Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBCC101T**	Course Title: Virology	
	Course Credit: **4**	Total contact hours: 60 Hrs	
Sr. No.	**Course Contents (Topics & subtopics)**		**Reqd. hours**
UNIT I	Bacterial Viruses: General properties, properties of phage infected Bacterial cultures, Specificity of Phage Infection; bacteriophage typing; application in bacterial genetics *E. coli* Phage T4: Properties of T4 DNA, Genetic organization, the T4 growth cycle, Replication of T4 DNA *E. coli* Phage T7 and Lambda: Organization of the T7 genes, Growth Cycle, Regulation of transcription of T7 phage. (4L) *E.coli* Phage (phi) X174, Filamentous DNA phages, Single stranded RNAphages, Lysogenic cycle.		**15 Hrs**
UNIT II	Plant viruses: Morphology, Transmission of plant viruses, symptoms of plant diseases caused by viruses, Diagnosis of viral infections in plants TMV, Citrus Tristeza Virus (CTV): Viral structure, Genome, Host range, Transmission, Symptom and Control. (6L) Plant satellite viruses and satellite Nucleic acids, prevention of crop loss due to virus infection- virus free planting material; vector control. Viruses of cyanobacteria, algae,fungi,and insects INPV)		**15 Hrs**
UNIT III	Animal Viruses: Host and viral factors involved in pathogenesis, host cell transformation by animal viruses. Clinical signs and symptoms, Structure, life cycle, Laboratory diagnosis, prevention and treatment of infections caused by Influenza viruses, Rabies virus, Pox virus, Herpes Virus, Human Immunodeficiency Virus, and Hepatitis Virus		**15 Hrs**
UNIT IV	Cultivation of viruses, Purification of viruses, virus detection and quantification by serological methods- hemaglutination methods and ELISA, physical and chemical methods (electron microscopy, Protein, nucleic acid, radio activity tracers), Infectivity assays (plaque methods, end point method), Infectivity assay of plant viruses New re-emerging viruses, Evolution and adaptation, Prions and Viroids, CJD, BSE, Viruses and Cancer		**15 Hrs**

	Suggested readings	
	1) General Virology – Luria 2) Introduction to Plant Virology – Bos L, I. Longman, London, NY. 3) Animal Virology – Fenner and White. Academic Press. NY 4) Chemistry of Viruses – Knight C. Springer Verlag. NY 5) Virology – Dulbecco and Ginsberg. Harper and Ravi Pub. NY. 6) Bacterial and Bacteriophage Genetics – Edward Birge 7) Microbial and Plant Protoplasts – Peberdy JF 8) Principles of Virology – Flint, Enquist, Racaniello & Skalka, Vol I and II. ASM, 9) Understanding Viruses – Teri Shors. Jones and Bartlett pub.	

MSMBCC101T; MS (Masters) **MB** (Microbiology) **CC101** (Core Course 1 of Semester 1) **T** (Theory)

	Course Code: **LAB 1**	Course Title: Virology Practical	
	Course Credit: **2**	Total contact hours: 60 Hrs (2 batches)	
Sr. No.	**Course Contents (Topics & subtopics)**	
1	Isolation ,Purification and characterization of bacteriophages from sewage	
2	Phage Typing of *E. coli* and *Salmonella* strains	
3	Study of One Step Growth Curve of Lambda phage / T4 Phage	
4	Study of Lysogeny in *E. coli*	
5	Studies on Specialized transduction	
6	Induction of lambda lysogen by UV radiation	
7	Isolation of Lambda DNA	
8	Demonstration: Egg inoculation and cultivating animal virus in embryonated egg	

Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBCC102T**	Course Title: Microbial Genetics	
	Course Credit: **4**	Total contact hours: 60 Hrs	
Sr. No.	**Course Contents (Topics & subtopics)**		**Reqd. hours**
UNIT I	**Gene Expression and regulation** Transcription (in prokaryotes & eukaryotes), RNA molecules and processing, translation, regulation of gene expression (control of gene expression in prokaryotes and eukaryotes)		**15 Hrs**
UNIT II	**Replication, recombination, mutation and repair** Regulation of replication, recombination, mutation, DNA repair mechanism		**15 Hrs**
UNIT III	**Cytoplasmic inheritance & chromosomal rearrangements** Cytoplasmic inheritance (mt-DNA, cp-DNA), Chromosomal Rearrangements and effects on gene expression		**15 Hrs**
UNIT IV	**Molecular tools for genetics and Population Genetics** Molecular tools for genetics, population genetics		**15 Hrs**
	Suggested readings		
	1. Watson, Baker, Bell, Gann, Levine, Losick, "**Molecular Biology of the Gene**", Fifth Edition, Pearson Education (LPE) 2. Trun, Trempy, "**Fundamental Bacterial Genetics**", Blackwell Publishing 3. Russell, P.J., "**iGenetics- A Molecular Approach**", Third Edition, Pearson International Edition 4. Snustad & Simmons, "**Principles of Genetics**", Third Edition, John Wiley & Sons Inc 5. Watson, Gilman, Witkowski, Zoller, "**Recombinant DNA**", Second Edition, Scientific American Books 6. Klug & Cummings, "**Concepts of Genetics**", Seventh Edition, Pearson Education (LPE) 7. Pierce, B.A., "**Genetics- A Conceptual Approach**", Second Edition, W. H. Freeman & Co 8. Lewin, B., "**Genes-IX**", Jones and Bartlett Publishers		
	Course outcomes (Students will be able to……)		

