>a. Gram positive cocci including <i>Staphylococcus</i>, <i>Micrococcus</i>, <i>Streptococcus</i>, anaerobic cocci etc.</p> <p>b. Gram negative cocci including <i>Neisseria</i>, <i>Branhamella</i>, <i>Moraxella</i> etc.</p> <p>c. Gram positive bacilli including <i>Lactobacillus</i>, <i>Coryneform bacteria</i>, <i>Bacillus</i> and aerobic bacilli, <i>Actinomyces</i>, <i>Nocardia</i>, <i>Actinobacillus</i> and other actinomycetales, <i>Erysipelothrix</i>, <i>Listeria</i>, <i>Clostridium</i> and other spore bearing anaerobic bacilli etc.</p>
	MM-202	Medical Mycology	<p>CO1. Explain general characteristics including morphology, reproduction and classification of fungi</p> <p>CO2. Demonstrate knowledge and skills for isolation and identification of fungi</p> <p>CO3. Explain tissue reactions to fungi</p> <p>CO4. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major fungal pathogens of medical importance given below. Yeasts and yeast like fungi including <i>Candida</i>, <i>Cryptococcus</i>, <i>Malassezia</i>, <i>Trichosporon</i>, <i>Geotrichum</i>, <i>Saccharomyces</i> etc.</p>
	MM-203	Human and Animal Virology	<p>CO1. Demonstrates knowledge about general properties, classification, morphology, virus replication and genetics of viruses. Explain pathogenesis of viral infections.</p> <p>CO2. Demonstrates knowledge about isolation and identification of viruses.</p> <p>CO3. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major DNA</p>

			viruses of medical importance including <i>Pox viruses, Herpes viruses, Adeno viruses, Hepadna virus, Papova viruses</i> and <i>Parvo viruses</i> etc.
	MM-204	Biochemistry and Haematology	<p>CO1. Understand the principles of various fields of chemistry and biology (organic chemistry, analytical chemistry, biochemistry, genetics, metabolism, and molecular biology). Develop as independent thinkers who are responsible for their own learning</p> <p>CO2. Develop transferable quantitative skills</p> <p>CO3. Be able to work with others demonstrating leadership and collaborative skills. Apply modern instrumentation theory and practice to biochemical problems</p>
	MM-205	Practical	MM-201 to MM-204
III	MM301	Molecular Immunology	<p>CO1. Components of immune system, types of immunity (Innate, acquired, mucosal, humoral and cell mediated immunity) and immune response</p> <p>CO2. Describes and identifies uses of various antigens, immunoglobulins (antibodies) and antigen and antibody reactions</p> <p>CO3. Complement system and Cytokines</p> <p>CO4. Various disorders like hypersensitivity, immunodeficiency and auto-immunity involving immune system</p> <p>CO5. MHC complex, Immune tolerance, Transplantation and Tumor immunity.</p> <p>CO6. Various types, techniques, advances, and applications of vaccines and immunotherapy</p>
	MM302	Microbial Genetics, Molecular Biology and Genetic Engineering	<p>CO1. Molecular Biology gives you in-depth knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.</p> <p>CO2. Student will gain an understanding of chemical and molecular processes that occur in and between cells. Your understanding will become such that you will be able to describe and explain processes and their meaning for the characteristics of living organisms.</p>

			<p>CO3. Students will gain insight into the most significant molecular and cell-based methods used today to expand our understanding of biology.</p>
	MM303	Laboratory Diagnosis in Clinical Microbiology	<p>CO1. Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology.</p> <p>CO2. Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.</p> <p>CO3. Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.</p> <p>CO4. Students will demonstrate engagement in the Microbiology discipline through involvement in research or internship activities, the Microbiology Student Association club (MSA) and outreach or mentoring activities specific to microbiology.</p>
	MM304	Biostatistics and Medico-informatics	<p>CO1. Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics</p> <p>CO2. Existing software effectively to extract information from large databases and to use this information in computer modeling problem-solving skills, including the ability to develop new algorithms and analysis methods</p> <p>CO3. An understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries</p>
	MM-305	Practical	MM-301 to MM-304

	MM 401	Parasitology	<p>CO1. Demonstrate knowledge about general characters, classification and methods of identification of parasites.</p> <p>CO2. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of Protozoan parasites of medical importance including <i>Entamoeba</i>, Free living amoebae, <i>Giardia</i>, <i>Trichomonas</i>, <i>Leishmania</i>, <i>Trypanosoma</i>, <i>Plasmodium</i>, <i>Toxoplasma</i>, <i>Sarcocystis</i>, <i>Cryptosporidium</i>, <i>Microsporidium</i>, <i>Cyclospora</i> <i>Isospora</i>, <i>Babesia</i>, <i>Balantidium</i> etc.</p>
IV	MM 402	Epidemiology: Disease Control and Public Health	<p>CO1: Understand the basic epidemiological methods and study designs.</p> <p>CO2: Understand and discuss population based perspective to examine disease and health-related events.</p> <p>CO3: Discuss the ethical issues in epidemiological research.</p> <p>CO4: Learn the basic concepts of screening and outbreak investigations.</p> <p>CO5: Disease surveillance</p> <p>CO6: Critically review published epidemiological studies.</p> <p>CO7: Applied epidemiology.</p>
	MM 403	Pharamaceutical Microbiology	<p>CO1: Explain the anatomy, identification, growth factors of microorganisms which include bacteria, virus, and fungus.</p> <p>CO2: Discuss the cultivation and identification of the microorganisms in the laboratory</p> <p>CO3: Explain different methods of sterilization and its properties and applications in pharmaceutical microbiology</p>

			<p>CO4: Discuss the concepts and types, antibody, antigen -antibody reactions</p> <p>CO5: Define the terms bacterial vaccines, toxoids, immunization programme, importance of booster dose.</p> <p>CO6: Identification of diseases by performing the diagnostic tests</p> <p>CO7: Estimation of potency of antibiotic by various microbial assay</p> <p>CO8: Understand infectious diseases its history, pathogenesis, treatment and control</p>
	MM 404	Nutritional Therapy	<p>CO1: Nutrition & Dietetics students will demonstrate the following learning objectives upon completion of this degree program:</p> <p>CO2: Understanding, critically assessing and knowing how to use and apply information sources related to nutrition, food, lifestyle and health.</p>
	MM-405	Practical	MM-401 to MM-404

Post-graduate training Program (One Year)

The post graduate training should include the following components for a holistic approach.

