

CH. CHARAN SINGH UNIVERSITY, MEERUT

Program: **M.Sc. Microbiology**

Program Code: MIC

Program (Specific): **M.Sc. Microbiology**

Year of Implementation: **2021- 2022**

Programme Objectives:

1. The M.Sc. Microbiology programme covers all aspects of Microbiology and involves classical, modern and inter-disciplinary approaches.
2. The proposed syllabus endeavours to provide training in microbiological skills through lectures, projects, practical exercises and seminars/presentations.
3. Microbiology is a multi-disciplinary course and various programmes have been developed to meet the growing demand for trained manpower to carry out meaningful microbiological activity in the country.
4. The programmes are designed to expose the students to recent exciting developments in the area of Microbiology/ Biotechnology/ Medical Microbiology/ Food science/ Bioinformatics and their application in industry, agriculture and medicine.

Programme Outcomes:

After completion of the two year Course in Microbiology, the students would have:

1. Gathered substantive knowledge that prepares post graduates for careers in areas of Biochemistry, Medical Microbiology, Environmental and Food Sciences, Molecular Biology and Biotechnology
2. Developed an exploratory mind-set along with problem-solving and analytical skills, to enable a smooth progress into the area of research and teaching.
3. Accumulated skills such as critical scientific thinking needed for data analysis.
4. Received training in the preparation of a Dissertation from the Internship in the last Semester, designed as a vital, gainful component of practical training for the students.

Specific Programme Outcomes (PSOs)

PSO1: Students pursuing the course will be able to explore the diversity of the microbial world, the structure and function of microbes/microbial cells.

PSO2: Students will be familiarized with the multitude of techniques involved in microbial study ranging from culture and microscopy to molecular.

PSO3: Students will be able to understand the role of microbes in evolution and life on earth, natural environments and microbial ecosystems.

PSO4: Students will be able to appreciate the impact of microbes in biotechnology, industry, agriculture, health and medicine.



Programme Employability

1. Plan and conduct complex research projects, such as improving sterilization procedures or developing new drugs to combat infectious diseases.
2. Perform laboratory experiments that are used in the diagnosis and treatment of illnesses.
3. Supervise the work of biological technicians and other workers and evaluate the accuracy of their results.
4. Isolate and maintain cultures of bacteria or other microorganism for study.
5. Identify and classify microorganism found in specimens collected from humans, plants, animals and the environment.
6. Monitor the effect of microorganisms on plants, animals, others microorganism or the environment.
7. Review literature and the finding of other researches and attend conferences
8. Prepare technical reports, publish research papers and make recommendations based on their research findings.
9. Present research findings to scientists, non scientist executives, engineers other colleagues and the public.

Courses/ Papers and their Outcomes (COs)

Semester	Course Code	Course Title	Course Outcome
MIC-CCSU-102	MIC-CCSU-102	MICROBIAL TOOLS AND TECHNIQUES	After completion of this course, the student will be able to CO1. Learn the concept of sterile techniques for isolation of microbes in pure culture, and understand the principles of optical microscopy including generation of contrast. CO2. Gain knowledge about the instrumentation, working principle and applications of varied forms of spectroscopy needed to study bio-molecules and crystal structures. CO3. Understand chromatographic techniques for separation of bio-molecules. CO4. Understand the working principle behind electrophoresis, and study of antigen-antibody interactions, including applications for the identification of microbes. CO5. Learn centrifugation techniques, and forms of electron microscopy for the purification and characterization of microorganisms.
	MIC-CCSU-102	MICROBIAL GENETICS	CO1. Understand the concept of Mendelian inheritance, genetic linkage and crossing over. CO2. Understand the organization of the bacterial chromosome, plasmid, and the eukaryotic genome, and the mechanism of DNA replication. CO3. Learn about the molecular basis of mutations and mechanisms of DNA repair. CO4. Know about the bacteriophage diversity

			and replication pathways of virulent and temperate phages, and working of the genetic switch in bacteriophage Lambda CO5. Understand the stages in mitotic and meiotic cell division, and the mechanisms of genetic recombination in bacteria.
	MIC-CCSU-103	MICROBIAL DIVERSITY	CO1. Know about bacterial and archaeal diversity in a morphological and phylogenetic context. CO2. Know how to classify and compare the morphological and genomic characteristics of viruses. CO3. Learn the diversity of fungi and algae along with their comparative structure and classification. CO4. Learn about the pathogenic aspects of the various groups of microorganisms, their disease cycles and control measures. CO5. Understand the characteristics of pathogenic nematode and protozoa.
	MIC-CCSU-104 (I): CORE ELECTIVE	Nutritional therapy	CO1. Improved nutritional status, early recovery, improved immune status and improved quality of life following critical illness. CO2. Understand that overall use of resources can be reduced by nutrition counselling, oral diet and oral supplements etc.
	MIC-CCSU-104 (II): CORE ELECTIVE	NATURAL RESOURCES AND CONSERVATION	CO1. Recall the concepts of file management. CO2. Know availability and distribution for water resources as applied to India. CO3. Analyses the components of air as resources and its pollution. CO4. Critically appreciate the environmental concerns of today. CO5. Discuss biodiversity and its role in ecosystem functioning.
	MIC-CCSU-105	Practical	
	MIC-CCSU: OE-I	Food quality testing (Minor Open Elective for other faculty)	CO1. Know about common food adulterants and their detection, know the legislator aspects of adulteration. CO2. Know about the basics of food microbiology, contamination and spoilage of different food items.
II	MIC-CCSU-201	MICROBIAL GROWTH AND PHYSIOLOGICAL DIVERSITY	CO1. Understand the structure of macromolecules and their basic building blocks CO2. Know the mechanisms of ATP generation by microbes, and importance of heterotrophic metabolism, fermentation and chemolithotrophy. CO3. Learn the generation of ATP in a light driven process and pathways of CO ₂ fixation by phototrophic microorganisms.

