MGMUNIVERSITY,CHH. SAMBHAJINAGAR

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTERPATTERN

Facultyof Bacis and Applied Sciences

Post Graduate (PG) programme

Microbiology/Virology - CURRICULUM

w.e.f. Academic Year 2023-24

M.Sc.Microbiology/Virology

CURRICULUM

Prepared By
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Submitted By
Dr. G. W. Narkhede

Approved By
Board of Studies

Illustrative Credit distribution structure for Two Years/ One Year PG									
M.Sc. Post Graduation Programme (M.Sc. Microbiology / Virology)									
Year	**Level**	**Sem.**	**Major**			**OJT/ FP**	**RP**	**Cum. Cr.**	**Degree**
			Mandatory	**Electives**	**RM**				
I	**6**	**I**	13 (3*3+2*2)	4	4			21	
		II	14 (4*3 +2)	4		4		22	PG Diploma (after 3 Yr Degree)
Cum. Cr. For PG Diploma			**27**	**8**	**4**	**4**	**-**	**43**	
Exit option: PG Diploma (43 Credits) after Three Year UG Degree									
II	**6.5**	**III**	12 (2*4 + 2*2)	4			4	20	
		IV	10 (1*10)	4			8	22	
Cum. Cr. for 1 Yr PG Degree			**22**	**8**	**4**		**12**	**42**	PG Degree After 3-Yr UG Or
Cum. Cr. for 2 Yr PG Degree			**49**	**16**	**4**	**4**	**12**	**85**	PG Degree after 4-Yr UG
2 Years-4 Sem. PG Degree (85-credits) after Three Year UG Degree or 1 Year - 2 Sem PG Degree (42- credits) after Four Year UG Degree									

Appendix-2023																			
PROGRAMME: M.Sc. Microbiology / Virology																			
Semester I																			
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MMMML101**	**Molecular Cell Biology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML102	**Microbial Physiology and Metabolism**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML103	**Microbial Diversity and Taxonomy**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML104	**Biochemistry and enzymology**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
	MMMMJ105	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30		20	50	-	-	8	20
	MMMEP106 **MMMEP107**	**1. Biotechniques Lab** **2. Microbial Genetics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	0	20	50	-	-	8	20
	MMMEP108 **MMMEP109**	**1. Micro Lab** **2. Microbial diversity Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30		20	50	-	-	8	20
	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
		Total (L- P) Hrs / week = 27			**15**	**12**	**21**	**90**	**90**	**90**	**90**	**180**	**60**	**600**		**72**	**24**	**240**

Semester II (M.Sc. MV)																		
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MMMML110**	**Cyanobacterial and Algal Biotechnology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML111	**Gene Technologies**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML112	**Genomics and Bioinformatics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML113	**Clinical and Diagnostic Microbiology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMEP114 **MMMEP115**	**1. Microbial Lab (Practical)** **2. Industrial Microbiology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMMEP116 **MMMEP117**	**1. Genomics and Diagnosis Lab** **2. Bioinformatics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMMMJ118	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMFPJ119	**Field Project**	**Practical**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L-P) Hrs / week = 32			**12**	**20**	**22**	**80**	**80**	**80**	**150**	**160**	**100**	**650**		**64**	**40**	**260**

Level 6.0 Award of PG Diploma (44 Credits) after Three Year UG Degree

Semester III (M.Sc. MV)																		
Level	**Course code***	**Course Title**	**Type**	**Category**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**		**Total**		**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**		**Internal**	**ESE**	**PR**	**Total**
6.5	**MMMML201**	**Medical Bacteriology, Mycology and Parasitology**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
	MMMML202	**Environmental and Agricultural Microbiology**	**Theory**	**Major Mandatory**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
	MMMEP203 **MMMEP204**	**1.Experimental Microbiology Lab (Practical)** **2. Immunology Lab**	**Practical**	**Major Elective**	-	8	4	20	20	20	-	-	40	100	-	0	16	40
	MMMMP205	**Environmental and agricultural Microbiology Lab**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMMMP206	**Scientific Writing and Publishing**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMRPJ207	**Major Project**	**Practical**	**RP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L- P) Hrs / week = 32			**8**	**24**	**20**	**60**	**60**	**60**	**120**	**80**	**120**	**500**	-	**32**	**48**	**200**

Semester IV (M.Sc. MV)																		
Level	**Course code***	**Course Title**	**Type**	**Category**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.5	**MMMEL208** **MMMEL209**	**1. Ethics/ Biosafety/ IPR** **2. Biostatistics for Applied Sciences**	**Theory**	**Major Elective**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
	MMJTI210	**On Job Training**	**OJT**	**Major Mandatory**	-	20	10	-	-	-	200	-	50	250	-	-	20	50
	MMRPJ211	**Research Project**	**RP**	**RP**	-	16	8	-	-	-	150	-	50	200	-	-	20	50
		Total (L- P) Hrs / week = 40			**4**	**36**	**22**	**20**	**20**	**20**	**350**	**40**	**100**	**550**	-	**16**	**40**	**140**

Level 6.5 Award of PG Degree after Three Years UG Degree with 86 credits OR Four Years UG Degree with 42 credits

MGM UNIVERSITY, AURANGABAD

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Bacis and Applied Sciences

Post Graduate (PG) programme

M.Sc. MICROBIOLOGY/ VIROLOGY - CURRICULUM

w. e. f. Academic Year 2023-24

M.Sc. Microbiology/ Virology 1st yr

SEMESTER-I

CURRICULUM

Appendix-2023																			
PROGRAMME: M.Sc. Microbiology / Virology																			
Semester I																			
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
								Internal				**External**				**External**		
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MMMML101**	**Molecular Cell Biology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML102	**Microbial Physiology and Metabolism**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML103	**Microbial Diversity and Taxonomy**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML104	**Biochemistry and enzymology**	**Theory**	**Major Mandatory**	2	-	2	10	10	10	-	20	-	50	-	8	-	20
	MMMMJ105	**Mini Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30		20	50	-	-	8	20
	MMMEP106 **MMMEP107**	**1. Biotechniques Lab** **2. Microbial Genetics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	0	20	50	-	-	8	20
	MMMEP108 **MMMEP109**	**1. Micro Lab** **2. Microbial diversity Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30		20	50	-	-	8	20
	-	**Research Methodology**	**Theory**	**RM**	4	-	4	20	20	20	-	40	-	100	-	16	-	40
		Total (L- P) Hrs / week = 27			**15**	**12**	**21**	**90**	**90**	**90**	**90**	**180**	**60**	**600**		**72**	**24**	**240**

SYLLABUS STRUCTURE SHEET

Molecular Cell Biology

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree: M.Sc.** M.Sc. Microbiology/ Virology

Course Unit Code: MMMML101 **Course Unit Title:** Molecular Cell Biology

Credits allocated: 3+0 (3 Theory+ 0 Practical) **Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs / weekly **Recommended Year /Semester:** M.Sc. Microbiology / Virology, Year 1/ Semester I **Prerequisites for registration:** Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.
Candidate should pass in Under Graduate Life Sciences.

Learning Outcomes:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function.

Objective:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how these cellular components are used to generateand utilize energy in cells.

Detailed Syllabus

Total Lectures = 45

UNIT 1: Cell Structure and Function (9 Lectures)

Subtopics:

Overview of cell structure and organization

Cell membrane structure and transport mechanisms

Cytoskeleton and cell motility

Cell cycle and cell division

UNIT 2: Cellular Signaling and Communication (9 Lectures)

Subtopics:

Introduction to cell signaling

Signal transduction pathways and second messengers

Receptor-mediated signaling

Intracellular signaling networks

UNIT 3: Gene Expression and Regulation (9 Lectures)

Subtopics:

DNA structure and packaging

Transcription and RNA processing

Translation and protein synthesis

Regulation of gene expression

UNIT 4: Cell Death and Cell Senescence (9 Lectures)

Subtopics:

Apoptosis and programmed cell death

Autophagy and cell survival mechanisms

Cellular senescence and aging

UNIT 5: Cell-Cell Interactions and Tissue Homeostasis (9 Lectures)

Subtopics:

Cell adhesion molecules and cell junctions

Extracellular matrix and cell-matrix interactions

Cell communication in tissue development and repair

Stem cells and tissue regeneration

SUGGESTED READINGS / REFERENCE BOOKS/ TEXTBOOKS

1. Molecular Biology of Gene by Watson, Baker, Bell
2. Lodish, et al. Molecular Cell Biology. 5th ed. New York,NY: W.H. Freemanand Company, 2003. ISBN: 9780716743668.
3. Hardin, J, and Bertoni, G.P. 2015. Becker's World of the Cell, 9th edition, Pearson
4. Bruce Alberts, et al. Molecular biology of the cell. Garland Science, 2015. 6th edition.
5. Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, and Walter. 2014. EssentialCellBiology 4th ed. Garland Science. ISBN: 978-0-8153-4454-4.