A. Laboratory and Diagnostic skills in Clinical Microbiology

Based on the available facilities, the department should prepare a list of Post Graduate experiments pertaining to basic, diagnostic and applied Microbiology. Active learning should form the mainstay of the postgraduate training. There should be lectures for the postgraduate students (at least 20 per year) along with seminars/symposia/group discussions and journal clubs. The postgraduate student should also attend a minimum of 20 ward rounds, discuss with the faculty, and maintain a log book for the same. They should be able to render consultative and investigative services in microbiology.

B. Teaching Skills

The Medical Education Department/Unit of the institution should be able to sensitize the postgraduate students in basic concepts of medical education like domains of learning, teaching skills, teaching - learning methods, learning resource material, evaluation techniques etc. The postgraduate students should attend all undergraduate lectures in the subject of Microbiology and participate actively in the undergraduate teaching programme including tutorials, demonstrations and practicals.

C. Research Methodology

The postgraduate students should be able to plan, design and conduct research in microbiology, as well as collaborate with other departments, analyze data and become familiar with basic biostatistics. They should also be able to write a research paper. All this can be achieved by writing a thesis on a current and relevant topic in Microbiology.

D. Communication and attitudinal skills

The post graduate student should be able to communicate effectively with patients, their relatives, peers, and consultants for better clinical correlation of laboratory findings as well as research. They should work as an effective team member and leader. They should also demonstrate right kind of attitude while handling clinical material and reports.

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Syllabus

Semester	Course Code	Course Title	Syllabus
I	MM 101	General Microbiology	<p>Unit I- Discovery of Microbial world; History of Microbiology; Scope and relevance of Microbiology; Role of microbes in disease; Current status of microbes in the living world: Haeckel's three kingdom concept, Whittaker's five kingdom concept, Eight kingdom system of classification of Cavalier Smith; Classification and salient features of bacteria according to the Bergey's manual of Determinative Bacteriology.</p> <p>Unit II- General account of Prokaryotes: Size, shape and arrangement of bacteria; Structure and function of Gram positive and Gram negative cell wall, cell membrane, cytoplasmic matrix, inclusion bodies, nucleoid, flagella, pilli and endospores; Reproduction and recombination in Gram positive and Gram negative bacteria.</p> <p>Unit III- History and discovery of viruses; Nature of viruses; General characters of viruses; Infection and replication; Nomenclature and classification of viruses; Purification and quantitative assays of viruses; Bacteriophage : Structure and life cycle pattern of T-even phage and λ phage.</p> <p>Unit IV- General characters of Eukaryotic microbes: ultra structure and organization of a typical eukaryotic cell; Classification of eukaryotic microbes (Fungi, Algae, Protozoans, Nematodes and Cestodes); Evolutionary relationship of each group based on modern system of classification.</p> <p>Unit V- Physical, chemical and Biological hazard: Safety in microbiological labs; Quality assurance in microbiological laboratories; Hospital and laboratory waste disposal and management; Decontamination; antiseptics.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. Bergey's manual systematic Bacteriology(2011) 2nd edition. 2. Prakash S. Bisen (2012). Microbes-concepts and applications, Wiley-Blackwell. 3. J.D.S.Panwar (2012)-Fundamentals of Microbiology-S.R.S Pub 4. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill 5. Bisen, P.S. (2014). Microbes in Practices, I K international publication house. 6. Sharma P.D. (2015-16). Microbiology, 3rd edn, Rastogi publications. 7. J.G.Black (2015) –Microbiology, 9th edition, Wiley publication.
	MM 102	Microbiological Tools and Techniques	<p>Unit I- Preparation of culture media; Types of culture media: simple media, complex media, synthetic media, enriched media, selective media, indicator media, differential media, anaerobic media; Sterilization and Disinfection; Pure culture techniques: streak plate, pour plate and spread plate method; Maintenance of pure culture; Methods of preservation of various microbes.</p> <p>Unit II- Introduction to Clinical Microbiology; occurrence of infections, infections of special concern, routes in infections;</p>