			<p>CO4.Understand how enzymes, the biological catalysts, work and factors affecting their catalytic function.</p> <p>CO5.Know about nucleic acids and their building blocks, enzyme specificity, energy-rich compounds and biological nitrogen fixation.</p>
	MIC- CCSU-202	Molecular Biology & Genetic Engineering	<p>CO1.Understand the regulation of transcription through the various operons, and the mechanics of translation in bacteria.</p> <p>CO2.Know about enzymes, vectors and cloning strategies in genetic manipulation.</p> <p>CO3.Learn about recombinant DNA technology and methods of DNA sequencing.</p> <p>CO4.Understand the protocol for cloning of a DNA fragment in a plasmid vector, transformation of bacterial cells and screening of cDNA libraries to identify a clone of interest.</p> <p>CO5. Learn techniques in molecular biology such as PCR, RFLP and DNA microarray that are useful in diagnosis.</p>
	MIC- CCSU-204	AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY	<p>CO1. Understand biomes, ecosystems, ecological pyramids and trophic levels in food chains and food webs.</p> <p>CO2. Learn about the diversity of microbes in aquatic environments, factors affecting their growth, and water-borne diseases caused by infectious microbes.</p> <p>CO3.Understand the concept of oxygen demanding wastes through BOD and COD, water pollution and its remediation, and waste management.</p> <p>CO4.Define remarkable role of microbes in cycling of nutrients, and study species interactions and associations in soil affecting physiology and growth of plants.</p> <p>CO5.Learn about microbes thriving in harsh environments, microbial blooms and their adverse effects, and methods of sampling air borne microbes.</p>
	MIC- CCSU-204 (I): CORE ELECTIVE	LAB DIAGNOSIS	<p>CO1.Understand the collection the clinical samples with aseptic Techniques.</p> <p>CO2.know about the different staining techniques for different structures.</p> <p>CO3.Learn about whole blood with other aspects.</p> <p>CO4.Also understand the different human diseases diagnosis their prevention and control.</p>
	MIC- CCSU-204 (II): CORE	FOOD MICROBIOLOGY	<p>CO1.Understand the significance and activities of microorganisms in food</p> <p>CO2.Know the characteristics of food borne, water borne and spoilage microorganism and methods for their isolation, detection and</p>

	ELECTIVE		identification. CO3. Learn the use of standard methods and procedures for the microbiological analysis of food.
	MIC-CCSU-205	Practical	
III	MIC-CCSU-301	IMMUNOLOGY	CO1. Understand pathogenesis and the role of toxins, enzymes and host factors in infection and disease. CO2. Know about diseases caused by diverse microorganisms with emphasis on emerging diseases and pandemics. CO3. Learn about the oncogenic viruses and cell transformation, and understand the importance of antimicrobial agents and drug resistance. CO4. Get an overview of immunology with a detailed account of molecular and cellular interactions that control innate and adaptive immunity. CO5. Understand the concept of autoimmunity, hypersensitive and allergic responses of the host and to learn methods of inducing immunity against the pathogen in the host.
	MIC-CCSU-302	MICROBIAL BIOTECHNOLOGY AND INDUSTRIAL MICROBIOLOGY	CO1. Understand industrial fermentation, manipulation of microbial strains, and techniques for producing optimal product. CO2. Learn about diseases caused by contaminated food stuffs and the lab tests for detecting the causal microorganisms. CO3. Learn of the valuable products obtained from industrially important microbes. CO4. Know about the ubiquitous presence of microbes, hence contamination of food items and food spoilage, and factors affecting their growth. CO5. Know the physical and chemical techniques utilized worldwide in food preservation.
	MIC-CCSU-303	COMPUTER APPLICATION, BIOINFORMATICS, STATISTICS AND RESEARCH METHODOLOGY	CO1. Demonstration the ability to choose methods appropriate to research aims and objectives. Understand the limitations of particular research methods. Develop skills in qualitative and quantitative data analysis and presentation. Develop advanced critical thinking skills. CO2. Restate the principal concepts about biostatistics, collect data relating to variable/variables which will be examined and calculate descriptive statistics. CO3. Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics. CO4. Existing software effectively to extract information from large databases and to use this information in computer modelling. CO5. Ability to understand the software concepts and their applications.

	MIC- CCSU-304 (I): CORE ELECTIVE	FOOD CHEMISTRY	CO1. Demonstrated ability to identify solutions to problems related to the chemical compositions and functionality of food and to apply and expand upon the theoretical concepts. CO2. Ability to use terminology, appropriate to the field of food chemistry, correctly and contextually.
	MIC- CCSU-304 (II): CORE ELECTIVE	FOOD BORNE AND WATER BORNE DISEASE	CO1. Identify potential sources of contamination in the food and water system. CO2. Understand how food borne pathogens and chemical contamination of food can impact health. CO3. Calculate the attack rate for a food borne and water borne illness outbreak. CO4. Describe the steps involved in a food borne illness outbreak investigation and the rationale for each. CO5. Describe ways to prevent food borne and water illness.
	MIC- CCSU-305	Practical	
	MIC- CCSU-OE II	HEALTH AND HYGIENE Minor open elective for other faculty	CO1. Learn about the hygiene cleaning processes. CO2. Understand the concepts of body, hand, foot, mouth, hair, nails, face, eye, ear and nose hygiene and cleaning. CO3. Calculate the attack rate for a food borne and water borne illness outbreak. CO4. Know the concepts of housing hygiene and health. CO5. Understand the role of public and government in health promotion.
IV	MIC- CCSU- 401	MEDICAL MICROBIOLOGY	CO1. Provides learning opportunities in the basic's principles of medical microbiology and infectious disease. CO2. Covers mechanisms of infectious disease transmission, principles of aseptic practices and the role of the human body Normal Microflora. CO3. Provides the conceptual basis for understanding pathogenic microorganism and the mechanisms by which they cause disease in the human body. CO4. Provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases. CO5. Understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.
	MIC- CCSU-	HUMAN, ANIMAL AND	CO1. Understand the basic principles of virology, and the structural diversity of plant viruses. CO2. Understand the genetic diversity of viruses

	402	PLANT VIROLOGY	and the contrasting replication strategies of viruses possessing an RNA or a DNA genome. CO3. Learn about the transmission characteristics of the viruses at the molecular level, and understand the genetic basis of host responses to virus infection. Understand the concept of sub-viral pathogens, and methods of plant virus control, both conventional and modern. CO4. Understand the biology of viroids, and study symptomatology and pathology of diverse plant viruses
	MIC- CCSU- 403 CORE ELECTIVE	FOOD PROCESSING, PRESERVATION AND PACKAGING	CO1. To enable the students to understand food composition and its physico-chemical, nutritional, microbiological and sensory aspects. CO2. To familiarize the students about the processing and preservation techniques of variety of foods. CO3. To emphasize the importance of food safety, food quality, food laws and regulations. CO4. To expose the students to different food processes used in industries and in research field. CO5. To prepare the students to accept the challenges in life sciences. CO6. To develop skills required in various industries, research labs and in different fields.
	MIC- CCSU- 403 (II) CORE ELECTIVE	FOOD SAFETY	CO1. Discuss how contamination of food can occur in a food service establishment. CO2. Describe the effect and consequences of food illness. CO3. Display sound practices to prevent the possibility of food poisoning. CO4. Identify measures/procedures that will reduce or eliminate accidents in food preparation and services areas
	MIC- CCSU- 403 (II) CORE ELECTIVE	EPIDEMIOLOGY	CO1. Understand the basics epidemiological methods and study designs. CO2. Understand and discuss population based perspective to examine disease and health related events. CO3. Discuss the ethical issues in epidemiological research. CO4. Learn the basic concepts of screening and outbreak investigation. CO5. Disease surveillance. CO6. Critically review published epidemiological studies.
	MIC- CCSU-405	Practical	CO1. Explain microbial metabolism CO2. Acquire knowledge and application ability on pharmaceuticals field CO3. Identify the problems about pharmaceutical field.