SYLLABUS STRUCTURE SHEET

Microbial Physiology and Metabolism

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/ Virology
Course Unit Code: MMMML102	**Course Unit Title:** Microbial Physiology and Metabolism.
Credits allocated: 3+0 (3 Theory+ 0 Practical)	**Level of Study: PG**

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ I Semester

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form. Candidate should pass in post Graduate life Sciences.

Learning Outcome

Get well versed with various life process like photosynthesis, respiration and fermentation, an aerobic respiration, and bacterial sporulation Elucidate bacterial membrane transport.

Objective

- Microbial Physiology is an intensive course with the goal of integrating biochemistry and genetics to enhance the understanding of the microbial cell and the robust and diverse nature of life.

Detailed Syllabus Theory (45 lectures)

Unit 1: (9 lectures)

Introduction to Microbial Physiology: Definition and scope of microbial physiology. Importance of studying microbial physiology. Microbial Cell Structure and Function: Prokaryotic and eukaryotic cell. Cell membrane structure and function. Cell wall composition and significance. Organelles and their roles in microbial physiology.

Unit 2: Microbial growth kinetics (9 lectures) :

Growth curve: Lag, exponential, stationary, and death phases; Factors influencing microbial growth

Unit 3: Enzymes and enzyme kinetics (8 lectures) :

Enzyme structure and function, Enzyme kinetics: Michaelis-Menten equation, inhibition, and regulation

Unit 4: Metabolic pathways and energy production (9 lectures):

Glycolysis, Krebs cycle, and oxidative phosphorylation, Fermentation and anaerobic respiration

Unit 5: Nutrient uptake and Utilization(10 lectures)

Transport mechanisms: Passive and active transport, Metabolism of carbohydrates, lipids, proteins, and nucleic acids

Reference:

1. Microbial Physiology and Metabolism by Daniel R. Caldwell in 1999.
2. Microbial physiology by Albert G. Moat, John W. Foster , Michael P. Spector in 2002.
3. Microbial physiology by S.R. Reddy, S. M. Reddy in 2004.

SYLLABUS STRUCTURE SHEET
Microbial Diversity and Taxonomy

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMML103	**Course Unit Title:** Microbial Diversity and Taxonomy
Credits allocated: 3+0 (3 Theory+ 0 Practical)	**Level of Study: PG**

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs weekly **Recommended Year/Semester:** M.Sc. Microbiology / Virology, Year 1/ I Semester **Prerequisites for registration:** Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form
Candidates should pass in Under Graduate Life Sciences.

Learning Outcome:

Gain the knowledge of basic principles of microbial diversity and taxonomy
Perform the constituent tasks for identification criteria for microbial forms
Understand the applied OMICS tools for metagenomics analysis

Objective:

Organizing and prioritizing in an orderly manner.
Microbial taxonomy may be defined as the study of the diversity of microorganisms with the aim of organizing and prioritizing in an orderly manner.

Detailed Syllabus Theory: (45 lectures)

Unit 1 (8 lecture)

Introduction to microbial diversity, Definition and scope of microbiology, Classification of microorganisms based on cellular organization

Unit 2 (9 lecture)

Bacterial taxonomy, Classification systems: Bergey's Manual and others, Identification methods: Phenotypic and genotypic approaches

Unit 3 (9 lecture)

Fungal taxonomy**;** Classification of fungi: Morphological and molecular characteristics**;** Identification techniques: microscopic features, molecular methods.

Unit 4 (9 lecture)

Viral taxonomy**,** Classification of viruses: Baltimore classification and ICTV system**,** Identification techniques: Serological and molecular methods

Unit 5 (9 lecture)

Parasitic taxonomy**,** Classification of parasites: Protozoa, helminths, and arthropods**,** Identification techniques: Microscopic examination, serology, and molecular methods.

Reference:

1. Principles of Microbial Diversity by James W. Brown in 2014.
2. Microbial Systematics: Taxonomy, Microbial Ecology, Diversity 1st Edition, Kindle Edition by Bhagwan rekadwad.
3. Microbial Diversity: Form and Function in Prokaryotes by Oladele Ogunseitan in 2004.

SYLLABUS STRUCTURE SHEET

Biochemistry and Enzymology

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMML104	**Course Unit Title:** Biochemistry and Enzymology
Credits allocated: 2+0 (2 Theory+ 0 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs. / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in under graduate life science.

Learning Outcomes:

Students will be able to understand microbial Biochemistry-Carbohydrate, Cell membrane and transport, Energy production in bacteria, Enzyme-Classification and nomenclature and Photosynthetic bacteria and cyanobacteria interpret and apply nutrition concepts to evaluate and improve the nutritional health of communities.

Objective:

Microbial Physiology is the study of structure, function, energy metabolism, growth and regulatory mechanisms of microorganisms. In this course, the students will learn about the metabolic diversity exhibited by microorganisms, their thermodynamics and regulatory networks that support their survival and growth

Detailed Syllabus Theory (30 lectures)

Unit 1: Structures & Functions of Proteins & Enzymes (7 Lectures)

Amino acids & Peptides, Proteins: Determination of Primary Structure, Proteins: Higher orders of structure, Proteins: Myoglobin & Hemoglobin, Enzymes: Mechanism of Action, Enzymes: Kinetics, Enzymes: Regulation of Activities; Coenzymes and mechanism of enzyme action, Enzyme inhibition and regulation, Enzyme Technology, Enzyme kinetics, Bioinformatics & Computational biology;

Bioenergetics & the Metabolism of Carbohydrates & Lipids

Bioenergetics: The role of ATP, Biological Oxidation, The Respiratory Chain & Oxidative Phosphorylation, Carbohydrates of Physiologic Significance, Lipids of Physiologic Significance, Overview of Metabolism & the provision of metabolic Fuels, The Citric acid cycle: The catabolism of Acetyl- CoA, Glycolysis & the Oxidation of Pyruvate, Metabolism of Glycogen, Gluconeogenesis & the Control of blood glucose, The pentose phosphate pathway & other pathways of hexose metabolism

Unit 2: Metabolism of Proteins & Amino Acids (4 Lectures)

Biosynthesis of the nutritionally Nonessential amino acids, Catabolism of Proteins & of amino acid nitrogen, Catabolism of the carbon skeletons of amino acids, Conversion of Amino Acids to Specialized products, Polyphyrin & Bile pigments.

