



MGM UNIVERSITY, AURANGABAD

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE-BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN

Faculty of Basic and Applied Sciences Graduate (UG) Program

Microbiology - CURRICULUM

W.e.f. Academic Year 2023-24

B.Sc., B. Sc. (Hons.), B. Sc. (Hons.) with Research of Microbiology

SEMESTER (I,II)

**Prepared By
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**Submitted By
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**Approved By
Board of Studies**

B.Sc., B. Sc. (Hons.), B. Sc. (Hons.) with Research of Microbiology

CURRICULUM

Academic Year 2023-24

B.Sc., B. Sc. (Hons.), B. Sc. (Hons.) with Research of Microbiology

FIRST YEAR

(SEMESTER I)

MGM University
Chhatrapati Sambhajnagar– 431003
(Template format as per discussion at 14/05/2023)

Name of the College/Institute: Institute of Biosciences and Technology

Faculty of Basic and Applied Sciences

Name of the Program : **(4 Years UG programme)B.Sc. (Hons. Hons with Research) Microbiology**

First Year (Semester I)																				
Level	Course Type	Course code	Course Title	Type	Teaching period per week (Hrs /week)			Credits	Duration of exam	Evaluation Scheme (Marks)							Minimum Passing (Marks)			
										Internal				External		Total	Internal		External	Total
										CA-I	MSE	CA-II	T W	ESE	PR		CA/MSE/TW	ESE	PR	
4.5	Core	BMMML101	Biochemistry the building block of Life	Theory	2			2		10	10	10	-	20	-	50		08		20
	Core	BMMML102	Microbial Structure, Identification and Distribution	Theory	3		-	3		20	20	20	-	40	-	100		16		40
	IKS		Annexure I	Theory	2		-	2		10	10	10	-	20	-	50		08	-	20
	AEC		Communicative English	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
	OE	BMOEL103	Open Elective I	Theory	2		-	2		10	10	10	-	20	-	50		08		20
	OE	BMOEL104	Open Elective II	Theory	2		-	2		10	10	10	-	20	-	50		08		20
	VSC	BMVSP105	Micro Lab I	Practical			4	2					30	-	20	50			08	20
	SEC	BMSEP106	Microbiology: Principle and Exploration-I	Practical			4	2					30	20	-	50			08	20
	VEC		Annexure I	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
	Core	BBMMP107	Micro building Block Lab	Practical	-	-	2	1					30	-	20	50			08	20
	CC		Annexure I	Practical		-	4	2					30	-	20	50			08	20
			Total (L-T-P) Hrs / week = 29		15		14	22												

Program Type: UG/PG/Integrated Masters Program/Diploma/Certificate -**UG**

Duration: - 04 Years (08 Semesters)

BMMML101

Biochemistry- The Building Blocks of Life

University: MGM University, Chh. Sambhajinagar **Faculty:** Basic and Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc. Microbiology (4yr. Hon./hons. With Res.)

Course Unit Code: BMMML101

Course Title: Biochemistry- The Building Blocks of Life

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

Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs / weekly

Recommended Year /Semester: Year I/ 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.

Course Objectives:

Develop in students the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in biochemistry.

Objectives of studying Biomolecules and Bioenergetics, that is, to analyze, appreciate, understand the basic concepts of chemical reactions that occur in living systems, which enable them to understand the various perspectives of applied sciences that benefit mankind.

Course outcomes:

Demonstrate knowledge and understanding of the molecular machinery of living cells; demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition; demonstrate knowledge and understanding of the principles and basic mechanisms of metabolic control and molecular signaling; use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments;

Detailed Syllabus: (30 Lectures)

Unit I: Biomolecules in their cellular environment (6 lecture)

The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in bio molecular structure. Major classes of biomolecules. Role of water in design of biomolecules.

Unit II: Bioenergetics: (8 lecture)

Thermodynamics –First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & exergonic reactions. Standard state free energy changes-DG, DG⁰ and DG^{’0}, Relationship between equilibrium constant and DG^{’0}, Feasibility of reactions. Simple problems, ATP-Structure, properties and energy currency of the cell, Introduction to Metabolism - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways.

Unit III: Amino acids, peptides, Sugars and polysaccharides (8 lecture)

Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides. Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides- their distribution and biological role. Carbohydrate Metabolism: Introduction, Aerobic and anaerobic pathways: Glycolysis, TCA cycle, Electron Transport chain, Oxidative phosphorylation, & production of ATP

Unit IV: Nucleosides, nucleotides and nucleic acids (8 lecture)

Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides. Amino Acid/ Nucleic Acid
Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments. Occurrence and nutritional role. Lipid Metabolism: Beta – oxidations of saturated & unsaturated fatty acids. Ketone bodies, production during starving and diabetes Biosynthesis of fatty acids .

Reference:

1. Lehninger, Nelson and Cox, Principles of Biochemistry, 4th Edition, W.H. Freeman Company, 2004.
2. Fundamentals of Biochemistry, Upgrade Edition, Wiley, 2002.
3. Lubert Stryer, Biochemistry, 4th Edition, W.H. Freeman

Text Book:

1. Prentice Hall Science: Test book, Prentice-Hall, Inc, Prentice Hall, 1993
2. Building Blocks of Tabletop Game Design: An Encyclopedia of Mechanisms 1st Edition by Geoffrey Engelstein , Isaac Shalev

BMMML102 Microbial structure, identification, & Distribution

University: MGM University, Chh. Sambhajinagar **Faculty:** Basic and Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc. Microbiology (4yr Hon. /hons. With Res.)

Course Unit Code: BMMML102

Course Title: Microbial structure, identification, & Distribution

Credits allocated: 3 (3 Theory+0 Practical)

Level of Study: UG

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

Recommended Year /Semester: Year I/ 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.