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Syllabus

Semester	Course Code	Course Title	Syllabus
I	MIC-CCS U-101	MICROBIAL TOOLS AND TECHNIQUES	<p>Unit I: Basic principles and methods of sterilization: control of microorganisms by physical and chemical methods, evaluation of antimicrobial agent effectiveness. Principle and functioning of LAF.</p> <p>Unit II: Microscopy & Staining techniques: Basic principles for the examination of microbes by light, dark field, phase contrast, fluorescent and electron (transmission and scanning) microscopy, Specimen preparation and basic principles of Simple, Gram's stain, Capsule, Endospore, Flagella, Acid fast and Nuclear/Geimsa's staining.</p> <p>Unit III: Basic principles and methods of media preparation: types of culture media, pH and buffers; Pure culture techniques: streak plate, dilution plate and spread plate method; maintenance of pure cultures; methods of preservation of various microbes.</p> <p>Unit IV: Basic principles and applications of spectrophotometry UV-Visible spectrophotometry & Fluorimetry, Flame photometry and atomic absorption spectrophotometry; Paper and Thin layer chromatography, Types of Column Chromatography (column, gel filtration, ion-exchange and affinity chromatography); GLC, HPLC and FPLC.</p> <p>Unit V: Miscellaneous techniques: Principles and applications of Electrophoresis for protein and DNA; Isoelectric focusing and 2-D gelelectrophoresis; Centrifugation; Ultracentrifugation; Dialysis, Ultrafiltration; Lyophilization.</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. T.A.Brown (2016). Gene cloning and DNA analysis, an introduction, Wiley Blackwell pub.6. B.D.Singh (2015). Biotechnology, Kalyani publication.
	MIC-	MICROBIAL	Unit I: Mendelian Principles, Fine structure of a gene in

<p>CCS U-102</p>	<p>GENETICS</p>	<p>prokaryote: The rII locus, complementation test, cistron, recon, muton, Diversity of Phage genomes, Life cycle of Bacteriophage (Lytic and Lysogenic), Linkage and Crossing over</p> <p>Unit II: Mutation; spontaneous mutation, Induced mutagenesis- mutagens (physical mutagens; non ionizing radiation; chemical mutagens; Base analogues, alkylating agents, deaminating agents, intercalating agents & others), molecular mechanism of mutagens. Suppressor mutation; DNA repair mechanism; repair by direct reversal, excision repair, mismatch repair systems, recombinational repair & SOS repair.</p> <p>Unit III: Recombination: Reciprocal and non reciprocal, mechanism of recombination; Holiday model and Fox model; Transposable element; Classes of transposable elements, nomenclature of transposable elements; insertion sequences (IS elements), Transposons (composite structure and complex transposons structure) mechanism of transposition.</p> <p>Unit IV: Gene transfer mechanisms: bacterial transformation (mechanism of transformation, transfection, competence), transduction; generalized transduction, specialized transduction, conjugation; effective contact and pilli in conjugation, the 'F' factor, the conjugal transfer process, high frequency recombination (Hfr) Strains, Formation of F prime.</p> <p>Unit V: Plasmids: types of plasmids (F plasmids, R plasmids, Col plasmids & Ti plasmid), control of copy no. and incompatibility; Bacteriophages, lytic phages-T7 and T4; lysogenic phages-λ & P1; M13 & ϕX 174.</p> <p>Suggested reading (Latest Editions):</p> <ol style="list-style-type: none"> 1. Freifelder O. Microbila. 2009. Genetics, Narosa publishing House. 2. Willey J. Sherwood L. & Woolverton C. 2007.Prescott/Harley/Klein'sMicrobiology, McGraw Hill. 3. J D Watson (2008), Molecular biology 4. Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith (2012). Becker's Word of the cell. 5. William. D Stans Field (2012). Molecular and cell Biology, Mc Graw Hill pub. 6. Gerald Karp (2014). Cell Biology, Wiley Blackwell, Pub.
<p>MIC- CCS U-103</p>	<p>MICROBIAL DIVERSITY</p>	<p>Unit I: Discovery of microbial world; History, Scope and relevance of Microbiology Introduction to microbial biodiversity distribution, abundance, ecological niche of bacteria and archaea.History of the evolution of three domain of life. Modern trends in microbial taxonomy including RNA world. Current status of microbes in the living world, Bergey's Manual of determinative</p>

			<p>bacteriology, Brief developmental Current thoughts on microbial evolution including the origin of life.</p> <p>Unit II: General characters of bacteria and Archaea; General characteristic of thermophiles, psychrophiles, osmophiles, acidophiles, alkaliphiles and halophile including ecology, adaptation and biotechnological applications. General characteristics of Cyanobacteria- Ultrastructure and Economic importance.</p> <p>Unit III: General account of fungi, classification of fungi and contribution of scientists, Cultivation, isolation and selection of some useful fungi Common genera– <i>Saccharomyces</i>, <i>Rhizopus</i>, <i>Penicillium</i>, <i>Neurospora</i>, <i>Agaricus</i>, <i>Aspergillus</i>, Economic importance of Fungi.</p> <p>Unit IV: General characters, nomenclature, classification, morphology and ultra-structure of viruses; Capsid and their arrangement; Cultivation of viruses Bacteriophages, Cyanophages, Mycophages; General characters and structure of viroids, satellites and prions and major diseases caused by them.</p> <p>Unit V: General characteristics of Protozoans and Helminth Parasites; Classification, characteristics and diversity of Protozoan and Nematodes with special reference to: <i>Plasmodium</i>, <i>Trypanosoma</i>, <i>Systoshoma</i>, <i>Taenia</i> and <i>Ascaris</i></p> <p>Suggested reading (Latest Editions):</p> <ol style="list-style-type: none"> 1. Plant Pathology, G.N. Agrios, 5th ed, 2005, Elsevier. 2. Introductory Mycology, C.J. Alexopoulos, C.W. Mims and M. Blackwell, 4th edition, 1996, Wiley India. 3. Microbiology: An Introduction, G.J. Tortora, B.R. Funke, C.L. Case, 11th edition, 2016, Pearson India Education. 4. Plant Diseases, R.S. Singh, 10th edition, 2019, Scientific International Pvt. Ltd. 5. Phycology, Robert Lee, 4th edition, 2008, Cambridge University Press
MIC-CCS U-104 (I)	CORE ELECTIVE: NUTRITIONAL THERAPY		<p>Unit I: Sources of Nutrition, Nutritional requirements of a healthy person, Therapeutic nutrition, Nutritional supplements, Artificial nutrition & types Functional foods & types, Prebiotics & Probiotics Nutraceuticals.</p> <p>Unit II: Use of Therapeutic nutrition in Nausea, Vomiting, Swallowing problems & Weight loss , Allergies, Food allergies, Diagnosis and intolerance, Dietary management of food allergies, Pea nut allergy, Cow milk allergy.</p> <p>Unit III: Diabetes types, complications, Therapeutic nutrition & management of diabetes; Fat and Cholesterol, Kidney (Renal) conditions, stones, Therapeutic nutrition & treatment</p> <p>Unit IV: Cancer, dietary factors associated with cancer, Therapeutic nutrition and dietary management, Digestive disorders and diets, Metabolic conditions of liver &</p>