			<p>Microbiological safety cabinets; Handling of Hazardous materials.</p> <p>Unit III- Microscopy: Specimen preparation and basic principles for the examination of microbes by light, phase-contrast, dark field, confocal, fluorescent and electron (transmission and scanning) microscopy; Micrometry and micro densitometry. Chromatography (paper, thin layer, column, partition, gel filtration, ion-exchange and affinity chromatography); GLC and HPLC.</p> <p>Unit IV- Principles and applications of Electrophoresis (one and two dimensional for proteins and DNA); Iso-electric focusing; Autoradiography, Centrifugation; Ultra-centrifugation; Dialysis and Ultra filtration; Lyophilization in microbiological studies.</p> <p>Unit V- Fractionation of microbial cells; Separation of different cell organelles and chemical analysis of microbial cells for carbohydrates, proteins, amino cells, lipids and nucleic acids.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. Nelson D and Cox MM. (2010). Lehninger's Principles of Biochemistry. W.H. Freeman and Company, New York. 2. Wilson K. and Walker J. (2013). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. 3. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill. 4. Upadhyaya and Nath (2015) Biophysical chemistry, Himalaya pub. House. 5. T.A.Brown (2016). Gene cloning and DNA analysis, an introduction,Wiley Blackwell pub. 6. B.D.Singh (2015). Biotechnology, Kalyani publication.
MM 103	Human Anatomy		<p>Unit I- General Anatomy: Introduction to anatomy; Anatomical terminology, anatomical plane; Organization of human body tissues and organ systems; Cellular organization of tissues and organs; Cell division.</p> <p>Skin: Structural and functional anatomy of skin.</p> <p>Unit II- Muscular System: Different types of muscles and their gross structure; Structure of sarcomere; Origin & insertion, tendons; Aponeurosis; Wasting and degeneration of muscles</p> <p>Skeletal System: Components of axial and appendicular skeleton; Development of bones; various joints, their structure and function.</p> <p>Digestive System: Morphology of gastro-intestinal system; Microflora of digestive tract; Structure of different digestive and associated glands.</p> <p>Unit III- Respiratory System: General anatomy of lungs, pleura, broncho- pulmonary segments, intercoastal muscles and diaphragm.</p> <p>Cardiovascular System: Various components of blood-vascular system; Blood and connective tissue; Haemopoiesis; Structure of various parts of heart; Lymph circulation, lymph-nodes and lymphoid tissues.</p> <p>Unit IV- Urinogenital System: Structure and function of kidneys, ureters, urinary bladder and urethra; General outline of male and female genital systems; Formation of semen; Spermatogenesis; Structure of sperm; Menstrual cycle and normal pregnancy.</p> <p>Endocrine System: Different endocrine glands and their secretions; Neuro-endocrinal controls.</p> <p>Unit V- Nervous System: Various types of nerves and structure of different parts of the brain and spinal cord; various somatic sensations; Neuromuscular junctions</p> <p>Special Sense Organs: Gross structure and function of eye,</p>

		<p>ear, nose and tongue.</p> <p>Suggested Readings (Latest Edition): -</p> <ol style="list-style-type: none"> 1. Drake (2014). Gray's Anatomy 2. B. D. Chaurasia (2013). BD Chaurasia's Human Anatomy Regional and Applied Dissection and Clinical. 3. Waugh (2014). Ross and Wilson Anatomy and Physiology in Health and Illness. 4. Ken Saladin (2015). Saladin's Anatomy and Physiology 7th Edition. 5. Gerard J. Tortora, Bryan H. Derrickson (2014) Principles of Anatomy and Physiology, 14th Edition.
<p>MM 104</p>	<p>Human Physiology</p>	<p>Unit I- General Physiology: Functional organization of cell; Structure of cell membrane and transport across membrane; Body fluids: Homeostasis.</p> <p>Skin: Different Mechanisms involved in Body temperature regulation; Pyrexia and Hypothermia; Sense receptors of skin.</p> <p>Muscular System: Basis of muscle contraction; Duration curve; Starling law; Electrical-biphasic and monophasic action potential; Chemical, thermal and physical changes; Isometric and isotonic contraction.</p> <p>Unit II- Blood: Composition, physical properties and function of blood; Plasma proteins and their functions; Erythropoiesis and its control; Structure, function and fate of RBC's; Haemoglobin and its functions; Pathophysiology of Anaemias; Structure and functions of Leukocytes; Immunity; Thrombopoiesis, structure and function of Platelets; Physiology of Clotting and Fibrinolysis; Blood groups and Physiological basis of transfusion medicine.</p> <p>Cardiovascular System: General Introduction of Cardiovascular system; Cardiac cycle and Heart sounds; Interpretation of normal Electrocardiogram; Cardiac output and Cardiac failure; Venous return; Heart rate and its regulation; Structure and organization of vascular tree; Arterial blood pressure and pathophysiology of Hypertension, angina and infarction.</p> <p><u>Unit III-</u> Digestive System: General principles of Gastro-Intestinal functions; Composition, Function and regulation of secretion of Saliva, Gastric Juice, Pancreatic Juice, Succus entericus and Bile; Movements of GIT; Digestion and absorption of Fats, Proteins and Carbohydrates; Functions of Liver and LFT.</p> <p>Respiratory System: Functional anatomy of Respiratory System; Mechanics of breathing: Mechanism of Inspiration and Expiration; Intra-pleural and Intra-alveolar pressures, Compliance, Surfactant, Air-way resistance and Work of breathing; Respiratory membrane and diffusion of gases; Pulmonary circulation; Composition of Gases and Partial Pressures; Oxygen and Carbon-dioxide transport; Lung volume, Capacities and Lung function tests.</p> <p>Unit IV- Reproductive System: Sex determination and development of puberty, Male sex hormones and Female sex hormone and their function; menstrual cycle; ovulation and contraceptives, Pregnancy; function of placenta and lactation</p> <p>Excretory System: Gross and minute structure of kidney; Features of renal circulation; Mechanism of formation of urine; GFR and tubular function; Renal function tests; Physiology of micturition.</p> <p>Unit V- Nervous System: Functioning of Autonomic Nervous System; Higher neural regulation of ANS. Special Senses: Functional anatomy of the Eye; Optics of vision; Visual pathways; Sense of hearing; Auditory pathway; Vestibular apparatus; Sense of Taste; Sense of Smell.</p> <p>Suggested Readings (Latest Edition):-</p>