Course Objectives:

To study the Basic concepts of microbiology & microorganisms.

Course Outcomes:

By the conclusion of this course, the students –

Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory. Are able to explain the useful and harmful activities of the microorganisms. Are able to perform basic experiments to grow and study microorganisms in the laboratory.

Detailed Syllabus:

(45 lecture)

Unit 1 Prokaryotic and Eukaryotic cell (07 lecture)

Prokaryotic and Eukaryotic cell differential account, Binomial nomenclature concept, Whittaker's five kingdom system, Carl woese's three kingdom system, Baltimore classification.

Unit 2 General characters, Bacterial cell – organization and structure (11 lecture)

General characters of Bacteria, Fungi, algae, actinomycetes, mycoplasma, rickettsia, archaea, protozoa. Morphology of acellular microorganisms (Viruses, Viroids, Prions).

Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Difference between gram positive and gram-negative cell walls, Cell membrane,

Ribosomes, mesosomes, chromosome, plasmids and endospore: structure and stages of sporulation. Archaeobacterial cell wall and acid fast bacterial cell wall,

Unit 3 Methods of studying microorganism (11 lecture)

Methods of studying microorganism; Staining techniques: simple staining, Gram staining and acid-fast staining. Sterilization techniques (physical & chemical sterilization). Culture media & conditions for microbial growth. Growth curve of bacteria. Pure culture isolation: Streaking, serial dilution and plating methods. Maintenance and preservation of pure cultures.

Unit4 Identification and Bacterial diversity (08 lecture)

Classification of bacteria according to the Bergey's Manual of Systematic Bacteriology. Numerical taxonomy. Modern methods of studying bacterial diversity.

Unit 5 Role of microbes (08 lecture)

Role of microorganisms in different fields such as agriculture, human health, industry, food processing.

Reference

1. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
2. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
3. Alcom, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).
4. Black J.G. Microbiology-Principles And Explorations. John Wiley & Sons Inc. New York, (2002).
5. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.

Text Book:

1. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication
2. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.
3. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.
4. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson 10.
Tom Besty, D.C Jim Koegh. Microbiology Demystified McGRAW-HILL

BMVSP105**Micro Lab-I****University:** MGM University, Aurangabad**Faculty:** Basic and Applied**Science Institute:** Institute of Biosciences and Tech. **Degree:** B.Sc. Microbiology (4yr Hon./hons. With Res.)**Course Unit Code:** BMVSP105**Course Unit Title:** Micro Lab-I**Credits allocated:** 0+2 (Practical)**Level of Study:** UG**Mode of delivery, planned learning activities and teaching method:** Practical 4 hrs / weekly**Recommended Year /Semester:** Year I/ 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.**Course 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.

Thrust Area :

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

- **Ideas of Lab:**

Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

- **Literature survey:**

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

1.Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2.Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3.Lab Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

BMSEP106 Microbiology: Principle and Exploration-I

University: MGM University, Chh. Sambhajinagar **Faculty:** Basic and Applied Science

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc. Microbiology (4yr Hon./hons. With Res.)

Course Unit Code: BMSEP106

Course Title: Microbiology: Principle and Exploration-I

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

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

Recommended Year /Semester: Year I/ 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.

Course Objectives:

To introduce various microorganisms, present in the environment and acquaint with common equipment used in routine microbiology laboratory

Course Outcomes

As an outcome of completing the course, students will be able to gain knowledge about, Microorganism Understanding of Principles of microbiology. Identify multidisciplinary approaches required in solving a society problem. Understanding of commercial microbiology. Use the basics of science project management skills in doing projects.

Demonstrate data analysis skills using a tool. Analyze microbial solutions from an ethical perspective.

Practical list:

1. To Study Various Instruments with its principle and application. (Autoclave, Laminar air flow chamber, Incubator, hot air oven, microscope, etc.)
2. To Study Aseptic Techniques in Lab.
3. To Study different types of glassware.
4. To prepare Bacterial media.
5. To prepare Fungal and actinomycetes media.
6. To isolation and enumeration of microorganisms from soil using serial dilution method.

7. To perform various plating methods
8. To perform streaking methods
9. Subculturing, broth cultures, maintenance of pure cultures.
10. To study storage and preservation techniques.
11. simple Staining technique for bacteria.
12. Slide culture technique for studying morphology of mold/fungi
13. Cover slip culture technique for preparing permanent fungi mount.
14. Microscopic examination of free-living protozoa from pond
15. Microscopic examination of algae/ cyanobacteria.
16. Preparation of selective media for *E. coli*
17. To perform IMViC test
18. Preparation of selective media for *Salmonella* and *Shigella*.
19. Preparation of selective media for *Staphylococcus aureus*
20. Demonstration of selective and differential media.
21. To study the growth of *Aspergillus Niger* using onion peel
22. Isolation of *Rhizobium* species.
23. Isolation of cyanobacteria
24. To study a research paper.

BBMMP107 Micro Building Block lab

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

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc. Microbiology (4yr. Hon./hons. With Res.)

Course Unit Code: BBMMP107 **Course Unit Title:** Micro building Block lab

Credits allocated: 1 (0 Theory +2 Practical) **Level of Study:** UG

Mode of delivery, planned learning activities and teaching method:

Recommended Year /Semester: Year 1/ Semester I

Subject Name: Micro building Block lab

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.

Course Objectives:

To provide overview of biology of microorganisms

To develop the understanding of microbial taxonomy and introduction to diversity To understand and perform the techniques of micro lab.