			<p>Gallbladder; Hepatitis, Cirrhosis</p> <p>Unit V: Food for man: use of microbes and microbial enzymes in the improvement of nutritive quality of food, 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., Textbook of Functional Medicine. 5. Jonathan V. Wright (latest Edition) Dr. Wright’s book of nutritional therapy 6. William C Frazier, Food Microbiology, McGraw Hill.
<p>MIC- CCS U-104 (II)</p>		<p>COREELECTIVE: NATURAL RESOURCES AND CONSERVATION</p>	<p>Unit I: Land: Land as a resource, types of lands, conservation of land forms, deforestation, Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.</p> <p>Unit II: Water: Global water resources, Indian water resources, Resources system planning. Water use sectors-domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water.</p> <p>Unit III: Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Ozone depletion weathering: physical, biogeochemical processes, erosion, agents of erosion.</p> <p>Unit IV: Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry.</p> <p>Unit V: Global warming: concept, indicators, factors and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity.</p> <p>Suggested reading (Latest Edition):</p> <ol style="list-style-type: none"> 1. Modi, P.N., “Irrigation Water Resources and Water Power Engineering”. Standard Book House, New Delhi. 10th Edition, 2019. 2. Raghunath, H.M., “Groundwater”,3rd Edition, New Age International Publishers, New Delhi, 2007.

			<p>3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.</p> <p>4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, NewDelhi, 2011.</p> <p>5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications, 2017.</p>
	MIC-CCS U-OE-I	FOOD QUALITY TESTING (MINOR OPEN ELECTIVE FOR OTHER FACULTY)	<p>Unit: Milk and Milk Products- Quality Testing, Chemical and Microbiological analysis, Common disease caused by infected milk and milk products- their prevention and cure.</p> <p>Unit II: Microbiological and chemical examination of low temperature stored food and beverages, frozen vegetables, pizza, soya cheese, Ice- creame, frozen yoghurt, frozen soup, soft drinks.</p> <p>Unit III: Microbiological examination of seasonal fruits and vegetables and the common disease caused by infected fruits and vegetables.</p> <p>Unit IV: Microbiological and chemical examination of common food adulterants in wheat, flour, sugar, turmeric, grounded coriander, salt, vegetables oils, ghee, honey etc.</p> <p>Unit V: Common food preservatives and their effect on human health.</p> <p>Suggested reading (Latest Edition):</p> <ol style="list-style-type: none"> 1. Food Microbiology – Frazier, W.C., Ed-4, Mc. Graw Hill – 2013. 2. Microbiology by John Garbult Essentials of Food Microbiology - Arnold International Student edition 1997. 3. Betty - c Hobbs & Diane Roberts – Food poisoning and food hygiene sixth edition by Arnold International Students edition – 1993. 4. Practical Food Microbiology & Technology – Mountnety Gould, Ed-3, Krieger Publishing Company, 1992. 5. Modern Food Microbiology – Jay J.H. CBS Publishers, 1990. 6. The Microbiological safety of processed foods – Growther, Marthi, Oxford and IBH Publishers Pvt. Ltd., 1988. 7. Basic food Microbiology – Banwart G.T., CBS Publishers, 1987
II	MIC-CCS U-201	MICROBIAL GROWTH AND PHYSIOLOGICAL DIVERSITY	<p>Unit I: Oxidative phosphorylation, Substrate-level phosphorylation, ATP synthase and ATP generation, Chemolithotrophy (oxidation of hydrogen, iron, and reduced sulphur and inorganic nitrogen compounds by bacteria), Glycolysis and TCA cycle, anaerobic respiration (Denitrification, sulphate and sulphur reduction), Fermentative diversity, Lactic acid fermentation, Alcoholic fermentation</p> <p>Unit II: Nutritional groups of microbes, nutritional uptake; transport across the membranes and cell wall (diffusion, passive diffusion, active transport, group translocation and iron uptake); Physiology of growth and kinetics, Growth</p>

			<p>curve, measurement of growth (biomass, turbidity, dry weight, protein content); environmental factors affecting microbial growth.</p> <p>Unit III: Types of bacterial photosynthetic pigments reaction centres and antenna pigments, photosynthetic membranes, Anoxygenic and oxygenic photosynthesis, Electron flow in purple, green and cyanobacteria, generation of reducing power and ATP Carboxysomes, pathways for CO₂ fixation (Calvin cycle, reverse citric acid cycle, hydroxypropionate pathway, Acetyl-CoA pathway)</p> <p>Unit IV: Carbohydrates: Structure and properties of starch, cellulose, hemicellulose, glycogen and their derivatives; structure of lignin; General characters of fats, saturated and unsaturated fatty acids, biosynthesis of fatty acids, oxidation of fatty acids.</p> <p>Unit V: Classification, structure and properties of proteins, Structure of amino acids, Classification of essential amino acids based on polarity, Classification and nomenclature of enzymes; mechanism of enzyme action, enzyme inhibition, allosteric enzymes, enzyme kinetics.</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. Voet D and Voet JG. (2013). Principle's of Biochemistry. John Wiley and sons New York. 3. Moat AG and Foster J W (Latest Edition). Microbial Physiology. John Wiley and Sons, New York. 4. Stryer. L (2003). Biochemistry. W. H. Freeman and Co. 5. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th edi McGraw Hil
MIC-CCS U-202		MOLECULAR BIOLOGY AND GENETIC ENGINEERING	<p>Unit I: Nucleic acids as genetic information carriers: DNA structure: historical aspects & current concepts, melting of DNA, types of DNA. DNA replication in prokaryotes and Eukaryotes : types of polymerases, steps: initiation, elongation (Asymmetric & dimeric nature of DNA Polymerase III & simultaneous synthesis of leading & lagging Strands), termination. synthesis of telomeric DNA. Various modes of replication.</p> <p>Unit II: Types and Structural features of RNA (mRNA, tRNA, rRNA): Transcription in prokaryotes and Eukaryotes: types of RNA polymerases (I, II & III); steps: initiation, elongation & termination. Inhibitors of RNA synthesis. Post transcriptional modification of mRNA: Basic features of the genetic code: Central dogma of life. Protein synthesis in prokaryotes and eukaryotes; steps-details of initiation, elongation & termination; Post translational modification of proteins.</p> <p>Unit III: Regulation of gene expression: operon concept, negative & positive regulation inducers and corepressors, catabolite repression. Negative regulation <i>E. coli</i>. lac operon; positive regulation- <i>E. coli</i>. ara operon;</p>