			<p>1. Kim E. Barrett, Susan M. Barman (2015). Ganong's Review of Medical Physiology, Twenty-Fifth Edition</p> <p>2. Gary D. Hammer, Stephen J. Mcphee (2014). Pathophysiology of Disease: An Introduction to Clinical Medicine</p> <p>3. Maxine A. Papadakis (2016). CURRENT Medical Diagnosis and Treatment.</p>
	Practical		
II	MM-201	Systematic Bacteriology	<p>Unit I- Classification of medically important bacteria; Normal flora of human body and its importance; Commensals and Pathogenic microorganisms; Culture and growth of bacteria; Morphological, Physiological and Biochemical Tests for the identification of bacteria; Nosocomial infections; Antimicrobial susceptibility test; Genetic basis of drug resistance.</p> <p>Unit II- Important human infections caused by Gram-positive cocci, their pathogenesis, lab diagnosis, prevention and control: Staphylococcus (Skin infections, Musculoskeletal, Respiratory, Central nervous system, Endovascular and Urinary infections, Toxic Shock Syndrome and Scalded Skin Syndrome), Coagulase negative Staphylococcus and Micrococcus, Streptococcus (Respiratory, Skin and Genital infections), other hemolytic and anaerobic Streptococci, Pneumococcus (Otitis media, Sinusitis, Pneumonia).</p> <p>Unit III- (A) Important human infections caused by Gram-negative cocci, their pathogenesis, lab diagnosis, prevention and control: Neisseria (Meningitis, Septicemia, Gonorrhea), Moraxella.</p> <p>(B) General characters, morphology, pathogenesis, lab diagnosis, prevention and control of diseases caused by: Mycoplasma (Pneumonic and Genital infections), Rickettsia (Typhus fever and spotted fever), Chlamydia (Trachoma, Inclusion conjunctivitis, Infant pneumonia), Spirochaetes (Syphilis), Actinomycetes (Actinomycosis), Nocardia (Nocardiosis).</p> <p>Unit IV- (A) Important human diseases caused by Gram-positive bacilli, their pathogenesis, laboratory diagnosis, prevention and control, e.g. Corynebacterium (Diphtheria), Bacillus (Anthrax Food poisoning), Listeria (Listeriosis), Clostridium (Gas gangrene, Food poisoning and other infection, tetanus).</p> <p>(B) Important diseases caused by Mycobacterium (Tuberculosis, Leprosy), their pathogenesis, laboratory diagnosis, prevention and control; Atypical <i>Mycobacteria</i>.</p> <p>Unit V- Important human infections caused by Gram-negative rods, their pathogenesis, lab diagnosis, prevention and control: Escherichia coli (Urinary tract infections), Klebsiella (Bronchopneumonia), Enterobacter (Wound, Respiratory and Urinary infections), Proteus (UTI), Salmonella (Enteric fever, Food poisoning), Shigella (Bacillary dysentery), Vibrio (Cholera), Campylobacter (Diarrhoea), Pseudomonas (Nosocomial infections), Haemophilus (Influenza, Meningitis, Bronchitis), Brucella (Brucellosis), Yersinia (Plague).</p> <p>Suggested reading (Latest Edition):</p> <ol style="list-style-type: none"> 1. Bergey's manual systematic Bacteriology (2011) 2nd edition 2. Prakash S. Bisen (2012). Microbes-concepts and applications, Wiley-Blackwell. 3. J.D.S.Panwar (2012)-Fundamentals of Microbiology-S.R.S Pub 4. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill 5. Bisen, P.S. (2014). Microbes in Practices, I K international publication house pvt Ltd. 6. J.G.Black(2015) –Microbiology, 9th edition, Wiley publication 7. Jawetz, Melnick and Adelberg's, (Latest Edition) <i>Medical Microbiology</i>, McGraw Hill Publishers.

MM-202	Medical Mycology	<p>Unit I- General characteristics and classification of medically relevant fungi, morphology and reproduction of fungi, isolation and identification of fungi; yeast and yeast like fungi of medical importance: <i>Candida</i>, <i>Cryptococcus</i>, <i>Malassezia</i>, <i>Trichosporon</i>, <i>Saccharomyces</i>; Mycelial fungi of medical importance: <i>Aspergillus</i>, <i>Zygomycetes</i>, <i>Fusarium</i> and <i>Piedra</i>; dimorphic fungi, economic importance of fungi.</p> <p>Unit II- Collection, storage and transport of clinical samples, laboratory diagnosis of important fungal diseases: Serodiagnosis, plating techniques; Mold identification based on spore/ conidium counting; culture media for fungi: Bird seed agar, Brain heart infusion agar, CHROM agar <i>Candida</i>, dermatophyte test medium, inhibitory mold agar, Mycosel agar, Yeast extract phosphate agar, Sabouraud's dextrose agar (SDA).</p> <p>Unit III- Dermatophytosis: Superficial mycosis eg. ringworm, superficial candidiasis, pityriasis, otomycosis, Mycotic keratitis, superficial infections of skin, nail, hair; Subcutaneous mycosis eg. Mycetoma, chromoblastomycoses, sporotrichosis; Systemic mycoses eg. Coccidioidomycosis, histoplasmosis, blastomycoses, paracoccidioidomycoses, cryptococcosis, rhinosporidiosis, aspergillosis, systemic candidiasis, zygomycosis, pneumocystosis, penicilliosis marneffeii; other opportunistic mycosis.</p> <p>Unit IV- Mycotoxocoses: Mode of action of aflatoxins, ochratoxins, trichothecenes, fumonisins, zearalenones, patulin, penicillic acid and ergotoxins; Methods of detoxication, prevention and treatment.</p> <p>Unit V- Common laboratory contaminant fungi; susceptibility test: Macrodilution, microdilution, colorimetric method and spectrophotometric methods, agar diffusion method; antifungal agents, antifungal therapy.</p> <p>Suggested Readings (Latest Edition): -</p> <ol style="list-style-type: none"> 1. David Greenwood (2015). Medical Microbiology, 18th edition. 2. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th ed McGraw Hill. 3. J.G. Black(2015) –Microbiology, 9th edition, Wiley publication 4. Jawetz, Melnick and Adelberg's, (Latest Edition). <i>Medical Microbiology</i>, Mc Graw Hill Publishers. 5. T.M. Butt (2001). Fungi as Biocontrol agents, CABI Publication. 6. G.D. Rodson (2007). Exploitation of Gungi, Cambridge pub.
MM-203	Human and Animal Virology	<p>Unit I- Origin and development of concept of virology; Collection of clinical samples; Diagnostic techniques for viral diseases: Detection of viral antigens, nucleic acids and specific antibodies; Virus isolation by conventional and non-conventional methods: monolayers, shell vials, lymphocyte cultures, animal and embryonated eggs; Virus identification: Immunofluorescence, Immunoperoxidase test, Neutralization, Light microscopy and Electron microscopy.</p> <p>Unit II- Pathogenesis of virus infection; Host cell responses to virus infection: Interferons and Apoptosis; Replication of DNA and RNA viruses; Antiviral drugs and their mechanism of action; Viral vaccines; Use of Bacteriophages in bacterial identification; Use of animal viruses as vectors.</p> <p>Unit III</p> <p>Human diseases caused by Orthomyxoviruses (Influenza), Paramyxoviruses (Mumps, Measles, Respiratory Syncytial Virus), Picornaviruses (Enteroviruses, Rhinoviruses), Poxviruses (Small pox, Cow pox, Molluscum Contagiosum), Herpesviruses (HSV-1, HSV-2, Varicella-Zoster,</p>

