

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Microbiology Phone : 0265-2794396		ACADEMIC YEAR 2020-2021	
M.Sc. Microbiology: Regular					
YEAR	I	CORE		CREDIT	3
SEMESTER	I	MBY2101C01-General Microbiology, Systematics and Diversity		HOURS	45
OBJECTIVES		To familiarize students with history, bacterial cell structure, microbial cultivation, nutrition, growth, control bacterial systematics and diversity.To introduce the students to Cynaobacteria, Actinomycetes, Fungi, Nitrogen fixing bacteria and Extremophiles.			
COURSE CONTENT / SYLLABUS					
UNIT-I	General Microbiology				15 hrs.
	History and scope of Microbiology. Bacterial Nutrition-Major and minor bioelements, nutritional diversity, oxygenic & anoxygenic, photosynthesis, respiration, fermentations, chemolithotrophy, syntrophy. Ultrastructure of bacteria-Endospore, Cell wall, Flagella, Cell membrane, Pili,Capsule Bacterial growth-Kinetics & measurements, methods of estimation, growth curve, factors affecting growth, batch, continuous and fed batch growth, synchronous growth.				
UNIT-II	Microbial systematics, evolution and biodiversity				15 hrs.
	Classification of bacteria - GC content analysis and nucleic acid hybridization, 16S rRNA sequence based phylogeny, Archaeobacteria. Origin of life: universal ancestor, Origin of eukaryotic cells.				
UNIT-III	General characters of microbial groups				15 hrs.
	Microbiological techniques : Isolation, Cultivation, Preservation of microorganisms, VBNC state and unculturable bacteria. Control of microorganisms-Sterilization methods, disinfection, sterility testing of substances, Safety and containment measures in handling microorganisms. General characteristics of Cyanobacteria, Actinomycetes. Fungi and yeasts - Classification, life cycle and cell structure. Physiology and Biochemistry of Nitrogen fixing bacteria, Thermophiles, Psychrophiles, Halophiles.				
REFERENCES					
1. Microbiology - M. J. Pelczar Jr., E.C.S. Chan & N. R. Krieg, 5 th ed.1998,Tata McGraw-Hill.					
2. Brock Biology of Microorganisms - M.T. Madigan, K. S. Bender & D. H. Buckley,W. Sattley & D. Stahl 15 th ed. (Global ed.)2018,Pearson.					
3. Prescott, Harley, and Klein's Microbiology – J. M. Willey, L. M. Sherwood & C. J. Woolverton. 7 th ed.2008, McGraw-Hill.					
4. Principles of Microbiology - R. M. Atlas, 2 nd ed. 1997, Wm.C.Brown.					
5. General Microbiology- R. Y. Stanier, J.L. Ingraham,M.L.Wheelis & P.R. Painter 5 th ed. 1987,Macmillan Press Ltd.					

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M.Sc. Microbiology: Regular						
YEAR	I	CORE			CREDIT	3
SEMESTER	I	MBY2102C02-Immunology			HOURS	45
OBJECTIVES		To familiarize the students about structural features of components of immune system as well as their function. The major emphasis of this course will be on development of immune system and mechanisms by which our body elicits immune response.				
COURSE CONTENT / SYLLABUS						
UNIT-I	Immunology: fundamental concepts and overview of the immune system					15 hrs.
	Overview, Cells and organs of immune system, primary and secondary lymphoid organs, mucosal immunity. Components of innate and acquired immunity; phagocytosis; complement and inflammatory responses . Innate immune response -pathogen recognition receptors (PRR) and pathogen associated molecular pattern (PAMP). Antigens: immunogens, non-peptide bacterial antigens and super-antigens, hapten-carrier system. Major Histocompatibility Complex: MHC genes, antigen processing and presentation, immune responsiveness and disease susceptibility. Basis of self & non-self discrimination, Immune Tolerance.					
UNIT-II	Humoral responses					15 hrs.
	Immunoglobulins : basic structure, classes & subclasses of immunoglobulins, Immunoglobulin effector functions, antigenic determinants; multigene organization of immunoglobulin genes; generation of antibody diversity. B-cell receptor, B cell maturation, activation and differentiation; memory.					
UNIT-III	T cell responses					15 hrs.
	T-cell receptor, T-cell development and maturation, activation and differentiation; functional T Cell subsets; cell-mediated immune responses. Cytokines and chemokines. Hypersensitivity. Types, properties and therapeutic uses.					
REFERENCES						
1.Kuby Immunology- J.A. Owen, J. Punt & S.A. Stranford,& P. Jones 7 th ed. 2013 , W. H. Freeman and Company.						
2.Roitt's Essential Immunology- I. M. Roitt & P. J. Delves 10 th ed.2001 , Blackwell Science.						
3.Clinical Immunology- J. Brostoff, J.K. Seaddin. D. Male & I.M. Roitt 6 th ed., 2002 ,Gower Medical .						
4.Fundamental Immunology- W. E Paul, 2012, Raven Press.						
5.The Immune System- P. Parham, 2005, Garland Science.						
6.Cellular and Molecular Immunology- A.K. Abbas, A. H. Lichtman & S. Pillai,2017, Elsevier						
7.Janeway's Immunobiology - K. Murphy, P. Travers, M. Walport, & C. Janeway, 2012, Garland Science.						