			<p>regulation by attenuation- his and trp operons, antitermination.</p> <p>Unit IV- Basic steps of r-DNA technology. Restriction endonucleases. Cloning vectors: general properties, Plasmids (types of plasmids- F plasmids, R plasmids, Col plasmids & Ti plasmid). bacteriophages, cosmids, shuttle vectors, bacterial artificial chromosomes. Eukaryotic cloning vectors for yeast, & animal cells. Gene libraries: genomic library, cDNA library.</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.</p> <p>Suggested Readings (Latest Editions):</p> <ol style="list-style-type: none"> 1. David P Clark (2010). Cell and Molecular Biology 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.
	<p>MIC- CCS U-203</p>	<p>AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY</p>	<p>Unit I: Microorganisms as biofertilizers: <i>Rhizobium</i>, <i>Azospirillum</i>, <i>Azotobacter</i>, Cyanobacteria, commercial production of biofertilizers, biopesticides and mechanism of biological control, Commercial reality of biopesticides limitations for Indian agriculture, Integrated pest management.</p> <p>Unit II: Soil microbiology: Soil as a habitat for microorganisms; Microbial diversity in surface soils, Biogeochemical cycles- C, N, S, P, Microbiology of composting, Microbial decomposition of organic matters, Microbiomics and microbial interactions, Phyllosphere, Rhizosphere, Endophytes, PGPM, Mycorrhiza.</p> <p>Unit III: Microbial degradation, deterioration and bioremediation, Biodegradation of xenobiotics including pesticides and military chemicals (explosives and gases); Biocorrosion of metals; Microbe-metal interactions (bioleaching, biomining, biohydrometallurgy), Integrated microbial bioremediation including oil spills, Role of biosurfactants.</p> <p>Unit IV: Microbes and water potability- Purification of potable water; Sanitary analysis of water (indicator microbes and methods of their detection), Standards of water quality of faecal contamination. Microbes in solid waste and sewage management, Sanitary landfills and composting.</p> <p>Unit V: Solid waste management in India. Methods of</p>

			<p>sewage management; composition of sewage, small scale and modern sewage treatment methods, oxidation ponds, trickling filters, biodisc system, Measurement of water quality after sewage removal.</p> <p>Suggested Readings (Latest Editions): 1. Willey J, Sherwood L and Woolverton C, 2020, Prescott's Microbiology, 11th ed McGraw Hill 2. J.G. Black, Microbiology, Principles and Explorations, 2015, 9th edition, Wiley publication. 3. R.C. Dubey and D.K. Maheshwari, A Textbook of Microbiology, 3rd edition, 2013, S. Chand Co. 4. G.N. Agrios, Plant Pathology, 5th ed, 2005, Elsevier</p>
	MIC-CCS U-204 (I)	LAB DIAGNOSIS (CORE ELECTIVE)	<p>Unit I: Important microbes involved in spoilage of food, meat, poultry, vegetables and dairy products; factors affecting food spoilage, different types of spoilage, food preservation.</p> <p>Unit II: Bio-deterioration of food items, Bacterial and mycotoxins, Important microbes secreting toxins, chemical nature of important toxins; their role in food poisoning; physiology and mechanism of action, control of toxin contamination.</p> <p>Unit III: Uses of microbes in meats and poultry products, vegetables <i>etc.</i> Use of microbial enzymes in food; low calorie sweeteners, Flavour modifiers; Food additives.</p> <p>Unit IV: Microbiological examination of milk, standard plate count, direct microscopic count and reductase test, composition of milk, sources of contamination of milk, types of microbes in milk, pasteurization of milk, ability of milk to cause disease.</p> <p>Unit V: Common food borne pathogens, diseases caused by them and their symptoms, Disease caused by bacteria, molds and yeasts, viral contamination of foods, parasites, Surveillance system for tracking of food borne disease.</p> <p>Suggested Readings (Latest Editions): 1. Butt, TM, Jackson CW and Magan N. Fungi as Biocontrol agent. CABI Publishing, UK. 2. Adams Food Microbiology. 3. Prajapati Fundamentals of Dairy Microbiology. 4. John C, Ayres OM, William ES. Microbiology of Foods. W. H. Freeman and Co. 5. Andrew Proctor Alternatives to conventional food processing, RSC pub. 6. Frazer WC and Westhoff DC Food Microbiology. McGraw Hill, New York.</p>

<p>III</p>	<p>MIC- CCS U-301</p>	<p>IMMUNOLOGY</p>	<p>Unit I: Introduction to the immune system: Innate immunity; anatomic, physiological, phagocytic & inflammatory barriers. Adaptive immunity; natural & artificial immunity. Cells involved in immune response: lymphoid lineage (producing B & T lymphocytes) & Myeloid lineage (phagocytes: macrophages, neutrophils & eosinophils and auxillary cells; basophils, mast cells & platelets). Organs involved in immune system: primary & secondary lymphoid organs.</p> <p>Unit II: Antigens: preparation of antigens, types of antigens- haptens, superantigens & cluster of differentiation molecules (CDs), Processing and presentation of antigens.. Immunoglobulins: structure & types of immunoglobulins, genetic diversity of immunoglobulins, catalytic antibodies. B-cell biology & T-cell biology (major histocompatibility complex (MHC) molecules). HLA andH-2 systems.</p> <p>Unit III: Vaccines immunizations: types of vaccines (DNA vaccines, recombinant DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines) & their characteristics. Immune Disorders: hypersensitivities, autoimmune diseases, transplantation (tissue) rejection, immunodeficiency's.</p> <p>Unit IV: Complement: Classical alternative and lectin pathway of complement activation, regulation of complement system, biological consequence of complement activation. Cytokines: interferons (α, β & γ), TNF, interleukins (1-16), hematopoietins & chemokines.</p> <p>Unit V: Monoclonal antibodies: hybridoma technology, applications of monoclonal antibodies. Antigen-Antibody reactions in vitro: agglutination reactions (Widal, Haemagglutination), precipitation reactions (Immunodiffusion, Immuno electrophoretic method), Immunoassays; Immunoblotting, ELISA and RIA.</p> <p>Suggested Readings (Latest Editions): 1.Riott M (2003). Essentials of Immunology. Blackwell ScientificPublishers,London. 2.Claus D (2005). Immunology- Understanding of Immune System. Wiley - Liss, NewYork. 3. William P (Latest Edition). Fundamentals of Immunology. 4.Tizard Ian R (2009). Immunology. An introduction, 4th Edition. 5.Kindt, Goldsby and d Osborne (2013). Kuby Immunology. MacMillan HigherEducation.</p>
	<p>MIC- CCS</p>	<p>MICROBIAL BIOTECHNOLOGY</p>	<p>Unit I: Sources and characters of industrial microbes, their isolation, purification & maintenance. Screening of useful strains: primary screening & secondary</p>