Course outcome:

To understand the biology of bacteria

Understanding of basic concepts of microbiology lab

An overview of physical and chemical methods in microbiology Mode of Teaching: Practical

Practical List:

1. of bacteria from soil/water/Air using serial dilution method.
2. Isolation and enumeration fungi from soil/water/Air using serial dilution method.
3. Counting of bacterial population by the use of spectrophotometer.
4. To study morphology of fungi and microscopic study
5. To study gram staining
6. To study acid fast staining
7. To study endospore staining
8. To study cell wall staining

9. To study capsule staining
10. To study motility of bacteria using hanging drop technique.
11. Growth curve of bacteria
12. To perform yeast demonstration using sugar
13. Physical agent of control: moist heat, dry heat and UV radiations
14. Chemical agents of control: evaluations of antiseptics/alcohol/
15. Chemical agents of control: evaluations of disinfectants (Phenol Coefficient)
16. To perform Benedict's test for carbohydrate
17. To perform a Biuret test for protein.
18. To study Lowry's test for protein.
19. To perform Fehling's test for Carbohydrate.
20. Study research Paper

Reference:

1. Microbiology laboratory manual second edition revised pattern by Gayne Bablanian – Jainine Payne.
2. Microbiological edition practical edition by Amita Jain.

BMMML108 Microbial Physiology and Metabolism

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

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc. (Hons) Microbiology

Course Unit Code: BMMML108

Course Unit Title: Microbial Physiology and Metabolism

Credits allocated: 2 (2 Theory+0 Practical)

Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs / weekly

Recommended Year /Semester: Year I/ 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.

Course Objectives:

To study the concepts of Physiology of microbes and their metabolism

Course Outcomes:

Students have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. Have developed a very good understanding of the characteristics of physiology of microbes, environment factors which affect growth of microbes, respiration and photosynthesis.

Detail Syllabus (30 lecture)

Unit I: Microbial Growth and Effect of Environment on Microbial Growth (8 lecture)

Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve
Microbial growth in response to environment –Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophilic. Microbial growth in response to nutrition and energy – Autotroph/Phototroph, heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photoorganoheterotroph.

Unit II: Nutrient uptake and Transport (5 lecture)

Passive and facilitated diffusion Primary and secondary active transport, concept of uniport, symport and antiport, Group translocation.

Unit III: Chemo heterotrophic Metabolism – Aerobic Respiration (7 lecture)

Concept of aerobic respiration. EMP, ED, Pentose phosphate pathway, TCA cycle, Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC.

Unit IV: Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation (10 lecture)

Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction); Fermentation - Alcohol fermentation. Lactate fermentation (homofermentative and heterofermentative pathways). Introduction to phototrophic metabolism: an Overview - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria. Nitrogen metabolism an overview.

Reference Books:

1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
3. Stanier RY, Ingram JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, MacMillan Press.
4. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition Prentice Hall International Inc.
5. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
6. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
7. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

Text Book:

1. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India

BMMML109 Biology Concept and Connection Investigation and Application

University: MGM University, Aurangabad

Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech.

Degree B.Sc (Hons) Microbiology

Course Unit Code: BMMML109

Course title: Biology Concept, Connection Investigation and Application

Credits allocated: 3 (3 Theory+0 Practical)

Level of Study: UG

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

Recommended Year /Semester: Microbiology, Year I/ 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.

Course Objectives:

To familiarize students with the Biology concept. structure of genetic material, organization of genes, genetic code and mechanisms involved in the expression of genetic material in final functional form.

Course outcome

Students will acquire knowledge about biology concept

Detail Syllabus: (45 Lectures)

UNIT 1 Eukaryotic and prokaryotic cell

(9 lecture)

Eukaryotic and prokaryotic cell, organelle structure and functions, Integrated cellular functions, Apoptosis and natural cell death.

Brief account on plant and animal cells. Viruses – structure and features, types of viruses

Building blocks of cell

CARBOHYDRATES- nomenclature, structure and functions, monosaccharides, disaccharides, polysaccharides, homopolysaccharides, hetero polysaccharides, Glycoproteins

LIPIDS- Classification and functions; Fatty Acids- even-odd, saturated and unsaturated, length, nomenclature, TAGs, Phospholipids, Steroids, lipoprotein, Cholesterol; Amphipathic lipids, Soaps and detergents.

UNIT 2 Nucleic Acid

(9 lecture)

NUCLEIC ACID- Nucleotides, structure and nomenclature, DNA structure, different forms of DNA, measurement units. Denaturation, T_m value, melting point and renaturation.

Structure of RNA and its types, role of different RNA, Ribozymes.

UNIT 3 PROTEINS- functions & its chemical nature

(9 lecture)

PROTEINS- functions chemical nature; Amino acid structure and properties, peptide bond, Levels of protein structure- primary, secondary (alpha helix and beta structures), tertiary and quaternary structure. Other bonds in protein structure, examples. Properties of proteins and their classification, Protein denaturation, Determination of protein structure, Isolation and purification of proteins.

UNIT 4 Enzymes

(9 lecture)

ENZYMES- Historical events in discovery, nomenclature and classification, properties, Enzyme activity, Factors affecting enzyme activity like concentration of substrate or enzyme or product, temperature, pH, Active center of enzymes, Enzyme inhibition, Coenzymes, Enzyme action.

UNIT 5 Techniques in RDT

(9 lecture)

TECHNIQUES in RDT, DNA isolation, RNA isolation, Protein isolation, gel electrophoresis,
Reference Books-

1. Biology: Concepts and Investigations, Mariëlle Hoefnagels, 2, illustrated
2. Biology: Concepts and Applications 10th Edition by Cecie Starr, Christine Evers, Lisa Starr

Text Book:

1. Biology: Concepts and Applications, Cecie Starr, Christine Evers, Lisa Starr
2. Biology Concepts And Investigations, Mariëlle Hoefnagels: McGraw-Hill Europe

BMVSP114**Micro Lab-II****University:** MGM University, Aurangabad**Faculty:** Basic and Applied Science**Institute :** Institute of Biosciences and Tech.**Degree:** B. Sc (4 year Hons/Hons.