			<p>Cytomegalovirus, Epstein-Barr virus), Human Retroviruses (HTLV-1, HTLV-2, HIV), Adenovirus, Viral hepatitis.</p> <p>Unit IV- Nature of viral zoonoses: Rabies, Haemorrhagic fevers, Yellow fever, Colorado tick fever, Vesicular Stomatitis, Viral Encephalitis (Japanese encephalitis, Venezuelan equine encephalitis, Eastern and Western equine encephalitis, St. Louis encephalitis, Murray valley encephalitis); Emerging and re-emerging zoonoses.</p> <p>Unit V- Prions: Structure, replication and diseases caused by them; Transplantation associated viral infections; Tumor viruses and human cancers: Burkitt's lymphoma, Nasopharyngeal carcinoma, T-cell leukemia, Hepatocellular carcinoma, Kaposi's sarcoma, Skin cancer; Viroids; Emerging and re-emerging viral diseases.</p> <p>Suggested Readings (Latest Edition): -</p> <ol style="list-style-type: none"> David Greenwood (2015). Medical Microbiology, 18th edition. Wiley J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill. J.G. Black(2015) –Microbiology, 9th edition, Wiley publication Jawetz, Melnick and Adelberg's, (Latest Edition). <i>Medical Microbiology</i>, Mc Graw Hill Publishers. S. Ram Raddy (2012) Essential of Virology, Scientific Pub. Jane . Flint (2015) Principle of Virology, ASN Press.
MM-204	Biochemistry and Haematology		<p>Unit I- Carbohydrates: classification, structure and function, chemical and physical properties; Structure, properties and importance of starch, cellulose, glycogen and chitin. Carbohydrate metabolism: Glycolysis, TCA cycle, Electron transport chain; Metabolism of glycogen: Glycogenesis, Glycogenolysis; Metabolism of Galactose.</p> <p>Unit II- Proteins: structure, classification, chemical bonds involved in stability of protein structure, protein configuration, protein sequencing, peptide synthesis, biological role of proteins. Protein metabolism: transamination, deamination, urea cycle, and metabolism of essential amino acids.</p> <p>Unit III- Lipids: classification, structure and properties, oxidation of fatty acids: saturated, unsaturated and odd-chain fatty acids; Biosynthesis of lipids and its regulation; Biological role of lipids.</p> <p>Unit IV- Enzymes: classification and nomenclature; mechanism of enzyme action: active site, enzyme kinetics, enzyme inhibition, regulation of enzyme activity, allosteric enzymes; Clinical applications of enzymes.</p> <p>Unit V- Haematology: Introduction; Specimen collection and processing for clinical chemistry; Clinical examination of blood, blood collection methods of capillary puncture and venipuncture; haemocytometer: RBC, WBC and platelet count; Blood cell morphology and differential count; Haematology tests; Erythrocyte sedimentation rate; Principles of automated haematology; Hematocrit test; Bleeding disorders and its laboratory diagnosis; Blood-Bank and its management.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> Nelson D and Cox MM. (2010). Lehninger's Principles of Biochemistry. W.H. Freeman and Company, New York. Voet D and Voet JG. (2013). Principle's of Biochemistry. John Wiley and sons New York. J.L. Jain(2015).Fundamentals of Biochemistry, S. Chand and Co. U. Satyanarayan(2015). Biochemistry, Elsevier Bhagavan, N.V. (Latest Editions) <i>Medical Biochemistry</i>. Academic Press. Chatterjee, M.N. and Shinde, R. (Latest Editions) <i>Textbook of Medical Biochemistry</i>. Medical Publishers Sachdev, K.N. (Latest Editions) <i>Clinical Pathology and Clinical Bacteriology</i>. JayPee Brothers, Medical Publishers