	U-302	AND INDUSTRIAL MICROBIOLOGY	<p>screening. Strain improvement. Fermentation technology: Bioreactors: principles & designing, microbial growth kinetics in batch, continuous & fed-batch fermentation process. Fermentation media. Solid state fermentation & submerged fermentation.</p> <p>Unit II: Microbial transformations with special reference to steroids & alkaloids. Primary & secondary metabolites. Commercial production of antibiotics with special reference to penicillin, streptomycin and their derivatives.</p> <p>Unit III: Microbiology & production of alcoholic beverages: malt beverages, wine & champagne. Commercial production of organic acids like acetic, lactic, citric, & gluconic acids. Commercial production of important amino acids (lysine & tryptophan), insulin & vitamins (vitaminB₁₂ & vitamin A).</p> <p>Unit IV: Immobilization of microbial enzymes and whole cells and their applications in industries. Food fermentations: bread, vinegar, fermented dairy products & their spoilage. Bioprocess Engineering: Downstream processing, various steps for large scale protein purification. Single cell proteins.</p> <p>Unit V: Industrial enzymes production : Cellulases, Xylanases, Proteases, Amylases, Lipases & Pectinases and their applications. Bioconversion of waste for fuels (ethanol and methane). Mushroom cultivation.</p> <p>Suggested Readings (Latest Editions): 1.Reed G (2004). Industrial Microbiology. CBS Publishers (AVI Publishing Co.) 2.Stanbury PF, Whitekar A. and Hall (2006). Principles of Fermentation Technology. Pergaman. McNeul and Harvey. 3.Creuger and Creuger (2005). Biotechnology- A textbook of Industrial Microbiology, Panima pub. 4.Casida LE (2010). Industrial Microbiology, Wiley Eastern.</p>
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MIC-CCSU-303	COMPUTER APPLICATIONS, BIOINFORMATICS, STATISTICS AND	<p>Unit I: Basic principles of research, objectives of research, importance, types of research: basic and applied, selection of a research topic and problem, literature survey</p>
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		<p>RESEARCH METHODOLOGY</p>	<p>and reference collection, formulation of hypothesis, research designs, sampling designs, plagiarism, bio-safety regulations in biological research. Report writing, research papers writing, oral and written presentation of research (Abstract/Synopsis),</p> <p>Unit II: Impact Factor and Citation Index. Searching research information using J- gate and SCOPUS, Science Direct.</p> <p>Unit III: Introduction to Biostatistics: Definition, Types of statistics, Applications and uses of Biostatistics, Identification and types of variable, Tabulation of data, Graphical presentation (categorical and metric data), charting of data using MSEXcel; Sampling techniques; Frequency distribution; Measures of central tendency (mean, median and mode); Measures of dispersion: mean deviation and standard deviation; Correlation and regression.</p> <p>Unit IV: Introduction and classification; Components of computer; generation of computers; Number system; Flow chart; Basics for operating system (MS-DOS, WINDOWS, Unix and Linux); Introduction to softwares; MS-Office (MS-WORD, Power Point, MS- Excel). Introduction to networking and internet</p> <p>Unit V: Introduction to Bioinformatics, Role of Bioinformatics; Biological databases: Nucleic Acid Sequence Database, Protein Sequence Database and Protein Structure Database); obtaining BLAST Documentation and Help; Important bioinformatics websites (NCBI, EBI, SIB).</p> <p>Suggested Readings:</p> <ol style="list-style-type: none"> 1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age International publisher 2. Research Methodology: A step by step guide for beginners by Ranjit Kumar, SAGE Publications Ltd 3. Statistical Methods, by S.P. Gupta, Sultan Chand & Sons Publications
	<p>MIC-CCSU-304 (I)</p>	<p>FOOD CHEMISTRY (CORE ELECTIVE)</p>	<p>Unit I: Food chemistry, history, water structure and relations in food components, carbohydrates: monosaccharides, oligosaccharides and polysaccharides, starch and cellulose derivatives as food constituents, sugar and related products nutritional value, lipids: components, food lipids and health, antioxidants.</p>