With res.) Microbiology

Course Unit Code: BMVSP114**Course Unit Title :** Micro Lab-II**Credits allocated :** (0 Theory+ 4 Practical)**Level of Study :** UG **Recommended****Year /Semester :** Microbiology , Year I/ 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.**Thrust Area:**

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

• Ideas of lab:

Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.

- **Literature survey:**

A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. lab Log:

- a. The individual student's effort and commitment.
- b. The quality of the work produced by the individual student.
- c. The student's integration and co-operation with the rest of the group.
- d. The completeness of the logbook & time to time signature of guide

BMSEL115

Explorations in Microbiology -I

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

Institute: Institute of Biosciences and Tech. **Degree:** B.Sc (4 year Hons./Hons. With res.) Microbiology

Course Unit Code: BMSEL115

Course Title: Explorations in Microbiology -I

Credits allocated: 2 (2 Theory & Practical)

Level of Study : UG

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

Recommended Year /Semester: Microbiology, Year I/ 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.

Course Objectives:

To introduce various microorganisms present in the environment and acquaint with common equipment used in routine microbiology laboratory.

Course outcomes:

By the conclusion of this course, the students –

Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory. Are able to explain the useful and harmful activities of the microorganisms..

Are able to perform basic experiments to grow and study microorganisms in the

Practical list:

1. Isolation of Microorganism from soil.
2. Preservation of microbes.
3. Growth of microorganisms on various carbon sources.
4. Growth of microorganisms on various nitrogen sources.
5. Determination of growth rate of microorganisms.
6. Effect of pH on the growth of microorganisms.
7. Effect of temperature on the growth of microorganisms.
8. Effect of osmotic pressure on the growth of microorganisms.
9. Studies on aerobic respiration with suitable substrates.
10. Studies on anaerobic respiration with suitable substrates.
11. Studies on growth regulation by chemicals.
12. Studies on bacterial photosynthesis.
13. Nitrogen fixation
14. Studies on enzyme induction/assay in microorganisms.
15. Influence of metabolic intermediates on microbial growth and function.
16. Studies on different factors affecting growth and secondary metabolite production in microorganisms.
17. Use of P sources for studying P uptake by microorganisms.
18. Use of K sources for studying K uptake by microorganisms
19. Lethal effect of temperature on micro-organism(TDP)
20. Lethal effect of temperature on micro-organism(TDT)
21. Effect of Ph on micro-organism.
22. Effect of salt concentration
23. To study the protein hydrolysis test.
24. To study a research paper.

References:

- 1) .Atlas, R. M. (1997) Principles of Microbiology, 2nd edition, W.M.T.Brown Publishers, Dubuque, USA.
- 2) .Cappuccino J and Sherman N. (2010) Microbiology: A Laboratory Manual, 9th edition, Pearson Education Limited, New Delhi
- 3) .Parija S.C. (2005) Text Book of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi.
- 4) . Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
- 5) .Harley, J. P. and Prescott L. M. (2002) Laboratory Exercises in Microbiology, 5th edition, The McGraw-Hill Co., New York
- 6) . Benson H. (2001) Microbiological Applications Lab Manual, 8th edition, The McGrawHill Companies, New York
- 7) .Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New Delhi.

BBMMP116 Bio Skill Set Laboratory-I

University: MGM University, Aurangabad

Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech.
Microbiology

Degree: B. Sc (4 year Hons./hons. With res.)

Course Unit Code: BBMMP116

Course Title: Bio-skill Sets laboratory

Credits allocated: 1 (0 Theory+2 Practical)

Level of Study: UG

Mode of delivery, planned learning activities and teaching method: 2 hr/week

Recommended Year /Semester:

Microbiology, 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.

Course Objectives:

To equip students with basic skills required for carrying out experiments in biology laboratories.

Course outcomes:

Students should understand the importance of safety while working in a laboratory. Be familiar with handling of chemicals, Understand principles and proper handling of analytical instruments. Be comfortable with basic procedures required for carrying out experiments . Mode of Teaching: Laboratory exercises

Detailed Syllabus:

Practical's:

1. Study of Eukaryotic and Prokaryotic cells
2. To Study different phases of stages by using slides.
3. Isolation of protein
4. Isolation of human microflora from skin.
5. Separation of dyes by gel electrophoresis method.
6. To determine the surface tension of the given liquid using stalagmometer
7. Qualitative test for carbohydrates.

8. Estimation of reducing sugar by Sumner's method.
9. Blood staining
10. RA detection.
11. To study widal test detection of typhoid.
12. To study Biodegradable waste
13. To study non-Biodegradable waste
14. To observe the epidermal cell from onion.
15. To observe the stomatal cell from leaves.
16. Isolation of Enzyme
17. Effect of temperature on enzyme
18. Effect of ph on enzyme
19. To study Thin layer chromatography
20. To study Paper Chromatography
21. To Study a Research paper.