	Practical		
III	MM 301	Molecular Immunology	<p>Unit I- Introduction to the Immune system: Innate Immunity, anatomical physiological, phagocytic and inflammatory barriers; Adaptive immunity, natural and artificial immunity; Cells involved in immune response: lymphoid lineage (B lymphocytes & T lymphocytes) and Myeloid lineage (phagocytes: macrophages, neutrophils, eosinophils, basophils, mast cells, natural killer cells & plateletes); Cytokines: Interferons and Interleukins; Organs involved in immune system: primary & secondary lymphoid organs.</p> <p>Unit II- Antigens and Immunogenicity: structure and general properties of antigens, preparation of antigens, types of antigens-haptens, super-antigens; Cluster of differentiation molecules (CDs); Antigen recognition molecules; Major histocompatibility complex (MHC); T-cell receptor and B-cell receptor; Molecular features of Antigenic Determinants.</p> <p>Unit III- Immunoglobulins : structure and types of Immunoglobulins; Genetic diversity of Immunoglobulins; Antigen-antibody interaction; Binding of Immunoglobulins to antigen; B-cell biology and T-cell biology; Complement system.</p> <p>Unit IV- Immunoassays for diagnosis of infections diseases: Agglutination, Precipitation, Immunodiffusion, Immunoelectrophoresis, Immunoblotting, ELISA, RIA, Fluorescent antibody assay, Immunoelectron microscopy, Opsonization and Neutralization.</p> <p>Unit V- Immune system in health and disease: Infections and vaccines; Types of Vaccines and their characteristics, principles of vaccination and immunization of test animals; Monoclonal antibodies and Hybridoma technology; Applications of monoclonal antibodies; Immune disorders: Hypersensitivity reaction, Autoimmune diseases, Immunodeficiency, Transplantation rejection, Tumour immunology, Immunology and AIDS, Immunity to bacterial, viral, parasitic and fungal infections.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. Riott I M (2003). Essentials of Immunology. Blackwell Scientific Publishers, London. 2. Claus D (2005). Immunology- Understanding of Immune System. Wiley - Liss, New York. 3. William P (Latest Edition). Fundamentals of Immunology. 4. Abbas (2004). Cellular and Molecular Immunology. 5. Benjamin (2004). Immunology- A short Course. 6. Tizard Ian R (2009). Immunology. An introduction, 4th Edition. 7. Kindt, Goldsby and d Osborne (2013). Kuby Immunology. MacMillan Higher Education.
	MM 302	Microbial Genetics, Molecular Biology and Genetic Engineering	<p>Unit I- Nucleic acids as genetic information carriers, DNA structure, types of DNA. DNA replication in prokaryotes & eukaryotes. Structural features of RNA (mRNA, tRNA, rRNA). Transcription in prokaryotes & eukaryotes.</p> <p>Unit II- Regulation of gene expression. Basic features of the genetic code. Protein synthesis in prokaryotes and eukaryotes. Recombination: general principles. Plasmids (types of plasmids- F plasmids, R plasmids, Col plasmids & Ti plasmid). Gene transfer mechanisms: transformation, transduction, and conjugation.</p> <p>Unit III- Mutations: spontaneous mutation, Induced mutagenesis- mutagens (physical mutagens: non ionizing & ionizing radiations; chemical mutagens: Base analogues, alkylating agents, deaminating agents, intercalating agents & others), molecular mechanism of mutagenesis. DNA repair mechanism: repair by direct reversal, excision repair, recombinational repair & SOS repair.</p>

			<p>Unit IV- Basic steps of r-DNA technology. Restriction endonucleases. Cloning vectors: general properties, plasmids, bacteriophages, cosmids, shuttle vectors, bacterial artificial chromosomes. Eukaryotic cloning vectors for yeast, & animal cells. Gene libraries: genomic library (Shot gun approach), c DNA library (Different methods for synthesizing c DNA molecules).</p> <p>Unit V- Molecular Techniques; Principles, methods & their applications in medical diagnosis -such as PCR, Southern Blotting, Northern Blotting, RFLP, RAPD, Western Blotting, DNA finger printing and DNA sequencing. Microbial genetic & design of vaccines; for TB & leprosy. DNA vaccines design & advantages. Recombinant vaccines.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. David P Clark (2010). Cell and Molecular Biolgy 2. Robert J. Brooker (2011). Genetics, Analysis and principles, Mc Graw Hill. 3. J.E. Krebs (2011). Lewin's Genes X, Jones Pub. 4. T.A.Brown (2010). Gene cloning of DNA Analysis. Wiley Blackwell. 5. Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith (2012). Becker's Word of the cell. 6. William. D Stans Field (2012). Molecular and cell Biology, Mc Graw Hill pub. 7. Gerald Karp (2014). Cell Biology, Wiley Blackwell, Pub.
MM 303	Laboratory Diagnosis in Clinical Microbiology		<p>Unit I- Collection, transport and storage of clinical specimens; Specimen processing (Bacteriology, Virology, Mycology and Parasitology); Prevention and control of laboratory acquired infections; Identification of Microorganisms; Different staining techniques: simple, Gram's staining, Ziehl-Neelsen method for AFB, Flurochrome staining, Leishman's staining, Giemsa's staining and special staining methods to demonstrate granules, capsule and endospores.</p> <p>Unit II- Laboratory diagnosis of diarrhoea, dysentery, food poisoning, sore-throat, pyrexia of unknown organs, STD, UTI, RTI and upper respiratory tract infections.</p> <p>Unit III- Haemoglobin estimation; Blood collection: capillary puncture, venipuncture; White blood cells (WBC), Red blood cells (RBC) and Platelet count; Preparation of peripheral blood smear; Staining and Differential Leucocyte Count (DLC); Erythrocyte Sedimentation Rate (ESR), Packed Cell Volume (PCV) or Haematocrit, and Absolute values; Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC); Blood grouping.</p> <p>Unit IV- Clinical pathology: physical, chemical and microbiological examination of urine, stool, CSF and blood culture; Semen analysis; Pregnancy test and throat swab culture.</p> <p>Unit V- Infection in clinical practice: Infections of the Skin and Tissues, Respiratory tract, Gastrointestinal tract and related organisms, Urinary tract, Genital tract, Central nervous system, Eye and surrounding structure, Bone and Joints, Congenital and Neonatal infections, Hospital patients infections, Immunocompromised patients's infections.</p> <p>Suggested Readings (Latest Edition): -</p> <ol style="list-style-type: none"> 1. Sangeeta Sharma (2010) Medical Laboratories management, Viva Publications. 2. Murray, P.R., Baron, E.J., Pfaller, M.A., Tenover, F.C. and Tenover, R.H. (latest Edition) <i>Manual of Clinical Microbiology</i>, American Society for Microbiology, ASM Press. 3. Akhil Bansal (2012). Basic of body fluids analysis of undergraduate and post graduate students. Pvt Ltd. 4. Fleming, D.O., Richardson, J.H., Tulis, J.J. and Vesley, D. (latest Edition) <i>Laboratory Safety: Principles and Practices</i>, ASM Press, Washington, D.C. 5. Truant, AL (latest Edition). <i>Manual of Commercial Methods in Clinical Microbiology</i>, ASM Press Washington, D.C. 6. Estridge, B.H., Reynolds, A.P. and Walters, N.J. (latest Edition). <i>Basic Medical Laboratory Techniques</i>, Delmar, Thomson Learning.
MM	Biostatistics		Unit I- Computer System: Definition; Components