			<p>Unit II: proteins structure and functions, enzymes structure and functions, vitamins structure, types and functions, minerals and nutritional aspects, bioavailability of nutrients.</p> <p>Unit III: Food oxidants, food pigments, natural and synthetic food colours, flavoring agents, sweeteners, emulsifiers and stabilizers, spices and herbs, food preservatives, organic foods, advantages and disadvantages of organic food, food fortification.</p> <p>Unit IV: Food adulteration, types of adulteration: intentional adulteration, incidental adulteration, Food laws, food standardization and regulation agencies in India, national standards, international standards.</p> <p>Unit V- Evaluation of food quality, sensory tests, types of tests, objective evaluation and instruments used for texture evaluation.</p> <p>Suggested Readings (Latest Editions): 1.Voet D and Voet JG. Principle's of Biochemistry. John Wiley and sons New York. Moat AG and Foster J. W. Microbial Physiology. 2.John Wiley and Sons, New York. Willey J, Sherwood L. and Woolverton C. Prescott's Microbiology, McGraw Hil 3.U. Satyanarayan. Biochemistry, Elsevier Robinson Dairy Microbiology. 4.Jay JM Modern Food Microbiology. Van Nostraaand Reinhold Co., New York. 5.Andrew Proctor Alternatives to conventional food processing, RSC pub. 6.Frazer WC and Westhoff DC Food Microbiology. McGraw Hill, New York. 7.Srilakshmi B Food Science, New Age Publication.</p>
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	<p>MIC-CCSU-304 (II):</p>	<p>CORE ELECTIVE: FOOD BORNE AND WATER BORNE DISEASE</p>	<p>Unit I: Classification of food borne diseases, Food poisoning, infection, and intoxication, non bacterial toxins and mycotoxins Sea food toxin, Poisoning by chemicals.</p> <p>Unit II Major food and water borne bacteria <i>S.aureus, Pseudomonas, Clostridium, Bacillus, Vibrio, E.coli, Salmonella, Shigella</i>, Major food and water borne Viruses- Polio virus, Rotavirus, SARS, Enterovirus</p> <p>Unit III: Rapid methods for detecting microbial contaminants in foods, Interpretation and application of result and preventive measure</p> <p>Unit IV: Irradiation replaces other food borne disease, microbiological aspect of food, transmission, symptoms, diagnosis, treatment, prevention of disease, Surveillance system for tracking food borne disease.</p> <p>Unit V: Natural waters: Sources of contamination, Microbial indicators of fecal pollution and other pollution, IMViC test and Water quality test.</p> <p>Suggested Readings (Latest Editions): 1.Marth, E.H. and Steele, J.L. Applied Dairy Microbiology, Marcel Dekker, Inc. New York 2.Frazer, W.C. and Westhoff, D.C.Food Microbiology, McGraw Hill, New York. 3.Willey, J., Sherwood, L. and Woolverton, C. Prescott’s Microbiology, McGraw Hill, New York. 4.Murray, P.R., Pfaller, M.A., Tenover, F.C. and Tenover, R.H. Clinical Microbiology. ASM.</p>
	<p>MIC-CCSU-OE II</p>	<p>HEALTH AND HYGIENE (MINOR OPEN ELECTIVE FOR OTHER FACULTY)</p>	<p>Unit I: Individual health parameters, Determinants of Health, Key health indicators, Burden of diseases, Importance and Source of Public-health Data Health status in India: Standards, Relevance to social aspects, Future challenges in public health.</p> <p>Unit II: Role of Public, Private and NGO in Health sector, Expenditure in Healthcare, Government Plans and Policies in India, The Global Health Council, The International AIDS Vaccine Initiative, Malaria Vaccine Initiative, World Health Organization (WHO).</p> <p>Unit III: Public health and nutrition; Personal health, Food safety quality control and hygiene: Personal and domestic Hygiene. Classification of nutritional profiles of various foods and drinks, Balanced Diet, Nutritional Problems, Demography and Family Planning.</p> <p>Unit IV: Epidemiology and history of epidemiological diseases in India with special reference to COVID-19,</p>

			<p>Route of Transmission of Disease, Communicable and Noncommunicable diseases.</p> <p>Unit V: Common Community Diseases like – Chickenguniya, Dengue, Malaria, Cholera, T.B., HIV/AIDS, Hepatitis: Their prevention and control</p> <p>Suggested Readings (Latest Edition):</p> <ol style="list-style-type: none"> 1. Gordon Edlin and Eric Golanty Health & Wellness Jones &BarlettPublisher. 2. Skolnik Richard Global Health 101 Jones &Barlett Learning 3. Mary-Jane Schneider Introduction to Public Health Jones &Barlett 4. Geofferey Campbell-Platt Food Science and Technology, Willey andBlackwell Publication, UK. 5. Lightfoot NF and Maier EA Microbiological analysis of food and water,Elsevier Publication, Netherland.
IV	MIC-CCSU-401	MEDICAL MICROBIOLOGY	<p>Unit I: Historical developments in medical microbiology: Normal flora of human body, role of the resident flora; collection of clinical samples and laboratory diagnosis of important bacterial infections, pathogenic microorganisms. Brief account of air, water and soil borne diseases of microbes and their preventive and control measures.</p> <p>Unit II: Bacteriology: Brief account of important human diseases caused by <i>Staphylococcus</i>; <i>Streptococcus</i>; <i>Neisseria</i>; <i>Bacillus</i>; <i>Corynebacterium</i>; <i>Clostridium</i>; <i>Mycobacterium</i>; <i>Salmonella</i>; <i>Shigella</i> Lab diagnosis,Prevention and their control.</p> <p>Unit III: Virology: Collection of clinical sample and laboratory diagnosis of important viral diseases; Mumps; Measles; Influenza; Adenovirus; Rhinovirus; Poxvirus; Hepatitis virus; Herpesvirus; Lab diagnosis,Prevention and their control.</p> <p>Unit IV: Mycology: Classification of medically relevant fungi: Collection of clinical sample and laboratory diagnosis of important human fungal diseases; Candidiasis; Dermatophytosis; Aspergillosis; Cutaneous and subcutaneous mycoses; Systemic mycoses, Lab diagnosis,Prevention and their control.</p> <p>Unit V: Parasitology: Important diseases caused by intestinal and urogenital protozoa: <i>Entamoeba</i>; <i>Giardia</i>; <i>Trichomonas</i>; Blood and tissue protozoa; <i>Plasmodium</i>; <i>Trypanosoma</i>; <i>Leishmania</i>; Cestodes: <i>Taenia</i>; Trematodes: <i>Schistosoma</i>; <i>Paragonimus</i>; Nematodes: <i>Ascaris</i>; <i>Ancylostoma</i>; Lab diagnosis, Prevention and their control.</p> <p>Suggested Readings (Latest Edition):</p> <ol style="list-style-type: none"> 1.Greenwood D. 2007. Medical Microbiology 4th Ed., I.K. International. 2.Murray P.R., Pfaller M.A., Tenover F.C., & Yolgen R.H.

			<p>2007. Clinical Microbiology, ASM Press.</p> <p>3. Talaro K. P. & Talaro A. 2006. Foundations in Microbiology (6th Ed.), McGraw-Hill College Dimensi. Willey J., Sherwood L. and 4. Woolverton C. 2007. Prescott/Harley/Klein's Microbiology, McGraw Hill. Atlas R. M. 1997. Principles of Microbiology II Ed., McGraw Hill.</p> <p>5. Nester E. W., Anderson D. G. & Nester M. T. 2006. Microbiology: A Human Perspective, McGraw Hill</p>
	MIC-CCSU-402	HUMAN, ANIMAL AND PLANT VIROLOGY	<p>Unit I Origin and development of concept of virology; Collection of clinical samples; Cultivation of Viruses, Diagnostic techniques for viral diseases. Virus identification: Immunofluorescence, Immunoperoxidase test, Neutralization, Light microscopy and Electron microscopy.</p> <p>Unit II Nature of viral zoonoses: Rabies, Haemorrhagic fevers, Yellow fever, Colorado tick fever, Viral Encephalitis (Japanese encephalitis, Venezuelan equine encephalitis, Eastern and Western equine encephalitis, St. Louis encephalitis, Murray valley encephalitis).</p> <p>Unit III Human diseases caused by Orthomyxoviruses (Influenza), Paramyxoviruses (Mumps, Measles, Respiratory Syncytial Virus), Picornaviruses (Enteroviruses, Rhinoviruses), Poxviruses, Herpesviruses, Human Retroviruses, Adenovirus, Hepatitis.</p> <p>Unit IV: Classification, characteristics and diversity of Plant Viruses with special reference to: Cucumber mosaic virus (CMV), Tobacco mosaic virus (TMV), Papaya ring spot mosaic virus (PMV) Tomato yellow leaf curl virus (TYCLV), Bhindi yellow mosaic vein virus (BYMV).</p> <p>Unit V: Prions: Structure, replication and diseases caused by them, Viroids; Emerging and re-emerging viral diseases.</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). Medical Microbiology, Mc Graw Hill Publishers. 5. S. Ram Raddy (2012) Essential of Virology, Scientific Pub. 6. Jane . Flint (2015) Principle of Virology, ASN Press.