Unit 3: Structure, Function & Replication of Informational Macromolecules (10 Lectures)

Nucleotides, Metabolism of Purine & Pyrimidine nucleotides, Nucleic acid, Structure & function, Nucleic acid structure & function, DNA Organization, Replication, & Repair, RNA synthesis, Processing & Modification, Protein Synthesis & genetic code, Regulation of gene expression, Molecular genetics, Recombinant DNA, & Genomic Technology

Unit 4: Biochemistry of Extracellular & Intracellular Communication (9 Lectures)

Membranes: Structure & Function, The Diversity of Endocrine system, hormone action & Signal Transduction, Nutrition, Digestion & Absorption, Micronutrients: Vitamins & Minerals, Free radicals and Antioxidant Nutrients

Suggested Readings / Reference Books/ Textbooks

1. Berg,J.M., Stryer,L(2002) *Biochemistry* W.H Freeman & Company
2. Nelson, D.L., Cox, M (2008) *Lehninger's Principles of Biochemistry* MacMillan
3. Voet,D and Voet, J.G (2010) *Biochemistry* 4th edition Wiley
4. Jain, J.L(2005) *Fundamentals of Biochemistry* 6 th edition S. Chand & Co.
5. Deb, A.C(2001*) Fundamentals of Biochemistry* New Central Book Agency(P) Ltd
6. Pelczar,M.J., Chan,E.C.S and Kraig(1977) *Microbiology* McGraw-Hill
7. Talaro, K.P., and Talaro A (2004) *Foundations of Microbiology* 5 th edition McGraw-Hill
8. Aneja, K.R., Jain p. and Aneja, R (2008) *Text book of Basic and Applied Microbiology* New Age International

SYLLABUS STRUCTURE SHEET

Mini Project

University: MGM University, Aurangabad
Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.
Degree: M.Sc. M.Sc. Microbiology/Virology
Course Unit Code: MMMMJ105
Course Unit Title: Mini Project
Credits allocated: 0+2 (0 Theory+ 2 Practical)
Level of Study: PG

Mode of delivery, planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year I/ Semester I

Learning Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Objective:

- In order for your objectives to guide the results of the project, you need to set them at the beginning and use them to guide your project. As we mentioned earlier, your project objectives are a key element of your project plan, which you should also create at the beginning of your project. 2. Involve your project team in the goal-setting process

Thrust Area:

1. Antimicrobial resistance
2. Host Microbe interactions (Plants, Animals, Humans, etc)
3. Microbial genomics
4. Microbial analysis
5. Bioremediaion
6. Microbial ecology
7. Bioprospecting (Biofuel, Biofertilizer, etc)
8. Microbial pathogenesis
9. mRNA technology
10. Synthetic biology

11. Cyanobacterial and algal biotechnology

SYLLABUS STRUCTURE SHEET

Biotechniques Lab

University: MGM University, Aurangabad
Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.
Degree: M.Sc. M.Sc. Microbiology/Virology
Course Unit Code: MMMEP106
Course Unit Title: Biotechniques Lab
Credits allocated: 0+2 (0 Theory+ 2 Practical)
Level of Study: PG

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly
Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester I
Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.
Candidates should pass in under graduate life science.

Learning outcome:
Practical skills and competencies are critical to student engagement and effective learning in laboratory courses. This article describes the design of a yearlong, stand-alone laboratory course—the Biotechniques Laboratory. A common core course in the second year of all our degree programs in the biological sciences. It is an enabling, introductory laboratory course with a focus on the development of basic, practical skills, competencies, and knowledge in experimental techniques commonly used across the biological sciences.

Objective:

Collect and prepare the sample Handle fully automated analysers Understand and perform special stains and smears Understand and perform basic cytology and hematology procedures Perform grossing, cutting & staining procedures in histopathology Counsel and screen the Donors and prepare the blood components Perform Quality control procedures.

List of Practical:

1. Double immunodiffusion assay
2. Blood agglutination test
3. Widal test
4. ELISA

5. Estimation of protein by Lowry method
6. Estimation of protein by biuret method
7. Quantitative method of reducing sugar by DNSA method
8. Qualitative analysis of carbohydrates by Molisch reagent
9. Qualitative analysis of carbohydrate by benedict's method
10. Qualitative analysis of carbohydrate by Fehling's test
11. Estimation of RNA by orcinol method
12. TLC-Separation of lipids by TLC method
13. Titration-Estimation of pKa values of amino acid by titration curves.
14. Preparation of sugar by gas Chromatography.
15. UV survival curve of bacteria.
16. Determination of enzymatic activity in biological tissues- serum/plasma, liver, plant extracts, etc (Any five) β hexosaminidase, Amylase , Trypsin, Urease.
17. Enzyme kinetics (amylase, trypsin, urease, yeast fructfuranosidase) –
18. Preparation and purification of any of the following enzymes . LDH from rabbit muscle, Urease from red gram, β-amylase from sweet potato
19. Identification of alkaloids in a mixture by TLC
20. Quantitative analysis of phytoconstituents by various methodsa. Determination of total phenolic content b. Determination of total flavonoid content c. Determination of total antioxidant activity
21. Isolation of DNA
22. Gel electrophoresis
23. Isolation of Plasmid and bacteria.
24. To study the spontaneous mutation by replica plating.
25. Reading Research paper

Reference: -

1. Dubey, R.C and Maheswari, D.K (2002) *Practical Microbiology S.* Chand Ltd
2. Cappuccino, J.G., Sherman,S (2002) *Microbiology. A Laboratory Manual* Benjamin Cummings Publishing Company
3. Aneja KR (2003) *Experiments in Microbiology, Plant Pathology and Biotechnology*. New Age International.

SYLLABUS STRUCTURE SHEET

Microbial Genetics Lab

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMEP107	**Course Unit Title:** Microbial Genetics Lab
Credits allocated: 0+2 (0 Theory+ 2 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in under graduate life science.

Learning Outcome:

With the increased advances in genomics, leading health authorities have advocated the importance of incorporating genomics content into health professional school education to ensure those students achieve adequate genomic competencies. Yet, information regarding the genomics education status for this particular group is lacking. We conducted a systematic literature review to summarize the characteristics and evaluation outcomes of genomics curricula for health professional students.

Objective:

Discoveries of the genomes of literally thousands of organisms inhabiting this planet have facilitated renewed emphasis on the study of life and its meaning in the social sciences and humanities as well as in the life sciences. For every individual, experiencing and living the implications of such scientific discoveries depends on understanding the social and personal complexity embedded within the many contexts and filters applied to genomic information – in research labs, computer science and data management, quantitative biology, ethics debates dealing with emerging technological capabilities, genome

databases, social interactions, and policy deliberations.

Practical List:

1. Preparation of Master and Replica Plates
2. Study the effect of chemical (HNO2) and physical (UV) mutagens on bacterial cells.
3. Study survival curve of bacteria after exposure to ultraviolet (UV) light.
4. Isolation of Plasmid DNA from E. coli.
5. Isolation of RNA.
6. Study different conformations of plasmid DNA through Agarose gel electrophoresis.
7. Demonstration of Bacterial Conjugation.
8. Demonstration of bacterial transformation and transduction.
9. Demonstration of AMES test.
10. To prepare competent cells and transform plasmid DNA.
11. Transformation of different plasmid from different bacteria
12. Spontaneous mutation, induced mutation by chemical mutagenesis.
13. UV survival curve of bacteria
14. Photoreactivation.
15. To study the spontaneous mutation by replica plating.
16. To study the process of Gene expression in bacteria.
17. To learn the process of cloning of foreign genes into vectors.
18. To study yeast competent cell & transformation yeast plasmid DNA.
19. To understand the principle of pH meter, colorimeter, spectrophotometer, UV spectra.
20. To study a research paper.

Reference:

1. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
2. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
3. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning.
4. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings.

5. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
6. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings.
7. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
8. Maloy SR, Cronan JE and Freifelder D (2004) Microbial Genetics 2nd EDITION., Jones and Bartlett Publisher

SYLLABUS STRUCTURE SHEET

Micro Lab

University: MGM University, Aurangabad
Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.
Degree: M.Sc. M.Sc. Microbiology/Virology
Course Unit Code: MMMEP108
Course Unit Title: Micro Lab.
Credits allocated: 0+2 (0 Theory+ 2 Practical)
Level of Study: PG

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly
Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester I
Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.
Candidates should pass in under graduate life science.

Learning outcome:
This work describes outcomes of a research-driven advanced microbiology laboratory and literature research course intended to enhance undergraduate preparation for and contributions to original research.

Objective:
The initial step that should be taken in a microbiological research laboratory is an analysis of the research activities that will be undertaken, the hazards associated with each operation, and an evaluation of the relationships that exist between each activity.

