

		The Maharaja Sayajirao University of Baroda Faculty of Science Department of Microbiology Phone : 0265-2794396		ACADEMIC YEAR 2020-2021	
M.Sc. Microbiology : Regular					
YEAR	II	CORE MBY2401C01-Cell Biology and Enzymology-II		CREDIT	3
SEMESTER	IV			HOURS	45
OBJECTIVES		To familiarize the students with membrane biology, cell biology; Mechanism of enzyme action and Allostery.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Membrane biology			10 hrs.	
	Structure, function, membrane protein transport in eukaryotes Signal transduction in eukaryotes : MAP kinase pathway, G-proteins, protein kinases, Phosphoinositides.				
UNIT-II	Cell biology			15 hrs.	
	Cell junction and cell adhesion, extracellular matrix composition, diversity. cell-ECM and cell-cell interactions; cell receptors and trans-membrane signaling; cell motility and migration; cell death: different modes of cell death and their regulation.				
UNIT-III	Mechanisms of enzyme action and Allostery			20 hrs	
	Transition state theory, active site mapping. Case studies of chymotrypsin, lysozyme. Allostery. Hill, Adair, MWC, KNF models. Case studies of aspartate transcarbamylase, hemoglobin.				
REFERENCES					
1.Molecular Cell Biology-H. Lodish, A. Berk, C. A. Kaiser, M. Krieger,M.P. Scott, A. Bretscher, H. Ploegh, & P. Matsudaira 6 th ed. 2008 W.H.Freeman and Co.					
2.Molecular Biology of the Cell- B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts & P. Walter 5 th ed.2008, Garland Science.					
3.The Cell: a Molecular Approach- G. M., Cooper & R. E Hausman 6 th ed. 2013, ASM Press.					
4.Becker's World of the Cell -J. Hardin. G. Bertoni, L. J. Kleinsmith, & W. M Becker 8 th ed. 2012, Benjamin Cummings.					
5.Kuby Immunology- J.A. Owen, J. Punt & S.A. Stranford,& P. Jones 7 th ed. 2013, W. H. Freeman and Company.					
6.Fundamentals of Enzymology- N. C. Price & L. Stevens, 3rd ed. 2006, Oxford University press.					

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M.Sc. Microbiology : Regular					
YEAR	II	CORE		CREDIT	3
SEMESTER	IV	MBY2402C02-Microbial Physiology, Molecular Pathogenesis, IPR and Nanobiotechnology		HOURS	45
OBJECTIVES		To familiarize the students with physiology, molecular pathogenesis, cancer, signal transduction, bioethics ,IPR and Nanobiotechnology.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Physiology of autotrophs				15 hrs.
	Physiology of autotrophs & anaerobic respiration : autotrophic CO ₂ fixation, hydrogen bacteria, nitrifying bacteria, sulphur bacteria, iron bacteria, methanogen.				
UNIT-II	Molecular pathogenesis, Cancer and Signal transduction in prokaryotes				15 hrs.
	Horizontal gene transfer; pathogenicity islands, type three secretory system, regulation of virulence genes, evolution of pathogen. Molecular pathogenesis of <i>Shigella</i> . Advances in malarial research. Two component systems, chemotaxis, receptor structure & function. Quorum sensing (bioluminescence). Cancer: characterization, retroviruses, oncogenes, angiogenesis, therapy Pipeline of discovery and development of new anticancer drugs.				
UNIT-III	Bioethics, IPR and Nanobiotechnology				15 hrs.
	Bioethics: Introduction, ethical conflicts in biological sciences. Bioethics in research IPR: introduction,Types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs; Nanobiotechnology Introduction; Concepts,; Different formats of nanomaterials and applications; Synthesis and characterization of different nanomaterials. Thin films; Colloidal nanostructures; Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for diagnostics and imaging; and cancer therapy, Nanodevices Nanobiotechnology for biosensor development.				
REFERENCES					
1.Mechanisms of Microbial Disease-M. Schaechter, N. C. Engleberg, B.I.Eisenstein & G. Medoff 3 rd ed.2012,Williams and Wilkins.					
2.Molecular Cell Biology-H. Lodish, A. Berk, C. A. Kaiser, M. Krieger,M.P. Scott, A. Bretscher, H. Ploegh, & P. Matsudaira 6 th ed. 2008, W.H.Freeman and Co.					
3.Becker's World of the Cell -J. Hardin. G. Bertoni, L. J. Kleinsmith, & W. M Becker 8 th ed. 2012 , Benjamin Cummings.					
4.Trading in Genes- R. M. Ortiz & V. Sanchez 1 st ed. 2005, Earthscan.					
5.Emerging Consequences of Biotechnology- K. Dronamraju, 1 st ed. 2008,World Scientific.					
6.Multilayer Thin Films: Sequential Assembly of Nanocomposite Materials G. Decher & J. B. Schlenoff 2003, Wiley-VCH Verlag GmbH & Co.					
7.Bionanotechnology: Lessons from Nature- D. S. Goodsell, 2004, Wiley-Liss.					
8.Biomedical Nanotechnology- N. H. Malsch 2005 , CRC Press.					
9.Bioconjugate Techniques- G. T. Hermanson 3 rd ed. 2013, Elsevier.					