Reference:

1. Jurg P. Seiler, Good laboratory practices-why and how, Springer
2. WHO, Laboratory Biosafety Manual,

Text Book:

1. WHO, Good Laboratory practice handbook
2. Wilson and Walker, Principles and Techniques of Biochemistry and Molecular Biology, Cambridge

List of Options to select from Bucket of Courses provided in various categories (Sample of Faculty of Basic and Applied Sciences):

Major
Microbiology

Minor options Within Faculty of Basic Sciences	Biotechnology
	Bioinformatics
	Food Processing and Technology
	Food Nutrition and Dietetics

Minor options from Other Faculty	Faculty of Engineering and Technology	Faculty of Social Sciences and Humanities	Faculty of Design	Faculty of Management and Commerce	Interdisciplinary Faculty	Performing Arts
	Artificial Intelligence (AI)	Journalism and Mass Communication	Product Design	Operations and Supply Management	Cosmetic Technology	Theatre Arts
	Machine Learning (ML)	Film Making	Visual Communication	Human Resource (HR)	Educational Technology	Dance
	Data Analytics	Photography	Contemporary Arts	Finance Management	Yog Sciences	Music
	Robotics	Psychology	Interior Design	Marketing	Physical Education	Painting
	Industrial Automation	Economics	Fashion Technology	Accounting	Library Sciences	Pottery

IKS (As per the UGC guidelines. Visit Link:https://iksindia.org/English-BGSamposhan-Kendram-1-updated.pdf) ***	Faculty of	AEC (to be discussed and developed by committee of Dean)*		OE (Provide 4-8 courses of your department to be approved by the BOS)	Faculty of
Holistic medicine and wellness	***Courses For reference purpose only	Communicative English	*Courses For reference purpose only	Chemistry for Biology	Basic and applied science
Indian psychology and yoga		Communication and Soft Skills		Biological Waste recycle,	Basic and applied science
Indian sports and martial arts		German		Good Lab Practices	Basic and applied science
Architectural engineering, town planning, civil engineering, Vaastu and Shilpa Shastra		French		Microscopy	Basic and applied science
Sustainable agriculture and food preservation methods		Spanish		Introduction to Finance	

VSEC (Respective departments will prepare the list)	Faculty of	CC(Two courses to be finalized for I & II Semester)***		VEC (to be discussed and developed by committee of Dean) ***
		NSS	***Courses For reference purpose only	Universal Human Values
		Digital Awareness		
		Personality Development		Gandhian Studies
		Yoga		
		NCC		Value Education

VSEC Vocational and Skill Enhancement Course (Respective departments will prepare the list)

	VSC		SEC I, II, IV, sem		
I Sem		Micro Lab I	I sem		Microbiology: Principle and Exploration-I
II sem		Micro Lab II	II sem		Explorations in Microbiology -I
III sem		Mini Project	IV sem		Infection Control Lab
V		Mini Project	V sem		
		Python			

Minor (Bucket to be prepared by the respective faculty) (UPDATED)

		Theory		Practical
II Sem		Immune System in health & Disease		
III sem		Enzymology		Molecular chemical biology laboratory
IV Sem		Microbial Enzyme and kinetics		Genome analysis laboratory
V Sem		Synthetic Biology		Microbial Genome analysis
VI sem		Pharmaceutical Microbiology		Biomanufacturing laboratory

First Year (II Semester)

Level	Course	Course code	Course Title	Type	Teaching period per week			Credit	Duration of exam	Evaluation Scheme							Minimum Passing			
					Internal					External		Total	Internal	External		Total				
					CA-I	MSE	CA-II			TW	ESE		PR	CA/MSE/TW	ESE		PR			
L	T	P																		
4.5	Core	BMMML108	Microbial Physiology and Metabolism	Theory	2			2		10	10	10	-	20	-	50		08		20
	Core	BMMML109	Biology: Concept, Connections, Investigation and applications	Theory	3		-	3		20	20	20	-	40	-	100		16		40
	MIN	BMMML110	Annexure I	Theory	2		-	2		10	10	10	-	20	-	50		08		20
	AEC		Communicative English II	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
	OE**	BMOEL111	Open Elective I	Theory	2		-	2		10	10	10	-	20	-	50		08		20
	OE	BMOEL112	Open Elective II	Theory	2		-	2		10	10	10	-	20	-	50		08		20
	VEC*		Annexure I	Practical			4	2					30	-	20	50			08	20
	VSC*	BMVSP114	Micro Lab II	Practical			4	2					30		20	50			08	20
	SEC*	BMSEL115	Explorations in Microbiology -I	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
	Core	BBMMP116	Bio-Skills Sets Laboratory-I	Practical	-	-	2	1					30	-	20	50			08	20
CC		Annexure I	Practical	-	-	4	2					30	-	20	50			08	20	
					15		14	22												

*As per the requirement VSC / SEC can be used for Theory or Practical of core subject **As per the requirement, Department/Institute can offer OE practical

Level 4.5 Award of UG certificate with 44 credits and an additional 4-credits core NSQF course / internship OR continue with major and minor

Second Year (Semester IV)																						
Level	Course	Course code	Course Title	Type	Teaching period per week			Credit	Duration of exam	Evaluation Scheme							Minimum Passing					
										Internal				External			Total	Internal			External	
					CA1	MSE	CA2			TW	ESE	PR	CA	MSE	TW	ESE		PR				
5	Core	BMMML210	Genome Maintenance and Regulation	Theory	2	-	-	2		10	10	10		20	-	50				08	20	
	Core	BMMML211	Advance Fermentation Technology	Theory	3		-	3		20	20	20		40	-	100				16	40	
	Core	BMMML212	Molecular Basis of Bacterial Infection	Theory	2	-	-	2		10	10	10		20	-	50				08	20	
	OE	BMOEL213	Annexure I	Theory	2	-	-	2		10	10	10		20	-	50				08	20	
	MIN	BMMIL214	Annexure I	Theory	3	-	-	3		20	20	20		40	-	100				16	40	
	AEC		Annexure I	Theory	2	-	-	2		10	10	10		20	-	50				08	20	
	SEC	BMSEP215	Infection Control Lab	Practical		-	4	2					30		20	50					08	20
	MIN	BMMIP216	Annexure I	Practical	-	-	2	1					30		20	50					08	20
	Core	BMMMP217	Advance Fermentation Laboratory	Practical	-	-	2	1					30		20	50					08	20
	CEP	BMCEJ218	Community Engagement and Service (Mini project)	Practical		-	4	2					30		20	50					08	20
CC		Co-curricular Course	Practical		-	4	2					30		20	50					08	20	
			Total=30		14	16	22															