List of Practical's

1. Enumeration and Isolation of bacteria by plate count or serial dilution- agar plate technique
2. Morphology study of bacteria from soil
3. Maintenance of pure cultures
4. Staining method: Simple staining
5. Negative staining
6. Staining method: Gram Staining
7. Isolation of fungi from soil.
8. Studying morphology of fungi by using microscope
9. Study of diverse flora of total water/air bacterial/fungi population.
10. Isolation and enumeration of actinomycetes from soil

11. Microscopic examination of algae/protozoa/fungi by using permeant slide/photographs
12. Determination of bacterial population growth by turbidity
13. Biochemical activities of bacteria: Starch hydrolysis and Citrate utilization
14. Biochemical activities of bacteria: MR-VP and Indole
15. Cellulose production test
16. Biochemical activities of bacteria: Fermentation of Carbohydrates
17. Effect of temperature on growth of bacteria or fungi
18. Effect of pH on growth of bacteria or fungi
19. Growth of microorganisms on various carbon sources.
20. Growth of microorganisms on various nitrogen sources.
21. Use of P sources for studying P uptake by microorganisms.
22. Use of K sources for studying K uptake by microorganisms.
23. Microbiological Examination of Milk/ any other diverse environment
24. To study *Rhizobium* from root nodules/ any other diverse environment
25. Research Paper Reading

Reference: -

1. Dubey,R.C and Maheswari,D.K (2002)*Practical Microbiology S*.Chand Ltd

2. Cappuccino, J.G., Sherman,S(2002) *Microbiology. A Laboratory Manual* Benjamin-Cummings Publishing Company

3. Aneja KR (2003) *Experiments in Microbiology, Plant Pathology And Biotechnology*. New Age International.

SYLLABUS STRUCTURE SHEET

Microbial Diversity Lab

University: MGM University, Aurangabad
Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.
Degree: M.Sc. M.Sc. Microbiology/Virology
Course Unit Code: MMMEP109
Course Unit Title: Microbial Diversity Lab
Credits allocated: 0+2 (0 Theory+ 2 Practical)
Level of Study: PG

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly
Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester I
Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.
Candidates should pass in under graduate life science.

Learning outcome:

Compare microbial communities from different environments Identify factors that affect microbial growth Isolate microorganisms on agar plates Describe the appearance of, and quantify, microbial colonies Explain the mechanisms and effects of antimicrobials

Objective:

Compare microbial communities from different environments Identify factors that affect microbial growth Isolate microorganisms on agar plates Describe the appearance of, and quantify, microbial colonies Explain the mechanisms and effects of antimicrobials

List of Practical:

1. Microbiology Good Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Study divers' microflora i.e. bacteria from soil and study morphology of different bacteria.
4. Gram Staining and Describe bacterial structure: colony morphology, cell shape and state of aggregation.

5. Biochemical characterization of bacteria for example IMViC test.

6. Study diverse Fungi from soil and study morphology of different fungi.

7. Preparation of culture media for actinomycete cultivation

8. Study of diverse actinomycetes from soil and study morphology of different actinomycetes.

9. Describe a bacterial community in aging milk, relating this to changes in environmental conditions such as pH and nutrient availability.

10. Describe a fungal community in aging milk, relating this to changes in environmental conditions such as pH and nutrient availability.

11. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.

12. Demonstration of the presence of microflora present in water.

13. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts

14. Study of Spirogyra and Chlamydomonas, Volvox using permanent Mounts

15. Study of the following protozoans using permanent mounts/photographs: Amoeba, Paramecium, Plasmodium

16.Select different area for microbial diversity.

17. Microsymbionts: Rhizobia.

18. Microbial examination of vegetables/fruits

19. Isolation of aquatic fungi.

20. Study of phylloplane microflora by leaf impression method or others

21. Isolation of DNA

22. Gel electrophoresis

23. molecular diversity by using PCR-RAPD

24. A visit to any educational institute/Microbial lab to see microbial Diversity.

25. Study Research Paper.

Reference:

1. Dubey., R.C and Maheswari, DK (2002) *Practical Microbiology S*. Chand Ltd
2. Aneja., KR (2003) *Experiments in Microbiology, Plant Pathology and Biotechnology*. New Age International.

Research Methodology

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** Microbiology / Virology (PG)
Course Unit Code:-	**Course Unit Title:** Research Methodology
Credits allocated: 4+0 (4 Theory 0 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method:

theory 4 hrs / weekly

Objectives:

- To get introduced to research philosophy and process in general
- To be able to formulate the problem statement and research plan for the problem under investigation
- To be able to apply various numerical/ quantitative techniques for data analysis
- To be able to communicate the research findings effectively

Detailed syllabus (60 lectures)

Unit I: (12 Lectures)

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Unit II: (12 Lectures)

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of

a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Unit III: (12 Lectures)

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling:Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method**.**

Unit IV: (12 Lectures)

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests**.**

Unit V: (12 Lectures)

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Suggested Readings

1. 'Management Research Methodology' by K.N. Krishnaswamy, Appa Iyer Sivakumar & M. Mathirajan, Person Education.
2. 'Research Methodology. G.C. Ramamurthy, Dream Tech Press, New Delhi
3. 'Research Methodology: A Step by Step Guide for Beginners' by Ranjit Kumar, 2nd Edition
4. 'Research Methodology: An Introduction for Science and Engineering Students', byStuart Melville and Wayne Goddard

5. ‘Research Methodology: An Introduction’ by Wayne Goddard and Stuart Melville ‘Research Methodology: Methods and Techniques’, by Dr. C.R. Kothari, New AgeInternational Publisher

MGM UNIVERSITY, AURANGABAD

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Sciences

Post Graduate (PG) progrmme

M.Sc. MICROBIOLOGY/ VIROLOGY - CURRICULUM

w. e. f. Academic Year 2023-24

M.Sc. Microbiology/ Virology1st yr IInd Sem

SEMESTER-II

CURRICULUM

Semester II (M.Sc. MV)																		
Level	**Course Code**	**Course Title**	**Type**	**Course Type**	**Teaching Scheme**		**Credit**	**Evaluation Scheme**							**Minimum Passing**			
					L	**P**		**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**	**Total**	**Internal**	**ESE**	**PR**	**Total**
6.0	**MMMML110**	**Cyanobacterial and Algal Biotechnology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML111	**Gene Technologies**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML112	**Genomics and Bioinformatics**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMML113	**Clinical and Diagnostic Microbiology**	**Theory**	**Major Mandatory**	3	-	3	20	20	20	-	40	-	100	-	16	-	40
	MMMEP114 **MMMEP115**	**1. Microbial Lab (Practical)** **2. Industrial Microbiology Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMMEP116 **MMMEP117**	**1. Genomics and Diagnosis Lab** **2. Bioinformatics Lab**	**Practical**	**Major Elective**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMMMJ118	**Micro Project**	**Practical**	**Major Mandatory**	-	4	2	-	-	-	30	-	20	50	-	-	8	20
	MMFPJ119	**Field Project**	**Practical**	**FP**	-	8	4	-	-	-	60	-	40	100	-	-	16	40
		Total (L-P) Hrs / week = 32			**12**	**20**	**22**	**80**	**80**	**80**	**150**	**160**	**100**	**650**		**64**	**40**	**260**

SYLLABUS STRUCTURE SHEET

CYANOBACTERIAL AND ALGAL BIOTECHNOLOGY

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMML110	**Course Unit Title:** CYANOBACTERIAL AN ALGAL BIOTECHNOLOGY
Credits allocated: 3+0 (3 Theory + 0 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs. / weekly

Recommended Year /Semester: Microbiology/Virology -Masters of Science, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form

Learning outcome:

To teach students about this upcoming fascinating field of microbes developed at a faster pace, mainly due to the photoautotrophic nature of Cyanobacteria and Algae.

Objective

TO understand/know students about cyanobacteria and algae, ability to survive under a variety of habitats and wide diversity of thallus structure and functions. Their importance for mankind is enormous including their role as biofertilizers, nutraceuticals, experimental models, dyes, biofuels and a variety of biochemicals. regarding structure, molecular evolution and properties of cyanobacteria and algae

Detailed Syllabus Theory

(45 Lectures)

Unit I (9 lectures)

Introduction to Cyanobacteria and algae. Definition, occurrence and distribution, thallus structure, reproduction, life cycles, molecular evolution and horizontal transfer of genes.

Unit II (9 lectures)

Algal pigments, storage products, carbon metabolism, photosynthesis. Algal culturing and cultivation. Culture types, culture conditions, culture media, sterilization, culture methods, synchronous cultures, photobioreactors, algal density and growth, seaweed cultivation.