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M.Sc. Microbiology : Regular					
YEAR	II	CORE MBY2403C03-Microbial Differentiation and Adaptation		CREDIT	3
SEMESTER	IV			HOURS	45
OBJECTIVES		To familiarize the students with genetics of nodulation, cell division, bacterial sporulation; microbial stress adaptation, prokaryotic transport and antibiotic biosynthesis.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Yeast mating type, genetics of bacterial nodulation, cell division and bacterial sporulation				15 hrs.
	Yeast mating types switching mechanism and regulation. Genetics of nod and nif, regulation in nitrogen fixation. Genetics of bacterial cell division, Regulation of DNA segregation and septum formation. Genetics of sporulation in <i>Bacillus</i> , Alternative sigma factors in sporulation and their regulation.				
UNIT-II	Microbial adaptation to stress				15 hrs.
	Temperature, salt and oxidative stress regulon, Heat shock response & regulation, thermometers of cell, Oxidative stress regulon, Salt stress response and stringent response.				
UNIT-III	Transport in prokaryotes and antibiotics biosynthesis				15 hrs.
	Types, methods of study, transport of sugars, amino acids, organic acids, iron. Structure and organization of various transporters in bacteria, Secretion systems in bacteria . Antibiotics Biosynthesis, mode of action, regulation, genetics, hybrid antibiotics, Antibiotic resistance mechanisms. Protein engineering ,stability and Protein folding.				
REFERENCES					
1. Microbial Physiology- A.G Moat, J.W. Foster & M. P. Spector; 4 th ed. 2002 Wiley-Liss.					
2. Molecular Genetics of Bacteria- L. Snyder & W. Champness, 2 nd edition; 2003 ASM press.					

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M.Sc. Microbiology : Regular					
YEAR	II	ELECTIVE MBY2401E01-Microbial Technology		CREDIT	2
SEMESTER	IV			HOURS	30
OBJECTIVES		To familiarize students with applications of microbial technology			
COURSE CONTENT / SYLLABUS					
UNIT-I	Biofertilizers				8 hrs
	Biofertilizers: Symbiotic systems between plants – microorganisms (nitrogen fixing symbiosis, mycorrhiza fungi symbiosis), Plant growth promoting rhizobacteria (PGPR) – uses, practical aspects and problems in application.				
UNIT-II	Biopesticides				8 hrs
	Bioinsecticides: <i>Bacillus thuringiensis</i> , Baculoviruses, uses, genetic modifications and aspects of safety in their use; Biofungicides: Description of mode of actions and mechanisms (e.g. <i>Trichoderma</i> , <i>Pseudomonas fluorescens</i>)				
UNIT-III	Biocontrol of phytopathogens				7 hrs
	Definition of biocontrol agents, Types of interactions contributing to biological control, Mechanisms of biological control, Hyperparasites and predation, Antibiotic-mediated suppression, Lytic enzymes and other microbial byproducts, Competition, Quorum quenching, Applications				
UNITIV	Food technology				7hrs
	Dairy and non dairy products. Special products –aroma compounds, sweeteners, bioactive compounds, polysaccharides Nutraceutical compounds, functional foods, Enzymes used in food industry, Special processing and packaging; Food safety aspects, Application of microbes in food technology development, Probiotics, Newer products and processes and Regulatory aspects				
REFERENCES					
1.New and Future Developments in Microbial Biotechnology and Bioengineering:Trends of Microbial Biotechnology for Sustainable Agriculture and Biomedicine Systems: Diversity and Functional Perspectives – Chapter 15 - Microbial biopesticides: Current status and advancement for sustainable agriculture and environment- N. Thakur,S. Kaur,P.Tomar,S.Thakur &A.J.Yadav Eds: A. A. Rastegari, A. N. Yadav, N. Yadav, 2020, pp. 243-282, Elsevier.					
2.Biopesticides:A Review of their Action, Applications and Efficacy- L.. G. Copping & J. J Menn, Society of Chemical Industry- Pest Management Science, 2000, 56 : pp. 651-676, Wiley Online Library.					
3. Microbial Interactions and Biocontrol in the Rhizosphere - J.M.Whipps, J. Experimental Botany 52:Roots Special Issue pp. 487-511, Oxford Academic.					
4. Biological Control of Soil-borne Pathogens by Fluorescent Pseudomonads-D.Haas & G.Défago Nature Reviews Microbiology, published online, 2005; doi:10.1038/nrmicro1129, Springer Nature.					
5. Plant growth-promoting rhizobacteria (PGPR): Their potential as antagonists and biocontrol agents-A. Beneduzi, A. Ambrosini & L. M.P. Passaglia, Genetics and Molecular Biology, 35, 4 (suppl), 2012, pp 1044-1051 Sociedade Brasileira de Genética.					
6. Modulation of Host Immunity by Beneficial Microbes-C. Zamioudis & C. M. J. Pieterse, Molecular Plant-Microbe Interactions 25, (2), 2012, pp. 139–150.,The American Phytopathological Society.					
7.Encyclopedia of Biotechnology in Agriculture and Food – Eds. D. R. Heldman, M. B. Wheeler & D.G. Hoover. 2011, CRC press Taylor and Francis.					
8. Modern Food Microbiology - J.M Jay, M.J.Loessner & D.A. Golden 7 th ed. 2005, Springer.					