	304	and Medico-informatics	<p>(Input/Output Unit, Control Unit, Primary Storage Unit, Arithmetic and Logic Unit); Types of Memory; Communication Pathways (Control Bus, Address Bus, Data Bus); Classification of Computers (according to logic & size), Generation of Computers; Introduction to Software; Definition; Classification of Software; Introduction to Internet; Internet basics for Microbiologist (Electronic mail, Downloading files with anonymous FTP, Gopher, World Wide Web).</p> <p>Unit II- Database System: Definition; Purpose of Database System; Advantages of Database System; Components of Database System (Data, Hardware, Software & Users), Database Administrator; Data. Administrator; Data Models (Relational, Network, Hierarchical); Three Level Architecture for Database System (Internal Level; Conceptual Level; External Level).</p> <p>Unit III- Biological Databases: Introduction to Bioinformatics; Biological Databases System (Nucleic Acid Sequence Database, Protein Sequence Database & Protein Structure) Important bioinformatics websites (NCBI, EBI, SIB, etc.); Information Retrieval through ENTREZ; BLAST Programs; (BLASTP, BLASTN, BLASTX, TBLASTN, TBLASTX); CLUSTALX; PRIMER Designing Software; Restriction Enzyme Software.</p> <p>Unit IV- Frequency distribution; measures of central tendency (mean, median and mode); Measures of dispersion: mean deviation and standard deviation. Correlation and regression: Scatter Diagram, Coefficient of Correlation, Rank correlation. Lines of Regression. Probability: Basic concepts related to probability theory, classical probability. Probability distributions: Introduction and simple properties of Binomial, Poisson, Normal and skewed distribution and their applications in biology. Sampling: Concept of sampling and sampling techniques.</p> <p>Unit V- Testing of hypotheses: Some basic concepts, Errors in hypothesis testing; critical region, Students t-test for the significance of population mean and the difference between two population means; Paired t-test; Chi square test for population variance, goodness of fit and for the independence of two attributes in a contingency table; F-test for the equality of two population variance; Analysis of variance-- One-way and two-way analysis of variance.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. Bailey, NT J (2000). Statistical Methods in Biology. English Univ. Press. 2. Campbell R.C (Latest Edition). Statistics for Biologist. Cambridge University Press, UK. 3. Sinha PK (Latest Edition). Fundamentals of computers. BPB Publication, New Delhi 4. Jonathan, P. 2008. Bioinformatics & Functional Genomics. 5. B.D.Singh(2015). Biotechnology, Kalyani Publication. 6. Sharma and Munjal(2015). A test book of Bioinformatics, Rastogi publication.
	Practical		
IV	MM 401	Parasitology	<p>Unit I- General characters of parasites, parasitological terminology, basics of parasitology, introduction to pathogenic parasites: Pathogenicity and Epidemiology of parasitic infections; parasitic infection versus host resistance , Epidemiology of infectious diseases; Classification of pathogenic protozoa and helminths with characterstisc of each</p>

			<p>class.</p> <p>Unit II- Classification, pathogenesis, laboratory diagnosis, treatment and prevention of intestinal and urogenital diseases caused by protozoan: <i>Entamoeba</i>, <i>Giardia</i>, <i>Balantidium</i> Blood and tissue protozoa, <i>Trichomonas</i>, <i>Leishmania</i>, <i>Trypanosoma</i>, <i>Toxoplasma</i> and <i>Plasmodium</i>.</p> <p>Unit III- Classification, pathogenesis, laboratory diagnosis, treatment and prevention of intestinal and urogenital diseases caused by Helminths: cestodes; <i>Taenia</i>, <i>Diphyllobothrium</i>, <i>Echinococcus</i>, <i>Hymenolepis</i> and Trematodes: <i>Paragonimus</i>, <i>Fasciola</i> and, <i>Schistosoma</i>. Nematodes; <i>Ancylostoma</i>, <i>Ascaris</i>, <i>Necator</i> and <i>Wuchereria</i>.</p> <p>Unit IV- Common Arthropods and other vectors viz. Mosquito, sand fly, ticks, mites, Cyclops, louse, mysis; The role of vector in causing disease, elimination and control of vectors.</p> <p>Unit V- Host-Parasite interaction: Symbiosis and Parasitism- Ecological Aspects of Parasitism- Parasite-Host Interaction- Sources of parasitic infections. Detection and identification of parasites: Examination of stool, intestinal content, Urine sputum and blood; antiparasitic agents and susceptibility tests.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. Chatterjee K.D. (2015). Parasitology, Calcutta publication. 2. David Greenwood (2015). Medical Microbiology, 18th edition. 3. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hill. 4. J.G. Black(2015) –Microbiology, 9th edition, Wiley publication 5. Talaro K.P. & Talaro A. (Latest Edition). Foundations in Microbiology (6th Ed.), McGraw-Hill College Dimensi. 6. H.Srinivasa (2013). Text book of Medical Parasitology- protozoology and Helminthology. 7. Liu Chang Xing (Latest Edition). Medical Microbiology and Parasitology.
MM 402	Epidemiology: Disease Control and Public Health		<p>Unit 1: History of epidemiology, basic vocabulary and processes used in the science of epidemiology, routes of transmission of disease, incidence and prevalence rates, non communicable and communicable infection, healthcare associated infection- nosocomial infections, microorganism responsible for nosocomial infection, epidemiology of nosocomail infection.</p> <p>Unit 2: Studies of infectious notifiable diseases as AIDS, anthrax, botoulism, cholera, gonorrhoea, encephalitis, hepatitis, rabies, syphilis, tetanus, tuberculosis, typhoid, yellow fever with their sign, symptoms, diagnostic test, chemotherapy and vaccines availability.</p> <p>Unit 3: Health and Disease: Basic Concepts and Definition, Disease Control and Levels of Prevention, Determinants and Indicators of Health, Health situation and Trends in India. Genesis and Development of the concept, Healthcare versus Medical Care, Approaches to Public Health, Primary Health care, Millennium developmental Goals.</p> <p>Unit 4: Environment and Health: Environmental degradation and human pathology, Examination of living/ working environment & its impact on human health; Laws on Environmental protection, the Right to a safe biosphere.</p> <p>Unit 5: Nutrition and Health: Classification and Nutritional profiles of various foods and drinks, Balanced diet, Diet survey, consumption unit, nutritional classification, Nutritional problems e.g. LBW, PEM, Xerophthalmia, IDD, etc. Nutritional factors in selected/ major diseases (Cardiovascular, Diabetes, Obesity, Cancer), Food toxicity, socio-ecology of nutrition; Industrial and Occupational Health: Industrial and</p>