Unit III (9 lectures)

Cyanobacterial and algal fuels, Fine chemicals (restriction enzymes etc) and nutraceuticals from algae; UV absorbing pigments, Industrial products from macro algae - seaweed biotechnology, sustainable aquaculture. Ecology of algae- distribution in soil and water; primary colonizers, carbon sequestration and cycling in soil and water. nitrogen fixation, nitrogen metabolism and outline.

Unit IV (7 lectures)

Algae in pollution - as pollution indicators, eutrophication agents and role in Bioremediation.

Unit V (9 lectures)

Cyanobacterial and algal toxins, allelopathic interactions, Algae in global warming and environmental sustainability. Cyanobacteria and selected microalgae in agriculture – biofertilizers & algalization; soil conditioners; reclamation of problem soils.

Text Books & Reference Books

4. Ahluwalia AS. 2003. Phycology: Principles, Processes and Applications. Daya Publ. Barsanti L & Gualtieri P. 2006. Algae: Anatomy, Biochemistry and Biotechnology. Taylor & Francis, CRC Press. Carr NG & Whitton BA. 1982. The Biology of Cyanobacteria. Blackwell.
5. Herrero A & Flores E. 2008. The Cyanobacteria Molecular Biology, Genomics and Evolution. Caister Academic Press Kumar HD. 2005.
2. Introductory Phycology. East West Press. Linda E Graham & Lee W Wilcox. 2000. Algae.
3. Prentice Hall. Robert A Andersen.2005. Algal Culturing Techniques. Academic Press. Venkataraman LV & Becker EW. 1985.Biotechnology and Utilization of Algae: The Indian Experience.

SYLLABUS STRUCTURE SHEET
GENE TECHNOLOGIES

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Microbiology/Virology

(PG) **Course Unit Code: MMMML111** **Course Title:** Gene Technologies

Credits allocated 3+0 (3 Theory+0 Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs weekly.

Learning Outcome:

1. Describe, illustrate and apply different techniques in the fields of genomics and transcriptomics.
2. Describe, illustrate and apply different techniques used for high-throughput molecular biology studies.
3. Report orally and in writing within the subject.
4. Review and give constructive feedback on the reports within the subject.
5. Explain the theory of state-of-the-art tools/algorithms for processing data from high- throughput molecular biology experiments.
6. Choose and use appropriate methods and tools for processing data from high-throughput molecular biology experiments.
7. Describe how naturally occurring organisms regulate the expression of their genes.
8. Describe how the regulation of the genes and properties of gene products can be altered with synthetic biology methods used during the course.
9. Describe how synthetic biology alters the properties of the cell or the organism.
10. Apply a scientific approach to the planning, execution, reporting and interpretation of advanced projects with the aim at creating replicating systems with new properties that can be regulated, and to critically analyze the results and generate testable hypotheses from these experiments.
11. Critically analyze, present and defend scientific literature in synthetic biology, including practical applications such as biofuel and metabolic engineering.
12. Develop ethical perspectives in synthetic biology

Objective:

- Genetic technologies are changing the way we produce food, improving crop yield and preventing catastrophic losses from droughts, floods and pests. They also are offering new solutions for fighting cancer and many hereditary diseases, improving quality of life and life expectancy.

Detailed syllabus (45 lectures)

Theory

Unit 1: Molecular Techniques (9 lectures)

PCR Techniques- Principle of polymerase chain reaction (PCR) - Components of PCR reaction and optimization of PCR -Gene specific primer and degenerate primer – Inverse PCR, Hot- start PCR, Loop mediated PCR -, Reverse transcription PCR and Real time PCR. Chemistry of primer synthesis. Hybridization methods-Probes – Labelling of probes- Radioactive and non-radioactive probes - Detection techniques, Southern hybridization, Northern hybridization, Western blotting, DNA Sequencing methods-Sanger's method of DNA sequencing – Manual and automated methods. Pyrosequencing – massively parallel 454- sequencing, Illumina sequencing, Solid sequencing, single molecule sequencing. Protein Sequencing Methods-Electrophoresis of protein – native and denaturing conditions, capillary and gel electrophoresis, 2D gel electrophoresis, ELISA, yeast hybrid system – one hybrid system – two hybrid system, phage display.

Unit II Molecular tools for Gene Cloning (9 lectures)

Restriction enzymes – Introduction and types with examples, methylation sensitivity of restriction enzymes Dam, Dcm and CpG methylases, star activity of restriction enzymes, . modifying enzymes, DNA and RNA polymerases, reverse transcriptase, terminal transferase, DNA/RNA modifying enzymes-methylases-CpGmethylase (M. Sss I), dam methylase, M.EcoRI, Introduction to cloning vectors, plasmid biology, plasmid vectors (high copy and low copy), phage biology, phage vectors, cosmid vectors, phasmid vectors, BAC vectors and YAC vectors, yeast vectors. Construction of Gene Libraries-Construction of cDNA library-

construction subtractive cDNA library – construction of genomic DNA library – BAC library – YAC library.

UNIT III Cloning Techniques (9 lectures)

RFLP, DNA fingerprinting and footprinting, chromosome walking, marker techniques

Gene cloning strategies, cloning in bacteria other than E Coli, Cloning in Saccharomyces cerevisiae and other fungi, Gene transfer to animal cells, Genetic manipulation of animal Cloning after restriction digestion - blunt and cohesive end ligation – creation of restriction sites by PCR- cloning using linkers and adapters - cloning after homopolymer tailing. Cloning Technologies Strategies for cloning PCR products – TA cloning -TOPO-TA cloning- Ligation free cloning. Bio Brick cloning, Restriction Enzyme Cloning, Gateway recombination cloning, Topo cloning / TA, Gibson Assembly, Type II S Assembly, Global Gate/Moc, Ligation independent cloning, Peast mediated cloning & oligonucleotide stitching, PCR cloning, Seamless cloning, Recombinational cloning, Gateway cloning, Infusion cloning, BI/ multi- cistronic Cloning.

UNIT IV Expression methods & Synthetic Biology (9 lectures)

Basics of Gene expression – hybridization techniques, Northern blot analysis, Primer extension, S1 mapping, RNAase protection assays, Reporter assays), Nucleic acid microarrays. Gene expression in bacteria and Yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants – characterization of recombinant proteins, stabilization of proteins; Phage display, Yeast Two- and three Hybrid system.

Expression of Recombinant Proteins-Construction of expression vectors for bacteria and yeast Construction of expression vectors for plants and animal cells. Bias in codon use and codon optimization.

Methods of Plant Transformation-Biology of Agrobacterium tumefaciens- plant transformation methods - stable and transient -Agrobacterium-mediated, biolistic, PEG/ liposome-mediated, electroporation, chloroplast transformation, protoplast transformation, site directed integration of transgene (zinc finger).

Plant Transformation Vectors-Binary and co-integrate vectors- gateway vectors - promoters - selectable and screen-able markers - marker free transgenics -significance and applications.

Noise in gene expression: Origin, propagation, consequences, and control, Robustness and evolvability of genetic networks, Bacterial circuits: Toggle switch and repressilator Instructor out of town, Bacterial circuits: Feedback, feed-forward, signal propagators, and band filter, Bacterial communication circuits: Population control and patterning systems, Bacterial communication circuits: Synchronized oscillators, Functional synthetic systems: From modules to systems, Gene circuit design and engineering: Bio bricks/Bio FAB and designing software's, Synthetic circuits beyond bacteria: Phage, virus, and eukaryotes

UNIT V Advance Gene Technologies & RNA Engineering (9 lectures)

Genome-Editing Technologies: Principles and Applications, RNA Interference: Biology, Mechanism, and Applications, Genome editing with engineered zinc finger nucleases, CRISPR-Cas: biology, mechanisms and relevance, TALEN Genome-Editing System, Mega nucleases,

Introduction-- Amplify aptamer-encoding DNA, SELEX I: Building a Library-Purify aptamer- encoding DNA, SELEX II: Selecting RNA with target functionality-Prepare RNA by IVT, SELEX III: Technical advances & problem-solving--Purify RNA and run affinity column, Characterizing aptamers--RNA to DNA by RT-PCR, Introduction to porphyrins: chemistry & biology--, Aptamer applications in biology & technology--Aptamer binding assay, Aptamers as therapeutics Introduction--Start-up biomaterials engineering, Introduction to biomaterials; cartilage composition--Initiate cell culture.