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M.Sc. Microbiology : Regular						
YEAR	I	CORE MBY2103C03-Biochemistry-I			CREDIT	3
SEMESTER	I				HOURS	45
OBJECTIVES		To familiarize students with basic biochemical pathways, protein structure; carbohydrate, lipid and vitamins chemistry and introduction to enzymology.				
COURSE CONTENT / SYLLABUS						
UNIT-I	Protein structure				15 hrs.	
	Amino acids-building blocks of proteins, structure and functional group properties, peptide bond, Dihedral angles, Ramchandran plot, primary, secondary, tertiary and quarternary structure, determination of sequence, N-terminal & C-terminal analysis. Properties of water, concepts of pH and buffer, chemical bonds.					
UNIT-II	Principles of Bioenergetics and Carbohydrate				15 hrs.	
	Anabolism, catabolism, Concept of free energy, Laws of thermodynamics, Biological oxidation-reduction, high energy compounds. Structure, properties and classification, stereochemistry, function of carbohydrates, storage polysaccharides etc.					
UNIT-III	Vitamins, Lipid Chemistry and Introduction to enzymes				15 hrs.	
	Vitamins-Fat soluble, water soluble and coenzyme form of vitamins, biosynthesis, biological role, chemistry, reaction etc. Urea cycle. Lipid Chemistry- Structure and properties of important members of lipids , biosynthesis and catabolism of lipids. Introduction to enzymes: classification, Quantification of enzyme activity and efficiency, purification.					
REFERENCES						
1. Lehninger ,Principles of Biochemistry- D.L. Nelson & M.M. Cox 7 th ed. 2017, W. H. Freeman and Co.						
2. Biochemistry - J. M. Berg, J.Tymoczko & L. Stryer, 7 th ed. 2010 ,W.H.Freeman and Co.						
3. Biochemistry- G.L. Zubay 4 th ed. 1998 ,McGraw-Hill.						
4. Fundamentals of Enzymology- N. C. Price & L. Stevens, 3 rd ed. 1999 ,Oxford University Press.						
5. Biochemistry- D. Voet & J. G. Voet, 4 th ed. 2011, John Wiley & Sons.						
6. ENZYMES:Biochemistry, Biotechnology, Clinical Chemistry- T. Palmer & P. L Bonner,2nd ed.2007,Woodhead Publishing Ltd.						