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

Level 5.0 Award of UG Diploma in major and minor with (44+44)= 88 credits and an additional 4-credits core NSQF course / internship OR continue with major and minor

Third Year (Semester VI)																						
Level	Course	Course code	Course Title	Type	Teaching period per week			Credit	Duration of exam	Evaluation Scheme						Total	Minimum Passing					
					L	T	P			Internal				External			Internal			External		Total
										CA1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
5.5	Core	BMMML312	Symbiosis, Plant Immunity and Disease	Theory	2	-	-	2		10	10	10		20	-	50				08		20
	Core	BMMML313	Industrial Microbiology	Theory	3		-	3		20	20	20		40	-	100				16		40
	Core	BMMML314	Gene Editing Technologies for Microbiology & therapeutic	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	Core elective	BMMEML315	Mycology	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	MIN	BMMIL316	Annexure I	Theory	2	-	-	2		20	20	20		40	-	100				16		40
	OJT	BMJTI317	On Job Training/Internship/Apprenticeship	Practical		-	8	4					30		20	50					08	20
	MIN	BMMIL318	Annexure I	Theory	2	-		2		10	10	10		20	-	50				08		20
	Core	BMMMP319	Diagnosis and Industrial Microbiology Lab.	Practical	-	-	2	1					30		20	50					08	20
	Core	BMMMJ320	Mini project	Practical	-	-	2	1					30		20	50					08	20
Core elective	BMMEP321	Data analysis and statistics	Practical	-	-	2	1					30		20	50					08	20	
			Total=29		15		14	22							750							

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

Core Elective: **Respective departments will prepare the list**

Level 5.5 Award of UG degree in major and minor (44+44+44)=132 credits OR continue with major and minor

Four Year (Semester VIII)																						
Level	Course	Course code	Course Title	Type	Teaching period per week			Credit	Duration of exam	Evaluation Scheme							Minimum Passing					
					L	T	P			Internal				External		Total	Internal			External		Total
										CA1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
6	Core	BMMML410	Systems Microbiology	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	Core	BMMML411	Bacterial Genetics	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	Core	BMMML412	Cosmetic Microbiology	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	Core	BMMML413	Enterpreneurship microbiology	Theory	2		-	2		10	10	10		20	-	50				08		20
	Core electiv e	BM MEL414	Microbial quality control	Theory	3	-	-	3		20	20	20		40	-	100				16		40
	OJT	BMJTI415	On Job Training/Internship/Apprenticeship	Practical			8	4					30		20	50					08	20
	Core electiv e	BM MEP416	Microbial quality control lab	Practical	-	-	2	1					30	-	20	50					08	20
	Core	BM MMP417	Practical Based on Research Methodology	Practical	-	-	2	1					30	-	20	50					08	20
	Core	BM MMP418	Big Idea	Practical	-	-	2	1					30	-	20	50					08	20
Core	BM MMP419	Cosmatic microbiology lab	Practical	-	-	2	1					30	-	20	50					08	20	
			Total=30		14		16	22														

Level 6.0 Four year UG Honours Degree in major and minor (44+44+44+44) = 176 credit

Four Year (Semester VIII)																							
Level	Course	Course code	Course Title	Type	Teaching period per week			Credit	Duration of exam	Evaluation Scheme							Minimum Passing						
										Internal				External			Total	Internal			External		Total
					L	T	P			CA1	MSE	CA2	TW	ESE	PR	CA		MSE	TW	ESE	PR		
6	Core	BMMML410	Systems Microbiology	Theory	3	-	-	3		20	20	20		40	-	100				16		40	
	Core	BMMML411	Bacterial Genetics	Theory	2	-	-	2		20	20	20		40	-	100				16		40	
	Core	BMMML412	Cosmetic Microbiology	Theory	2	-	-	2		20	20	20		40	-	100				16		40	
	Core	BMMML413	Entrepreneurship microbiology	Theory	2		-	2		10	10	10		20	-	50				08		20	
	Core elective	BMMEL414	Microbial quality control	Theory	3	-	-	3		20	20	20		40	-	100				16		40	
	Core elective	BMMEP415	Microbial quality control lab	Practical	-	-	2	1					30	-	20	50					08	20	
	Core	BMMMP416	Practical Based on Research Methodology	Practical	-	-	2	1					30	-	20	50					08	20	
	RP	BMRPJ417	Research Project II	Practical	-	-	16	8					30	-	20	50					08	20	
			Total=32		12		20	22															

Level 6.0 Four year UG Honors with research Degree in major and minor (44+44+44+44) = 176 credits

*[Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year.]

BMOEL103**Chemistry for Biology****University:** MGM University, Aurangabad**Faculty:** Basic and Applied Science**Institute:** Institute of Biosciences and Tech.**Degree:** B. Sc. Microbiology**Course Unit Code:** BMOEL103**Course Unit Title:** Chemistry for Biology**Credits allocated:**2**Level of Study:** UG**Mode of delivery, planned learning activities and teaching method:** Lecture 2 hrs. / weekly**Recommended Year /Semester:** B. Sc. Microbiology 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.

Course Objective

Chemical reactions and strategies to balance them. the relative quantities of reactants and products. the fundamental properties of atoms, molecules, and the various states of matter.

Course outcome

- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health, and medicine.
- Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
- Students will be able to function as a member of an interdisciplinary problem-solving team.