Suggested Reading/ Reference Books/ Textbook

1. Principles of Gene Manipulation and Genomics (link is external) – 7thEdition – Sandy B. Primrose, Richard Twyman – Blackwell Publishing
2. Gene Cloning and DNA Analysis: An Introduction (link is external) - 6th Edition - T. A. Brown - John Wiley & Sons
3. An Introduction to Genetic Engineering (link is external) - 3rd Edition - Desmond S. T.Nicholl - Cambridge University Press
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA (link is external)- 4th Edition - Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten - ASM Press.
5. Synthetic Biology: Tools and Application by Huimin Zhao
6. Bioengineering: A conceptual Approache by Mirjana Pavlovic
7. Synthetic biology: a lab manual by *Liljeruhm, Josefine; Gullberg, Erik; Forster, Anthony C.*
8. Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits, Chapman & Hall/CRC (2006).

9. Eric Davidson, The Regulatory Genome: Gene Regulatory Networks In Development And Evolution, Academic Press (2006).

10. Hamid Bolouri, Computational Modeling of Gene Regulatory Networks - A Primer, Imperial College Press (1st edition) (2008).

11. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular Biology of the Cell, Garland Science (4th edition) (2002).

12. Robert Brooks Phillips, Jane Kondev and Julie Theriot, Physical Biology of the Cell, Garl and Science (1st edition) (2008).

13. Mark Ptashne and Alexander Gann, Genes and Signals, Cold Spring Harbor Laboratory Press (1st edition) (2001)

GENOMICS & BIOINFORMATICS

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** M.Sc. Micro/Virology (PG)

Course Unit Code: MMMML112 **Course Title:** Genomics & Bioinformatics

Credits allocated 3+0 (3Theory+0 Practical) **Level of Study:** PG

Mode of Delivery, Planned Learning Activities and Teaching Method: Lecture 3 hrs weekly

Recommended Year /Semester: 1 Year / Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and adviser and acceptance by the principal. The approved courses must be mentioned in the roster form. Candidates should pass in post graduate life science.

Learning outcome

On completion of the course, the student should be able to:

1. Access and browse a range of structural data repositories
2. Explain the relationship between protein sequence and protein structure
3. Describe how structure translates into function within different biological fields such as catalysis, transport and regulation
4. Estimate the validity of information in macromolecular structure databases, and use computer programs to visualize and analyze macromolecular structures from a functional perspective
5. Use bioinformatics tools for sequence alignment, sequence motif identification and prediction of secondary and tertiary structures.

Objectives:

Structural biology, determining the three-dimensional shape of a protein, can tell us a lot about how a protein functions and the role it plays within a cell. Bioinformatics data derived from structural determination experiments can aid biological researchers asking a wide variety of questions. It aids the understanding of how DNA mutations might alter a protein's shape, disrupt a catalytic site, or alter the binding affinity of a pharmaceutical compound. This course explores bioinformatics data resources and tools for the interpretation and exploitation of bio-macromolecular structures. It will focus on how best to analyse available structural data to gain useful information given specific research contexts. The course content will investigate the impact of genetic variation on structure,

predicting protein structure and function, and exploring interactions with other macromolecules as well as with low-MW compounds. Participants will also have an opportunity to explore protein docking using HADDOCK.

This course will enable the students to:

The students shall obtain necessary skills to analyze and predict structural properties of biological macromolecules and complexes, which includes proteins and nucleic acids. Our students shall gain a good understanding of key concepts of structure and dynamics of biological assemblies at the atomic, molecular, and cellular level.

- understand the levels of structural organization of macromolecules and experimental methods of structure determination
- know the approaches for structure analysis
- acquire knowledge of various algorithms & methods of structure prediction
- Understand the principles of macromolecular interactions.

Detailed SyllabusTheory (45 lectures)

UNIT I (9 lectures)

Relation between sequence, structure and function. Structural basis for macromolecular dynamics, binding specificity and catalysis. Overview of biological databases, servers and information centers. Sequence comparisons. Basic macromolecular structure: three-dimensional structure, PDB coordinates, classification of proteins in structure families, programs for analysis and comparison of structures. Introduction to the theory of classification and comparison of sequences and extraction of common distinctive features (e.g,motifs). Sequence analysis for prediction of secondary and tertiary structures, and homology modeling of three-dimensional structures based on sequence data.

UNIT II (9 lectures)

Macromolecular Structure Protein - Primary, Secondary, Super secondary, Tertiary and Quaternary structure, Potential energy maps, Ramachandran map, Nucleic acid – DNA and RNA, Carbohydrates o Co-ordinate systems.

UNIT III (9 lectures)

Overview of experimental techniques to study macromolecular structures o Methods to study 3D structure: X-ray, NMR, Cryo-electron microscopy o Validation using Procheck, ProsaII.

UNIT IV (9 lectures)

Principles of protein folding and methods to study protein folding · Macromolecular interactions, Protein – Protein, Protein – Nucleic acids Protein – carbohydrates.

UNIT V (9 lectures)

Structure of Ribosome · Prediction of protein structure. secondary structure prediction methods. First, second and third generation methods. Tertiary structure prediction Homology modelling, fold recognition and ab initio methods.

- Public repositories of structural data: Protein Data Bank (PDB) and Electron Microscopy Data Bank (EMDB), and tools to search and analyse information in these repositories from PDBe (Protein Data Bank in Europe).
- Computational approaches to structure prediction: ModBase, Rosetta, PHYRE, Interactome 3D.
- Protein docking: HADDOCK.
- Impact of genetic variation on protein structure: Ensembl VEP, DBSeq, SAAPdb
- Protein analysis and classification: Pfam, CATH, SCOP, InterPro, PDBeFold, PDBePISA, Pro Function.
- Tools and resources for drug discovery: ChEMBL.

Suggested Reading/ Reference Books/ Textbooks

1. The Molecules of Life – Physical and Chemical Principles. First Edition, 2012. John Kuriyan, Boyana Konforti, and David Wemmer. Garland Science. Taylor & Francis.
2. Forbes Burkowski. Structural bioinformatics: An algorithmic approach. Publisher: CRC Press, 2009. ISBN: 9781584886839.
3. Introduction to Proteins – Structure, Function, and Motion. First Edition, 2011. Amit Kessel and Nir Ben-Tal. Chapman &Hall/CRC. Francis & Taylor Group.
4. Structural Bioinformatics, Vol. 44, Series: Methods of Biochemical Analysis; 2005.
5. Editor(s): Philip E. Bourne, Helge Weissig. Print ISBN: 9780471202004; Online ISBN: 9780471721208; DOI: 10.1002/0471721204
6. Drenth Jan. Principles of Protein X-Ray Crystallography. Publisher: Netherlands, Springer Science. 2007. ISBN: 9780387333342.
7. Bourne Philip E., Weissig Helge. Structural Bioinformatics (Methods of Biochemical Analysis, V. 44), 2003. Publisher: Wiley-Liss. ISBN: 0471202002.

8. Höltje Hans-Dieter, Sippl Wolfgang, Rognan Didier, Folkers Gerd. Molecular Modeling: Basic Principles and Applications. Publisher: New York, Wiley-VCH. 2003. ISBN: 3527305890.
9. Leach, Andrew. Molecular Modeling: Principles and Applications. Publisher: Prentice Hall. 2001. ISBN: 0582239338. · Friesner Richard A. Computational Methods for Protein Folding: advances in Chemical Physics Volume 120 Kindle Edition. Publisher: New York, John Wiley & Sons. 2002. ISBN: 0471209554.
10. Heilmeyer L., Friedrich P. Protein Modules in Cellular Signaling. Publisher: Amsterdam, IOS Press. 2001. ISBN: 1586031805.
11. Rhodes Gale.Crystallography Made Crystal Clear, Third Edition: A Guide for Users of Macromolecular Models. Publisher: USA, Academic Press 2000 ISBN: 0125870728.
12. Branden ,Tooze John. Introduction to Protein Structure. Publisher: New York, Garland Publishing Inc. 1999. ISBN: 0815323050.
13. Hill H.A.O. Sadler P.J., A.J. Ed. Metal Sites in Proteins and Models Redox Centres Publisher: New York, Springer 1999. ISBN: 3540655564.
14. Sternberg Michael J. E. Protein Structure Prediction: A Practical Approach. Publisher: USA, Oxford University Press. 1997. ISBN: 0199634953.
15. Fasman G.D.Prediction of Protein Structure and the Principles of Protein Conformation. Publisher: New York, Plenum Press. 1989 ISBN: 0306431319.
16. Creighton T. E. Editor. Protein Structure: A Practical Approach. Publisher: IRL Press at Oxford University Press. 1989. ISBN: 0199630011.