MSMBCC102T; MS (Masters) **MB** (Microbiology) **CC101** (Core Course 2 of Semester 1) **T** (Theory)

	Course Code: **LAB 2**	Course Title: Microbial Genetics	
	Course Credit: **2**	Total contact hours: 60 Hrs (2 batches)	
Sr. No.		**Course Contents (Topics & subtopics)**	
1		β galactosidase assay	

2		Isolation of mutants by Replica plate technique
		  - UV mutagenesis
		  - Acridine orange mutagenesis	

3		Plasmid and genomic DNA extraction	
4		Nucleotide sequence analysis by using BLAST and construction of a phylogenetic tree based on the comparison results of 16S rRNA sequences	
5		Design of primer & PCR	
6		Agarose and polyacrylamide gel electrophoresis	
7		Restriction mapping	
8		Southern hybridization technique	
9		Northern Blotting technique	
10		Problems on population genetics	

Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBCC103T**	Course Title: Microbial Biochemistry	
	Course Credit: **4**	Total contact hours: 60 Hrs	
Sr. No.	**Course Contents (Topics & subtopics)**		**Reqd. hours**
UNIT I	Composition of living matter, biochemistry of bacterial, animal and plant cell, specialised components of microorganisms and their structure and function		**15 Hrs**
UNIT II	Enzymes as biocatalysts, enzyme classification, specificity , active site, activity unit, isozymes, Enzyme kinetics: Michelis-Menten equation for simple enzymes, determination of kinetic parameters, multistep reactions and rate limiting steps, enzyme inhibition, allosterism, kinetic analysis of allosteric enzymes, principles of allosteric regulation		**15 Hrs**
UNIT III	Structural features and chemistry of macromolecules: Nucleic acids, proteins, carbohydrates and lipids and bio-molecules such as antibiotics, pigments and other secondary metabolites. Metabolism of macro-molecules: catabolic principles and breakdown of car-bohydrates, lipids, proteins and nucleic acids, biosynthesis of macro-molecules, hormone regulation of metabolism, vitamins and their role as coenzymes.		**15 Hrs**
UNIT IV	Bioenergetics and strategy of metabolism: Flow of energy through biosphere, strategy of energy production in the cell, oxidation-reduction reactions, coupled reactions and group transfer, ATP production, structural features of bio-membranes, transport, free energy and spontaneity of reaction, G, G0,G' and equilibrium, basic concepts of acids, base, pH and buffers		**15 Hrs**
	Suggested readings		
	1. Lehninger Principles of Biochemistry: Albert Lehninger, David Nelson, and Michael Cox, Publisher : W H Freeman & Co; 7th edition (2017) 2. Biochemistry: Jeremy M. Berg , Lubert Stryer, John Tymoczko and Gre- gory Gatto, Publisher: WH Freeman; 9th edition (2019) 3. Outlines of Biochemistry: Eric Conn, Paul Stumpf, George Bruening and Roy Doi. Publisher: Wiley; 5th edition (2006) 4. Fundamentals of Biochemistry: Life at the Molecular Level: Donald Voet, Judith Voet,and Charlotte Pratt. Publisher: Wiley, 5th edition (2016)		
	Course outcomes (Students will be able to……)		

MSMBCC103T; MS (Masters) **MB** (Microbiology) **CC103** (Core Course 3 of Semester 1) **T** (Theory)

	Course Code: **LAB 3**	Course Title: Microbial Biochemistry Practical	
	Course Credit: **2**	Total contact hours: 60 Hrs (2 batches)	
Sr. No.	**Course Contents (Topics & subtopics)**		
	Enzyme Electrophoresis (Native, SDS Page, Urea PAGE) and zymography		
	TLC of Carbohydrates and Amino acids		
	Qualitative tests for carbohydrates and analysis of unknowns		
	Qualitative tests for amino acids and analysis of unknown		
	Tests for lipids (qualitative)		
	Quantitative estimation of glucose and fructose		
	Determination of saponification value of fats		
	Partial purification of enzymes		
	Effect of substrate concentration, pH, time and temperature on enzyme activity		
	Calculation of Km for partially purified enzyme		
	Study for inhibition of enzyme activity		

Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBIE101T**	Course Title: Medical Microbiology and Immunology	
	Course Credit: **4**	Total contact hours: 60 Hrs	
Sr. No.	**Course Contents (Topics & subtopics)**		**Reqd. hours**
UNIT I	**Advances in Medical Microbiology**		**15 Hrs**
	Detailed Study of following infections including Aetiology, Transmission, Pathogenesis, Clinical Manifestations, Lab diagnosis, Prophylaxis, and Treatment: AIDS , MOTT (mycobacteria other than TB), Legionellosis, Chikungunya, Cholera caused by *V. cholerae* 0139, Conditions caused by *Helicobacter pylori*, SARS.		
UNIT II	**Epidemiology of infectious diseases**		**15 Hrs**
	Historical aspects-definition, Descriptive Epidemiology-aims and uses, Host parasite interactions in the cause of diseases, Epidemiological principals in prevention and control of Diseases, Measures of risks: frequency measures, morbidity, frequency measures, mortality frequency measures, natality(birth) measures, measures of association, measures of public health impact. Public health surveillance: purpose and characteristics, identifying health problems for surveillance, collecting data for surveillance, analyzing and interpreting data, disseminating data and interpretation, evaluating and improving surveillance.		
UNIT III	**Immune Response & Molecular basis of diversity generation**		**15 Hrs**
	Effector mechanisms of innate and adaptive immune response		
	Molecular basis of diversity of immunoglobulin molecules		
	Molecular basis of organization and rearrangement of TCR		
	Molecular Organization of Major Histocompatibility Complex		
UNIT IV	**Immunobiology in health and disease**		**15 Hrs**
	Infectious diseases & the immune system		
	Immunodeficiency diseases		
	Cancer and the Immune system		
	Suggested readings 1. Clinics in laboratory medicine, Emerging Infections and their causative agents. September 2004 vol. 24 no. 3. 2. Textbook of Microbiology 8th edition 2009-Ananthnarayan & Paniker-University press 3. Principles of epidemiology in public health practices 3rd edition (An introduction to Applied Epidemiology and Biostatistics, Oct 2006, Updated May 2012). CDC 4. Basic lab methods in medical bacteriology, WHO Geneva 5. Handbook of Epidemiology- W. Ahrens, I. Pigeot Springer-Verlag Berlin Herdelberg (2005).		

	6. Epidemiology for Public Health Practice- Robert H Friis & Thomas A. Sellers 3rd edition-Jones & Bartlett publishers 7. Textbook of preventive and Community medicine- Park & Park 8. Infectious disease surveillance by Nikuchia Nikanatha Blackwell Publishing 2005. 9. Basic Epidemiology. Bonita, Beaglehole and Kjellstrom (WHO), 2nd Edition (2006). 10. Immunology – Kuby 6th Edition; W.H. Freeman & Co., New York. 11. Immunology- Kuby, 8th Edition; McMillan Education 12. Immunology – Essential and Fundamental; Sulabha Pathak and Urmi Palan; 3rd Edition; Capital Publishing Company 13. The Elements of immunology- Fahim Halim Khan- Pearson Education 14. Immunology an introduction- 4th Edition- Ian R. Tizard- Thomson 15. Immunobiology –the immune system in health and disease 6th ed.-Janeway Travers. GS 16. Roitt's Essential Immunology - 13th Edition; Wiley Blackwell	

MSMBIE101T; M (Masters) **MB** (Microbiology) **IE101** (Inter-disciplinary Elective Course 1 of Semester 1) **T** (Theory)

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	Course Code: **LAB 4**	Course Title: Medical Microbiology and Immunology Practical	
	Course Credit: **2**	Total contact hours: 60 Hrs (2 batches)	
Sr. No.		**Course Contents (Topics & subtopics)**	
1		Diagnostic immunologic principles and methods	
		A. Precipitation method: Immunodiffusion	
		B. Agglutination method: Widal test	
2		Separation of human serum proteins by submerged agarose gel electrophoresis	
3		Immunoelectrophoresis of human serum	
4		Collection of human blood & separation of mononuclear cells by Ficoll hypaque density gradient centrifugation, Counting of viable cells by Trypan blue.	
5		Total and Differential blood count	
6		Study of phagocytosis using bacterial culture or yeast cells	
7		Passive hemaglutination	
8		Demonstration Experiments: ELISA, Western blotting	
9		Isolation of *Vibrio cholera* on TCBS, Identification: cholera red test, String test, Oxidase test, Biochemical tests	
10		Mono - Spot Test for diagnosis of Chikungunya	
11		*Helicobacter pylori* detection (kit based)	
12		Acid fast staining for MOTT	