		Occupational hazards and accidents, Occupational diseases and their prevention. Suggested reading (Latest Edition) 1. Kenneth. J. Ryan (2010) Sherris's Medical Microbiology, Mc Graw Hill. 2. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9 th edn McGraw Hill. 3. Greenwood D (2015). Medical Microbiology, 18 th Edition, Elsevier. 4. Murray PR, Pfaller MA, Tenover FC and Tenover FC (2007). Clinical Microbiology. ASM Press. 5. Robert S. Burlage (2012). Principles of Public health Microbiology. 6. Ronald M Atlas, James W Snyder (2013). Hand book of Media for clinical and public health Microbiology, CRC press.
MM 403	Pharmaceutical Microbiology	Unit I: General Characteristics of antimicrobial drugs, Factors influencing antimicrobial drug effectiveness, Antibiotics and synthetic antimicrobial agents: Aminoglycosides, β - lactams, tetracyclines, ansamycins, antifungal antibiotics, antitumor substances; peptide antibiotics, Chloroamphenicol, sulpha drugs; disinfectants, antiseptics and preservatives. Unit II: Mechanism of actions of antibiotics: penicillin, vancomycin (cell wall synthesis inhibition); aminoglycosides, tetracycline, chloramphenicol (protein synthesis inhibition); Rifampin, quinolones and fluoroquinolones (nucleic acid synthesis inhibition); polymyxin B (cell membrane disruption), determining the level of antimicrobial activity. Unit III: Molecular principles of drug targeting, drug delivery system in gene therapy, bacterial resistance to antibiotics; Mode of action of non-antibiotic antimicrobial agents; Penetrating defenses- how the antimicrobial agents reach the targets, cellular permeability barrier, cellular transport system and drug diffusion. Unit IV: Microbial contamination and spoilage of pharmaceuticals products: sterile injectibles, noninjectibles, and their sterilization; Manufacturing procedures and in process control of pharmaceuticals. Use of microbial enzymes in pharmaceuticals, biosensors, Immobilization procedures for pharmaceuticals application (Liposomes), Macromolecular, cellular and synthetic drugs carriers. Unit V: Good manufacturing practices (GMP) and good laboratory practices (GLP) in pharmaceutical industry, regulatory aspects of quality control, Quality assurance and quality management in pharmaceuticals ISO, WHO, and US certification, chemical and biological indicators, Safety in microbiology laboratory. SUGGESTED READING (Latest Edition) 1. Reed G (latest Edition). Industrial Microbiology. CBS Publishers (AVI Publishing Co.) 2. Kalapna Merchant (Latest Edition). Pharmacological regulation of Genes, CRC press. 3. Bhosh, Fiechter and Blakebrough Advances in Biochemical Engineering. Springer Verlag Publications. 4. Creuger and Creuger (2005). Biotechnology- A Textbook of Industrial Microbiology, Sinauer Associates. 5. Casida LE (2010). Industrial Microbiology, New Age International Publication. 6. B.D. Singh (2015). Biotechnology, Kalyani publication.
MM 404	Nutritional Therapy	Unit I: Sources of Nutrition, Nutritional requirements of a healthy person, Therapeutic nutrition, Nutritional supplements, Artificial nutrition, Enteral Nutrition, Parenteral Nutrition. Functional foods, types of functional foods, Unit II: Use of Therapeutic nutrition in Nausea, Vomiting, Swallowing problems, Weight loss and related problems; Allergies and intolerances, Food allergies, Diagnosis of food allergies and intolerance, Dietary management of food allergies, Pea nut allergy, Cow milk allergy. Digestive disorders and diets. Unit III: Diabetes, types of diabetes, complications associated with diabetes, Therapeutic nutrition and management of

		<p>diabetes. Hear diseases, dietary fat and cholesterol. Renal/kidney conditions, Acute Renal failure, Chronic renal failure, Eating the right amount of energy, fluid restrictions, sodium restrictions, diet and kidney stones.</p> <p>Unit IV: Cancer, dietary factors associated with cancer, Cancer therapy and nutrition, nutritional side effects and suggested dietary management. Other metabolic conditions of liver, Hepatitis, Cirrhosis, Gallbladder and Pancreas and their proper functioning by management of food diets.</p> <p>Unit V: Food for man: use of microbes and microbial enzymes in the improvement of nutritive quality of food, probiotics, microbiological criteria for food, fruit juices, food control.</p> <p>Suggested reading (Latest Edition):</p> <ol style="list-style-type: none"> 1. Adams M. R. & Moss M. O. Food Microbiology, Royal Society of Chemistry Publication, Cambridge.Pergamon Press. 2. Hobbs B. C. & Roberts D. Food poisoning and Food Hygiene, Edward Arnold (A division of Hodder and Stoughton London). 3. Robinson R. K. Dairy Microbiology, Elsevier Applied Sciences, London. 4. Jones, S., Quinn S.(2005). Textbook of Functional Medicine. 5. Jonathan V. Wright (latest Edition) Dr Wright's book of nutritional therapy 6. William C Frazier (2015). Food Microbiology, Mc Graw Hill.
	Practical	

FIFTH & SIXTH SEMESTER (Third Year)

MM 501 PRACTICAL (2 days) INCLUDING OBJECTIVE
MM 502 THESIS/REPORT

400 Marks
600 Marks

AK

AK
16/11

Daveedha K
16/11