SYLLABUS STRUCTURE SHEET

Clinical And Diagnostic Microbiology

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMML113	**Course Unit Title:** Clinical and Diagnostic Microbiology
Credits allocated: 3+0 (3 Theory+0 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester: Microbiology and Virology -Masters of Science, Year 1/ Semester II **Prerequisites for registration:** Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form

Learning Outcomes: Upon successful completion, students will have the knowledge and skills to: Microbiology Laboratory Safety, Diagnostic cycle, Diagnosis of microbial diseases, Gastrointestinal Tract infections

Objective: The students will understand about the disease-causing microbes, various cellular processes during disease development and the relevance of microbes in vaccine develop. **Detailed syllabus (45 lectures)**

UNIT I (9 Lectures)

Microbiology Laboratory Safety -General Safety Principles, Handling of Biologic Hazards, Disposal of Infectious waste, Biomedical waste management, infection control practice, emerging and reemerging infections.

UNIT II (9 Lectures)

Diagnostic cycle, General concept of specimen collection, transport, processing and rejection of clinical specimens. Mailing of biohazardous materials.

UNIT III (9 Lectures)

Diagnosis of microbial diseases - Clinical, microbiological, immunological and molecular diagnosis of microbial diseases. Modern methods of microbial diagnosis. Automation in Microbiology; Laboratory control of antimicrobial therapy; Immuno prophylaxis

UNIT IV (9 Lectures)

Normal microbial flora of the human body. Etiological agents and approach to diagnosis of Bloodstream infections, Respiratory tract infections, Meningitis, Urinary tract infections, Genital Tract infections, sexually transmitted diseases, Skin and Soft tissue infections, Nosocomial infections – common types, Sources, reservoir and mode of transmission, and Measures to control

UNIT V (9 Lectures)

Gastrointestinal Tract infections, Infections of sinuses, eye and ear. bone infections, Pyrexia of unknown origin and Zoonoses. Pyogenic infections. Infections in immunocompromised and immunodeficient patients. Infections in fetus and neonates

Suggested Readings:

1. Blair, J.E.e., Lennette, E.H.e., and Truant, J.P.e. (1970). Manual of clinical microbiology.
2. American Society for Microbiology, Bethesda, Md.
3. Gradwohl, R.B.H., Sonnenwirth, A.C., and Jarett, L. (1980).
Gradwohl's clinical laboratory methods and diagnosis. Mosby,
London.8th ed 53
4. Lennette, E.H., Balows, A., Hausler, W.J., and Shadomy, H.J. (1985).
Manual of clinical microbiology. American Society for Microbiology,
Washington, D.C. 4th ed.
5. Topley, W.W.C., Wilson, G.S.S., Parker, T., and Collier, L.H. (1990b). Topley and
6. Wilson's principles of bacteriology, virology and immunology. Edward Arnold,8th ed
7. Mukherjee, K.L. (2010) Medical Laboratory Technology. Tata McGraw-Hill Education.2nd ed.
8. Sood, R. 1999. Medical Laboratory Technology - Methods and Interpretations.
Jaypee Brothers Medical Publishers (P) Ltd. New Delhi. 5th ed.
9. Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries.
Cambridge University Press.2nd ed.
10. Mackie, T.J., McCartney, J.E., and Colle, J.G. (1989). Mackie & McCartney
practical medical microbiology. Churchill Livingstone, 13th ed
11. Black, J.G. (1999). Microbiology: principles and explorations. Prentice Hall
International, London. 4th ed.
12. Kindt, T.J., Goldsby, R.A., Osborne, B.A., and Kuby, J. (2006).
Kubyimmunology.W.H. Freeman, New York. 6th ed.
13. Forbes, B.A., Sahm, D.F., Weissfeld, A.S., and Bailey, W.R.D. m. (2007). Bailey &
Scott's diagnostic microbiology. Elsevier, Mosby, London. 12th ed.

SYLLABUS STRUCTURE SHEET

Microbial Lab

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** M.Sc. Microbiology/Virology
Course Unit Code: MMMEP114	**Course Unit Title:** Microbial Lab.
Credits allocated: 0+2 (0 Theory+2 Practical)	**Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidate should pass in under graduate life science

Learning Objective:

Students will gain: Understanding of fundamental concepts in microbial genetics. Insight into genetic methods used to investigate interesting biological problems. Insight into current, exciting topics in microbial genetics and related fields. Experience in reading and evaluating scientific articles.

Objective:

To provide 'hands-on' experience in the investigation and manipulation of microorganisms and their genes. To develop the ability to think critically and devise genetic strategies that might be used to address interesting biological problems.

Practical

1. Isolation of cyanobacteria
2. Isolation of algae
3. Study the role of algae in Nitrogen fixation/ P solubilization
4. Study the role of cynobacteria in Nitrogen fixation/ P solubilization
5. Biocontrol of bacteria or fungi using algae
6. Biocontrol of bacteria or fungi using cynobacteria
7. Role of cyanobacteria as biofertilizer
8. Role of cynobacteria as PGPr
9. Chemical agents of control: Evaluation of anticeptics by filter disc method

10. Chemical agents of control: Evaluation of Disinfectants (Phenol Coefficient)
11. Measurement of fungi
12. Normal Microflora of skin
13. Microbial examination of food
14. Role of yeast in bread making
15. Isolation of lipolytic microorganism from butter
16. Production of sauerkraut by microorganisms
17. Detection of number of bacteria in milk by breed count.
18. Determination of quality of milk sample by methylene blue reduction test.
19. Detection of arsenic by microbiological methods
20. Alcoholic fermentation
21. Detection of food-borne pathogens
22. Isolation of plant pathogens
23. Research Paper reading

References:

1. Medical laboratory Manual II edition Mohamed a Dew
2. practical microbiology Maheshwari and Dubey
3. Microbiology A Laboratory Manual By James Cappuccino, Chad Welsh

INDUSTRIAL MICROBIOLOGY LAB

University: MGM University, Aurangabad **Faculty:** Basic & Applied Sciences

Institute: Institute of Biosciences and Tech. **Degree:** Industrial Microbiology

(PG) **Course Unit Code:** MMMEP115 **Course Unit Title:** Industrial Microbiology lab

Credits allocated: 0+2 (0 Theory+ 2 Practical) **Level of Study:** PG

Mode of delivery, planned learning activities and teaching method: Practical 4 hrs weekly.

Recommended Year /Semester: Industrial Microbiology, Year I/ Semester II

Learning Objective:

Industrial microbiology includes the use of microorganisms to manufacture food or industrial products in large quantities. Numerous microorganisms are used within industrial.

Objective:

Describe how microorganisms are used in industry to manufacture food or products in large quantities Key Points The ability of specific microorganisms to produce specialized enzymes and proteins has been exploited for many purposes in industry.