Suggested Reading

1. Medical laboratory technology: by Godkar.
2. Clinical immunology: Principle & Practice 3rd ed. 2008 (Part -11 – clinical diagnostic immunology)
3. Practical Immunology: Frank Hay and Olwyn Westwood, 4th Edition Blackwell Science.
4. A textbook of practical and Clinical Immuology: Talwar and Gupta, Vol 1; 2nd edition
5. Bailey & Scott's – diagnostic microbiology 11th edition – Betty Forbes.
6. Manual of Molecular and Clinical Lab Immunology (Manual of Molecular and Clinical Laboratory Immunology by Barbara Detrick, Robert Hamilton; John Schmitz; 8th Edition

Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBAE101T**	Course Title: Software Tools for Research	
	Course Credit: **2**	Total contact hours: 30 Hrs	
Sr. No.	\multicolumn{2}{c}{**Course Contents (Topics & subtopics)**}	**Reqd. hours**
UNIT I	\multicolumn{2}{l}{Introduction to LaTeX • Why LaTeX?,Installation of LaTeX, Introduc- tion to Tex Studio, TexWorks and ShareLa-TeX, help and CTAN • Basic LaTeXDocument- Coding and Compilation, Basic LaTeXCommand and syntax • Page Layout - Titles, Abstract, Chapters, Sections, References, Equation references, citation. List making environments Table of contents, generating new commands, Tablehandling, Figure handling, numbering, List of figures, List of tables, generating index, handling citations generating bibliography • Packages: Geometry, Hyper ref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing • Classes: article, book, report, beamer, slides, custom classes • Applications to: Writing Resume, writing letter, writing question paper, writing articles/ research papers, Presentation using beamer, Writing Report, Writing book • Theory, Practical and exercises based on the above concepts}	**15 Hrs**
UNIT II	\multicolumn{2}{l}{Introduction to "R" • Why "R"?, Installation of "R", Introduction to RStudio, installation of packages, Helpand CRAN, script window, console, global environment and viewer • First R code, data types, data structures and mathematical operators,use of R as a calculator and functions • Base R graphics and Base GGplot2 Graphics • Handling data: indexing, ordering, sorting, substituting data, Handling Missing data, introduction to dplyr functions select, filter, ar-range and mutate • Statistical distributions and statistical tests using R, Statistical modeling in R: Linear Regression, nonlinear regression and neuralnetwork using R • GGPlot 2 Graphics for publication ready graphs- customization of Axis, labels, leg-ends, annotation, comparison, highlighting • R Extensions: R Markdown, R blogdown, R Bookdown}	**15 Hrs**
	Instructions: • Each session will be instructional and practical. For practicing the conceptsbeing taught Each student must bring Laptop computer for class • Student must be ready to do extensive practice to handle t tolls better	

Syllabus for Department of Microbiology (M.Sc. Sem I)

	Course Code: **MSMBGE101T**	Course Title: IPR	
	Course Credit: **2**	Total contact hours: 60 Hrs	
Sr. No.	\multicolumn{2}{c}{**Course Contents (Topics & subtopics)**}	**Reqd. hours**
UNIT I	\multicolumn{2}{l}{**Unit 1: Introduction to IPR** - Characteristics, types of Intellectual properties and need for IP protection - Tools of IPR and types: Patents,Trademark,Copyright,Tradeecret,Geographical Indications,Industrial Designs,Protection of plant Varieties and Plant breeder's right. - The role of International Institutions: WIPO and TRIPS - Convention on Biodiversity (CBD) - Patent: Prerequisite for patenting,benefits of patents,Types : Process patent and product patent ,Indian and International scenario of patents - Patent Infringement: meaning, scope, litigation, related case study. }	**15 Hrs**
UNIT II	\multicolumn{2}{l}{**Unit 2: Patenting Biological Material and Processes** - Patenting Microorganisms and microbial processes: Microorganisms Patent law, Criteria for Microorganism associated Patents, Defining Microorganisms, Patentability of Microorganisms, Budapest Treaty: Deposition of M.O.s, procedure for microorganism identification, and submission, International Depository Authorities (IDAs)Critical issues on Microbial Patents, Microbial Patents in Indian Scenario, Critics against microorganism patent, - Patentability of Stem cells, patentability of genes, - GLP and GMP. }	**15 Hrs**