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M.Sc. Microbiology : Regular					
YEAR	I	CORE		CREDIT	3
SEMESTER	I	MBY2104C04-Genetic Engineering		HOURS	45
OBJECTIVES		The objectives of this course are to teach students various approaches to conducting genetic engineering and their applications in biological research as well as in biotechnology industries .			
COURSE CONTENT / SYLLABUS					
UNIT-I	Introduction and tools of genetic engineering				15 hrs.
	Enzymes used in recombinant DNA technology: Restriction enzymes, ligases, polymerases etc. DNA labelling & hybridisation techniques. Nick translation; Northern and Southern blotting, probe preparation etc.; Sanger DNA sequencing; types of PCR; Construction and screening of libraries.				
UNIT-II	Type of Vectors				15 hrs.
	Plasmids- classification, incompatibility groups, copy number & control, vectors; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Principles for maximizing gene expression expression vectors;; Protein purification; His-tag; GST-tag etc.; Intein-based vectors; Inclusion bodies; methodologies to reduce formation of inclusion bodies; mammalian expression and replicating vectors; Adenovirus, Baculovirus and <i>Pichia</i> vector system, plant based vectors, Ti and Ri as vectors, yeast vectors, shuttle vectors.				
UNIT-III	Gene manipulation and protein-DNA interaction				15 hrs.
	Insertion of foreign DNA into host cells; transformation, electroporation, transfection; study of protein-DNA interactions: electrophoretic mobility shift assay; DNase footprinting; methyl interference assay, chromatin immunoprecipitation; protein-protein interactions using yeast two-hybrid system; phage display.				
REFERENCES					
1. Principles of Gene Manipulation: an Introduction to Genetic Engineering - S. B. Primrose, R. M. Twyman & R. W. Old, 6 th ed. 2004, Blackwell Science.					
2. Molecular Cloning: A Laboratory Manual- M. R. Green & J. Sambrook 4 th ed. 2012 , Cold Spring Harbor Laboratory Press.					
3. Gene cloning An introduction -T.A. Brown, 3 rd ed. 1995, Chapman Hall.					
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA B. R. Glick J. J. Pasternak & C. L. Patten 4 th ed. 2010, ASM Press.					
5. Genetic Engineering - S.Rastogi & Pathak N. 2009, Oxford University Press.					

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M.Sc. Microbiology : Regular					
YEAR	I	CORE MBY2105C05-Environmental Microbiology		CREDIT	3
SEMESTER	I			HOURS	45
OBJECTIVES		To introduce the students to environmental microbiology ,pollutants and their remediation and process chemical of biological origins			
COURSE CONTENT / SYLLABUS					
UNIT-I	Air, Water and Wastewater Microbiology				15 hrs.
	Microbiology of air and monitoring air pollution. Aquatic Microbiology : Habitats and microbial communities, biofilms Microbiology of water: Microbiological examination of water, indicator microorganisms, disinfection, purification processes. Waste-water treatment : Characterization of waste-water, self purification, conventional sewage treatment process, Microbiology of treatment plants, low cost plants and advances in treatment plants.				
UNIT-II	Pollutants and microbial interactions; Bioremediation Technology				15 hrs.
	Origin and dispersal of pollutants, types of pollutants-pesticides, hydrocarbons, surfactants, synthetic polymers, metals, monitoring pollutants. Biodegradation of representative pollutants and xenobiotic compounds. Bioleaching of metals. Bioremediation of soils and ground water, bioventing of petroleum hydrocarbons, bioremediation of oil spills. Phytoremediation techniques. Environmental impact assessment.				
UNIT-III	Process chemicals of biological origin				15 hrs.
	Description of the industrial processes involved, microorganisms and biotechnological interventions for optimization of production of bioplastics, biosurfactants, bioemulsifiers, biopesticides. Microbiologically enhanced oil recovery (MEOR); Biofuels, Microbial fuel cell. Metagenomics- Introduction, approaches to metagenomic analysis and applications.				
REFERENCES					
1. Environmental Microbiology -R. M. Maier, I. L. Pepper & C. P. Gerba 2000 ,Academic press.					
2. Microbial Ecology –Fundamentals and applications. R. M Atlas, R.Bartha & D. Atlas . 4 th ed. 1998 , Benjamin Cummings.					
3. Biodegradation and Bioremediation-A.Martin 1994 ,Academic Press.					
4. Biotechnology,A Multi-volume Comprehensive Treatise- H. J. Rehm & G. Reed, 2001, Vol. 11, 2nd Ed., VCH Publishers Inc.					
5. Environmental Biotechnology: Theory and Applications- G. M. Evans and J. C. Furlong,2003, Wiley Publishers					
6. Environmental Biotechnology: Principle & Applications-B. Ritmann and P. L. McCarty, 2nd Ed. 2000, McGraw Hill Science.					
7. Environmental Biotechnology- A. Scragg 2005, Pearson Education Limited.					
8. Environmental Engineering-H. S. Peavy, D. R. Rowe and G. Tchobanoglous, 2013, McGraw-Hill Inc.					