Practical List:

1. Culturing of industrial important microorganisms.
2. Biochemical characterization of Microorganism.
3. Production of red and white wine from grapes.
4. Production of citric acid using *A. Niger*.
5. Characterization of citric acid.
6. Isolation of amylase producing bacteria from soil.
7. Production of Amylase.
8. Ethanol production using various Organic wastes or raw materials.
9. Production of bread and yogurt.
10. Production of cheese.
11. Screening of antibiotics producing microorganisms from soil.
12. Production of penicillin.
13. Microbial production of hydrogen gas by algae /bacteria.
14. Microbial production of xanthan.
15. Microbial production of dextran by *Leuconostoc mesenteroides.*

16. Microbial biomass production (fungi/bacteria/yeast) by batch culture.
17. Microbial biomass production (fungi/bacteria/yeast) by continuous culture.
18. To compare production of citric acid using sucrose and molasses as carbon source.
19. Production of lactic acid using cheese whey as substrate.
20. Production of extracellular enzymes (e.g. amylases, proteases, xylanases) by thermophilic and mesophilic fungal culture.
21. Antimicrobial Susceptibity test method. Dilution & Disk diffusion method.
22. Special pherotypical methods of detecting antibacterial resistance.
23. Susceptibility testing by liquid media methods.
24. Assay of Vitamin Using Bacterial Method
25. Detection of microbes for pesticide degradation.
26. Demonstration of biogas production.
27. Production of biocontrol agents for plant pthogens
28. Research Paper reading
29. Industrial visit

Reference:

1. Manual of Industrial Microbiology and Biotechnology Alan T. Bull, Beth Junker, Leonard Katz, Lee R. Lynd, Prakash Masurekar, Christopher D. Reeves, Huimin Zhao in 2010.
2. Manual of Industrial Microbiology Arnold L. Demain, Nadine A. Solomon American Society for Microbiology, 1986

SYLLABUS STRUCTURE SHEET

Genomics and Diagnosis Lab

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree: M.Sc.** M.Sc. Microbiology/Virology

Course Unit Code: MMMEP116 **Course Unit Title:** Diagnosis Lab.

Credits allocated: 0+2(0 Theory+2 Practical) **Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Candidates should pass in under graduate life science.

Learning outcome:

1. To familiarize students with molecular diagnostic technologies,
2. To increase students' intuition and understanding of computational methods used to analyze diagnostic data, and to build students' abilities to interpret molecular diagnostic

Objective:

The main objective of this laboratory is to provide an efficient and rapid tool to sequence microbial genomes, mainly bacterial, and to provide key information on strains relatedness (typing), virulence factors (virulome) and/or resistance to antibiotics (resistome) within a few days.

List of Practical:

1. Preparation and pouring of media – Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Kligler iron agar, Robertson's cooked meat.
2. Bioassay of chloramphenicol by plate assay method or turbidimetric Assay method.
3. To determine MIC, LD 50 of Beta-lactam/aminoglycoside/ tetracycline/ansamycins.
4. Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations).
5. Determination of antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardized

experimental conditions.

6. Testing for antibiotic resistance /sensitivity
7. Microbiological investigations such as Blood, Urine.
8. Collection and Microbiological investigations such as Throat swab, Rectal swab, Stool, Pus, OT specimens.
9. Testing of antibacterial activity of skin- *Micrococcus luteus, Serratia marcescens*
10. Study of normal microbial flora of human beings
11. Study of coagulase tests.
12. Study of *S.aureus , S.typhi*
13. Antigen Antibody agglutination test
14. Detection of sugar from urine sample
15. Detection of albumin from urine sample
16. Estimation of hemoglobin (Hb) by Sahil's haemoglobinometer
17. Identification of unknown fungus
18. Diagnostic Tests for Some Fungal Pathogens.
19. Diagnostic tests for some common diseases, Widal, malarial parasite
20. Determination of minimum inhibitory concentration.
21. To isolate the genomic DNA from *E. coli*
22. Plasmid DNA Isolation using alkaline lysis method.
23. RNA Isolation
24. Fungi DNA isolation
25. Isolation of DNA from yeast.
26. Preparation of competent cells by calcium chloride method.
27. To study and perform polymerase chain reactions.
28. Perform transformation, transduction and conjugation methods.
29. Research Paper Reading

References:

1. Medical laboratory Manual II edition Mohamaed a Dew
2. practical microbiology Maheshwari and Dubey
3. Microbiology A Laboratory Manual by James Cappuccino, Chad Welsh
4. Pharmaceutical Microbiology A Laboratory Manual by G Shyam Prasad, Srisailam K
5. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology by K. R. Aneja
6. Lab manual basic biotechnology Verma and Das

SYLLABUS STRUCTURE SHEET

Bioinformatics Lab

University: MGM University, Aurangabad **Faculty:** Basic & Applied Science

Institute: Institute of Biosciences and Tech. **Degree: M.Sc.** M.Sc. Microbiology/Virology

Course Unit Code: MMMEP117 **Course Unit Title:** Bioinformatics lab

Credits allocated: 0+2(0 Theory+2 Practical) **Level of Study: PG**

Mode of delivery planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: M.Sc. Microbiology / Virology, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.
Candidates should pass in under graduate life science.

Learning outcome:

Be able to differentiate a nucleotide sequence from an ammino acid sequence. Understand what is the purpose of the software. Interpret and analyze graphics. Using simple computers and computer clusters to archive and analyze biological data.

Objective:

Appreciate the number and diversity of genomes and sequences stored in the NCBI databases. Use BLAST etc. To identify an organism through sequence comparison. Construct a phylogenetic tree using nucleotide sequences. Use MEGA to align protein sequences and develop a gene phylogeny.

Practical List:

1. Bioinformatics in microbiology and industrial biology
2. Introduction to metagenomics
3. Introduction to metatranscriptomics
4. Introduction to metabolomics
5. Microbial sequence retrieval
6. Microbial databases
7. Sequence alignment
8. Microbial phylogeny
9. Sequence quality checking
10. Motif identification
11. Domain and family identification

12. Family identification
13. Understanding microbial gene mapping
14. Understanding microbial gene expression
15. Understanding microbial taxonomic information
16. Diversity analysis
17. Sequence quality checking
18. Diversity analysis
19. Molecular modelling
20. Computer aided drug design
21. Industrial application of microbial- bioinformatics
22. Functional classification of microbes.

Reference:

1. Bioinformatics: Sequence and Genome Analysis, Second Edition (Mount, Bioinformatics) 2nd Edition by David W. Mount.
2. Introduction to Bioinformatics Practical Manual by Dr M K Tripathi, Ajay Gautam, Dr Sushma Tiwari.
3. Bioinformatics for Beginners Laboratory Manual by Dr. M.S. Vijaya Dr.S.C. Punitha Dr. S. Karpagavalli.

SYLLABUS STRUCTURE SHEET

Micro Project

University: MGM University, Aurangabad
Faculty: Basic & Applied Science
Institute: Institute of Biosciences and Tech.
Degree: M.Sc. M.Sc. Microbiology/Virology
Course Unit Code: MMMMJ118
Course Unit Title: Micro Project
Credits allocated: 0+2(0 Theory+2 Practical)
Level of Study: PG

Mode of delivery planned learning activities and teaching method: Practical 6 hrs/ weekly

Recommended Year /Semester: M.Sc. Microbiology/Virology, Year 1/Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Learning Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Objective:

A project objective states the desired results of a project at its outset, including goals and deliverables. An objective should be specific and measurable, and identify any time, budget, and quality constraints.

Thrust Area of Project:

1. Antimicrobial resistance
2. Host Microbe interactions (Plants, Animals, Humans, etc)
3. Microbial genomics
4. Microbial analysis
5. Bioremediation
6. Microbial ecology
7. Bioprospecting (Biofuel, Biofertilizer, etc)
8. Microbial pathogenesis
9. mRNA technology
10. Synthetic biology
11. Cyanobacterial and algal biotechnology.

FIELD PROJECT

University: MGM University, Aurangabad	**Faculty:** Basic & Applied Science
Institute: Institute of Biosciences and Tech.	**Degree: M.Sc.** Microbiology / Virology (PG
Course Unit Code: MMFPJ119	**Course Unit Title:** Field Project
Credits allocated: 0+4 (Practical)	**Level of Study: PG**

Mode of delivery, planned learning activities and teaching method: Practical 4 hrs / weekly.

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form. Candidates should pass in undergraduate Life Science.

Learning Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Objective:

Project objectives are what you plan to achieve by the end of your project. This might include deliverables and assets, or more intangible objectives like increasing productivity or motivation. Your project objectives should be attainable, time-bound, specific goals you can measure at the end of your project.

Thrust Area of Project:

1. Antimicrobial resistance
2. Host Microbe interactions (Plants, Animals, Humans, etc)
3. Microbial genomics
4. Microbial analysis
5. Bioremediation
6. Microbial ecology
7. Bioprospecting (Biofuel, Biofertilizer, etc)
8. Microbial pathogenesis
9. mRNA technology

10. Synthetic biology

11. Cyanobacterial and algal biotechnology