THEORY (30 lectures)**Unit-1 -Structure of Atom & Chemical Bonding****(6 lectures)**

Atom - Concept, Subatomic particles, Rutherford's nuclear atomic model, Bohr's atomic model its postulates and limitations, atomic orbitals, Hybridization and its type Planks quantum theory, quantum numbers, Heisenberg's uncertainty principle, Hund's rule.

Chemical bond and its type, Ionic bond, Covalent bond, Coordinate bond and Hydrogen Bond and its characteristics, Valance bond theory (VBT), Molecular orbital theory (MOT) structure of Homonuclear diatomic molecules (H_2 , N_2 , O_2 , F_2) Valance shell electron pair repulsion theory (VSEPR) , Shapes of $BeCl_2$, BF_3 , CH_4 , NH_3 and H_2O .

Unit-2 Chemical kinetics and Energetic (5 lectures)

Homogeneous, Heterogeneous, Reversible, Irreversible reactions, Rate of reaction, Collision theory of reaction rate, Rate equation / Rate law, Factors affecting rate of reaction.

Thermochemical reactions-Exothermic & Endothermic reaction, Enthalpy of reaction and its type, Enthalpy of formation, Enthalpy of combustion, Enthalpy of Neutralization, Hess's law of constant heat summation.

Unit-3 Alkanes, Alkenes, Alkynes. (10 lectures)

Alkane: Concept, Structure, Nomenclature, Preparations of alkane, Physical and chemical properties of alkanes. Octane number.

Alkenes: Concept, Structure, Nomenclature, Methods of preparation of alkenes, Physical properties of alkenes, chemical properties of alkenes (Hydrogenation, Halogenation, Hydrohalogenation, (Markovnikov's rule and peroxide effect), Hydration, Oxidation and Polymerization of alkenes. Alkyl halide and its derivatives: Alkynes: Concept, Nomenclature, Methods of preparation, Physical and chemical properties Alkynes Concept of alkyl halide, structure, Nomenclature, Methods of preparation of Alkyl halide, Physical and Chemical properties, Substitution reaction (SN1 & SN2), Elimination reaction (E1 & E2) Hoffmann Rule.

Unit-4 Stereochemistry in Organic compounds (9 lectures)

Concept of isomerism, Classification of isomerism (structural isomerism & Stereo isomerism), Optical isomerism, Optical activity, Elements of symmetry, Chiral molecule, Projection formulae, Enantiomers, Diastereomers, Meso compounds and their properties. Heterocyclic Compounds Concept and classification, 5-Membered Heterocyclic compounds Pyrrole: Structure, methods of preparation, physical and chemical properties, Furan: Structure, methods of preparation, physical and chemical properties, Thiophen: Structure, methods of preparation, physical and chemical properties.

Text books to refer:

1. Chemical Bonds: An Introduction to Atomic and Molecular Structure by Harry B. Gray.
2. A text book of Organic chemistry – B.S.Bahl & Arun Bahl
3. Text book of Essentials of Physical chemistry – B.S.Bahl, Arun Bahl & G.D.Tuli
4. Organic Chemistry Objective by Arihant (for practicing problems)
5. Wiley's solomons, Fryhle & Snyder organic chemistry by M.S Chouhan.
6. Textbook of Organic Chemistry by P.S Kalsi.

Reference:

1. Advanced Physical chemistry – Puri & Sharma
2. Concise Inorganic Chemistry-J.D. Lee
3. Organic Chemistry (Second Edition) by Clayden, Nick Greeves, and Stuart Warren.
4. Advanced Organic Chemistry. Francis A. Carey, Richard A. Sundberg
5. Reactions, Rearrangements and Reagents – S, N Sanyal
6. Stereochemistry of organic compounds- P S Kalsi

BMOEL104 Biological Waste Recycling

University: MGM University, Aurangabad

Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech.

Degree: B. Sc. Microbiology

Course Unit Code: BMOEL104

Course Unit Title: Biological Waste Recycling

Credits allocated:2(2 Theory+0Practical)

Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 2hrs/weekly

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

Course Objectives:

1. To enhance the knowledge on the scientific management of the biological waste for a sustainable future and promote environmental hygiene.
2. To create entrepreneurs and increase job opportunity for younger generation in biological waste recycling sector.
3. To learn broader understandings on various aspects of biological waste management practiced in industries, hospitals and Medical colleges.
4. To learn recovery of products from solid waste to compost and biogas, incineration and energy recovery, hazardous waste management and treatment, and integrated waste management.

Course outcome:

1. Identify different sources of biological waste.
2. Implement the method for disposal of biological waste.
3. Implement the relevant laws on related to biological waste management
4. Awareness in environmental sustainability.

Detail Syllabus: THEORY (30 lectures)

UNIT 1

Introduction To Biological Waste: (6 lectures)

Introduction and Background of Biological Waste, Definition, Classification of Bio-Medical Waste according to World Health Organization, source and generation of Biological Waste

UNIT II

Categories of Biological wastes (6 lectures)

Categories of Biological wastes, Human Anatomical Waste, Animal Waste, Microbiology and Biotechnology Wastes, Waste sharps, Discarded Medicines and Cytotoxic drugs, Discarded Medicines and Cytotoxic drugs, (Soiled) Waste.

UNIT III

Biomedical Waste Management (8 lectures)

Need of biomedical waste management, Biomedical Waste Management Process, Six steps of Bio medical waste Management, Management technologies, Health aspect during handling and processing, Salient Features of Biomedical Waste Rules 2016.