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M.Sc. Microbiology : Regular					
YEAR	I	ELECTIVE		CREDIT	2
SEMESTER	IV	MBY2402E02-IPR, Metagenomics, Research Methodology and Scientific Communication		HOURS	30
OBJECTIVES		To familiarize the students with Intellectual property rights, Bioethics, Metagenomics, Research methodology and Scientific communication			
COURSE CONTENT / SYLLABUS					
UNIT-I	IPR & Bioethics				8 hrs.
	Introduction to IPR: History, & current trend, Patent - subject matter, types of patents, Rights of patent holder, The patent sanction, application , scope of amendments & claims Case studies of Biotechnology patents. Bioethics: Introduction, ethical conflicts in biological sciences. Bioethics in research, cloning and stem cell research, Human and animal experimentation, animal rights/welfare, Agricultural biotechnology - Genetically engineered food, environmental risk, public opinion. Protection of environment and biodiversity, biopiracy.				
UNIT-II	Metagenomics				8 hrs.
	Concepts of Microbial Diversity and Species Richness, Next Generation Sequencing Technologies to explore microbial communities, Quality Control (QC) Procedures for Metagenomics, Reconstructing the genomic content of the microbial community from NGS Data, Amplicon Sequencing Analysis, Shotgun Metagenomics, Assessment of Taxonomy Based on Markers, The Binning Strategy, Functional Metagenomics Analysis, Comparative Metagenomics,Novel approaches.				
UNIT-III	Research Methodology				7 hrs
	Background and Introduction- Science Methodologies, Empirical science; The scientific method; Interrogative perturbation experiments and controls; Deductive and inductive reasoning; Descriptive science; Reductionist vs Holistic biology.				
UNIT-IV	Scientific Communication				7hrs
	Scientific writing skills - Importance of communicating science; Problems in writing a scientific document; Plagiarism; Elements of a scientific paper The peer review process and problems, recent developments such as open access and non-blind review; Plagiarism; Ethical issues; Scientific misconduct, poster preparation & presentation				
REFERENCES					
1. Intellectual Property Rights: Unleashing the Knowledge Economy- P. Ganguli 2001, Tata.					
2 Bioethics: an Anthology - H. Kuhse 2010, Blackwell.					
3. Metagenomics,Perspectives, Methods and Applications-Ed. M.Nagarajan, 2018, Academic Press.					
4.. Doing Science: Design, Analysis, and Communication of Scientific - I. Valiela 2001, Oxford University Press.					
5. On Being a Scientist: a Guide to Responsible Conduct in Research-National Academy of Sciences, National Academy of Engineering (US) and Institute of Medicine (US) Committee on Science, Engineering, and Public Policy 2009, National Academies Press.					
6. The Science of Scientific Writing. American Scientist- G. D. Gopen, & J. A .Smith, 78 (Nov-Dec 1990), 550-558.					