	<p>MIC-CCSU-403 (I)</p>	<p>FOOD PROCESSING, PRESERVATION AND PACKAGING CORE ELECTIVE</p>	<p>Unit I: Primary processing: Introduction, Classification & Method of Cleaning, Sorting, Grading, Cutting, Seeding, Chilling and freezing.</p> <p>Unit II: Secondary processing : Introduction, Classification & Method of Slicing, Pulping, Paste, Fryng, Chilling and freezing, Milling.</p> <p>Unit III: Common food processing: Introduction, Classification & Method of Cooking, Baking, Fryng, Roasting, Toasting, Grilling, Blanching, and Extrusion</p> <p>Unit IV: Introduction to preservation, types and methods of preservation, natural and artificial preservative agent, class I, II and III preservative agents.</p> <p>Unit V: Introduction to Food Packaging: Objectives and functions of food packaging, Requirements for effective food packaging, Types of packaging Materials, General properties of packaging material</p> <p>Suggested Readings (Latest Edition): 1.J. Scott Smith and Y.H. Hui., Food processing principles and applications. Blackwell publishing 2.B.S. Khatkar, Food Science and technology, Daya publishing house Delhi 3.Martin R Adams and Maurice O Moss Food Microbiology. The Royal Society of Chemistry. Cambridge UK 4. William C frazier, Dennis C Westhoff. Food microbiology. McGraw Hill Education private Limited New Delhi</p>
	<p>MIC-CCSU-403 (II):</p>	<p>CORE ELECTIVE FOOD SAFETY</p>	<p>Unit I- Introduction to food safety, hazards to safe food (chemical, biological, physical hazards), contamination and spoilage, food hygiene, food itself, safety of food, sources of contamination, food quality, food safety challenges, reducing the effect of contamination; Role of food processing industries and sector.</p> <p>Unit II- History, back ground and structure of HACCP, Food chain steps, benefits and barriers in implementing HACCP, HACCP prerequisites and good hygiene practice, Environmental hygiene, design and facilities in the establishment, equipment, utilities, personal health and hygiene, pest control.</p> <p>Unit III- Determination of critical control points, establishing the critical limits, Establishment of corrective action, establishment of verification procedure, establish documentation and record keeping,</p>

			<p>validation, general errors in HACCP plan, Quantitative approach in HACCP , implement of HACCP Plan, case studies of HACCP.</p> <p>Unit IV- Introduction to risk analysis, risk management, Risk assessment, and Risk communication.</p> <p>Unit V- Other food safety practices- Good Agriculture practices, good animal husbandry practices, good manufacturing practices, good retail practices, good transport practices, nutritional labeling, Traceability studies.</p> <p>Suggested Readings (Latest Editions): 1.Adams MR and Moss MO, Food Microbiology RSC publications, UK. 2.Lightfoot NF and Maier EA (Editor), Microbiological analysis of food and water, Elsevier Publication, Netherland. 3.Ray B and Bhunia A, Fundamental food Microbiology CRCpublication, UK B. Srilakshmi, Food Science New Age International Publisher, New Delhi 4.Martin R Adams and M J Robert Nout, Fermentation and Food Safety, Aspen Publication, Maryland. 5.Gilbert J., Food Packaging: Ensuring the safety and quality of Food, Publisher Taylor and Francis, Basingstake, Hants, UK</p>
	<p>MIC-CCSU-404 (I)</p>	<p>EPIDEMIOLOGY (CORE ELECTIVE)</p>	<p>Unit 1: History of epidemiology, basic vocabulary and processes used in the science of epidemiology, routes of transmission of disease, non communicable and communicable 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, hepatitis, rabies, syphilis, tetanus, tuberculosis, typhoid, 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.</p> <p>Unit 4: Environment and Health: Environmental degradation and human pathology, Examination of living/working environment & its impact on human health; Industrial and Occupational Health: Industrial and Occupational hazards and accidents, Occupational diseases and their prevention. 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</p>

			<p>classification, Nutritional problems e.g. LBW, PEM, Xerophthalmia, IDD, etc. Nutritional factors in selected/ major diseases (Cardiovascular, Diabetes, Obesity, Cancer),</p> <p>Suggested reading (Latest Edition)</p> <ol style="list-style-type: none"> 1. Kenneth. J. Ryan (2010) Sherris's Medical Microbiology, Mc Graw Hill. 2. Willey J, Sherwood L. and Woolverton C (2014). Prescott's Microbiology, 9th ed. McGraw Hill. 3. Greenwood D (2015). Medical Microbiology, 18th Edition, Elsevier. 4. Murray PR, Tenover FC and Tenover FC and Tenover FC and Tenover FC (2007). Clinical Microbiology. ASM Press. 5. Robert S. Burlage (2012). Principles of Public Health Microbiology.
	<p>MIC-CCSU-404 (II)</p>	<p>PHARMACEUTICAL MICROBIOLOGY (CORE ELECTIVE)</p>	<p>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.</p> <p>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).</p> <p>Unit III: Molecular principles of drug targeting, drug delivery system in gene therapy, 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.</p> <p>Unit IV: Microbial contamination and spoilage of pharmaceutical products: sterile injectibles, noninjectibles, and their sterilization; Manufacturing procedures and in process control of pharmaceuticals. Use of microbial enzymes in pharmaceuticals, biosensors.</p> <p>Unit V: Good manufacturing practices (GMP) and good</p>

			<p>laboratory practices(GLP) in pharmaceutical industry, regulatory aspects of quality control, Quality assurance and quality management in pharmaceuticals ISO, WHO, and US certification.</p> <p>Suggested reading (Latest Edition):</p> <ol style="list-style-type: none">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, Sinaeur Associates.5. Casida LE (2010). Industrial Microbiology, New Age International Publication.
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Man
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Abhinav
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Prat.

Rosh