UNIT IV (10 lectures) Biomedical Waste Processing Techniques & Source Reduction, Product Recovery & Recycling

Program for autoclave (steam sterilization) treatment of biohazardous waste, storage of biological/infectious waste, treatment of waste method/parameter. Purpose of processing, mechanical component separation, drying and dewatering, process of Recycling: basics, purpose, implementation monitoring and evaluation of recycling process, significance of recycling, planning of a recycling programme, recycling programme elements, commonly recycled biological materials and **Biomedical Waste Recycling Industry.**

Suggested Learning Resources:

Text Books:

1. Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers, 1993.
2. Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer, 1994

Reference book

1. White, F. R., Franke P. R., & Hindle M., Integrated solid waste management: a life cycle inventory. McDougall, P. John Wiley & Sons. 2001
2. Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005
3. Biomedical Waste: Management, Recycling And Applications **Hardcover – 1 April 2019**
Himadri Panda Discovery publishing house Pvt Ltd.

BMOEL111 Good Lab Practices

University: MGM University, Aurangabad

Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech.

Degree: B. Sc. Microbiology

Course Unit Code: BMOEL111

Course Unit Title: Good Lab Practices

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

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

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

Course Objectives:

1. To teach the students safety handling and regulation laboratory facility.
2. To learn how to record, keep and analyze laboratory data with accuracy.
3. To practice minimization of Errors related with handling of laboratory accessories and equipment's.
4. To learn Standard Operating Procedures (SOPs) Laboratory equipment's.

Course outcomes

On the successful completion of the course, student will be able to

1. Understand the basic calibration and handling of instrumentation in laboratory.
2. Safely practice, basic laboratory procedures and protocols in on job laboratory situations.
3. Maintain laboratory records, and SOP with current industry standards.

UNIT I (6 lectures) Introduction to Good Laboratory Practices (GLP)

Introduction to GLP, History, Scope, Importance, Objective, Principle apply for GLP, Fundamental points of GLP, basic elements in GLP. WHO guidelines on GLP .

UNIT II Quality assurances in Good Laboratory Practices (8 lectures)

Introduction to Quality standards and Quality Assurances: Quality Standards- Advantages and Disadvantages, Concept of Quality Control Quality Assurance- Their functions and advantages Quality assurance and quality management in industry. Trade and Company Standards Control by National, International, Social Organizations (example:FAO, WHO, UNICEF, CAB) .

UNIT III (9 lectures) Biosafety

Introduction, Historical Background, Biosafety in Laboratory, General Lab safety, Before entering in the Laboratory and during lab work, Laboratory associated infections and other hazards, assessment of Biological Hazards and levels of biosafety, prudent biosafety practices in the laboratory. Introduction to Biological safety cabinets, Primary Containment of Biohazards, Biosafety Levels, Recommended Biosafety Levels for Infectious Agents and Biosafety guidelines, Government of India Guidelines.

UNIT IV (7 lectures) Laboratory Infrastructure

Maintenance and calibration of equipments, maintainance cleanness and hygiene, control of insect and microbes, Handling of Reagent material and toxic chemical, waste and toxic chemical dispose, Standard operating procedure, Documentations and maintenance of records, Safe Housekeeping instrumentation for safe operation, personal protective equipment's.

Reference Book

1. Handbook Good Laboratory Practices-World health organization (WHO) 2021
2. Life science protocol manual (2018)-DBT star college scheme
3. Guidelines for good laboratory practices-Indian council of medical research, New Delhi (2008)
4. Good Laboratory Practice: the Why and the How Paperback – Import, 28 November 2014 by Jurge P.sailer (Springer).

Textbook

1. Good Laboratory Practice A Complete Guide - 2021 Edition by Gerardus Blokdyk

BMOEL112

Microscopy

University: MGM University, Aurangabad Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree : B. Sc. Microbiology

Course Unit Code: BMOEL112 Course Unit Title: Microscopy

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

**Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs/weekly
Recommended Year/Semester: Microbiology, Year I / Semester II**

Course Objectives:

At the completion of this course students should be able to

1. Use and take care of various kinds of microscopes
2. Prepare specimens for microscopy, immunocytochemistry, and histology
3. Describe the fundamental steps and applications of digital image processing.
4. Describe components of computer hardware and features of software used for image processing

Course outcome:

1. Students will learn foundational skills in microscopy, including operation of a compound microscope, focusing on a sample, preparing a wet mount, making a smear, heat fixation, simple staining, and Gram staining.
2. Students will be able to learn types of microscopes, parts of microscope and their functions
3. Students will be able to learn preparation of specimen(Sample) for observation
4. Students will be able to learn application of different types of microscope in biological science.

Detail Syllabus: THEORY (30 lectures)

UNIT I Introduction To Microscopy: (7 lectures)

Definition of Microscope, History of Optical Microscope, An Introduction to microscope, Principle of Microscope, types of microscopes, parts of microscope, structure and function of Parts, The components and maintenance of a standard light microscope. Principles of bright field and dark field light microscopy. Use of microscope in Biological science.

UNIT II The simple microscope and Compound Microscope (9 lectures)

Principles, Magnification, Aberration, Types of magnifiers, and parts of Simple microscope their functions and application. The compound Microscope, Optics, Mechanical components, illumination system, Objective, Aberration correction, High power Objectives, Depth of Focus, The eyepiece, image capture, The theory of image formation, and application of compound microscope.

UNIT III Electron Microscopy (SEM and TEM) (8 Lectures)

Introduction, history, principle, sample preparation techniques, application, Imaging and Guides to

Advanced Electron Scanning Electron Microscopy. Introduction, history, principle, sample preparation techniques, application, Imaging and Guides to Advanced Transmission Electron Microscopy

UNIT IV

Slide (Tissue) Preparation (6 Lecture)

Slide preparation, specimen collection, fixation, sectioning, basic staining, Staining techniques of sample, Mounting of sample, Labelling and Storage of slides, Tissue Preparation for Light Microscopy – paraffin technique, basic stain and special stain, immunocytochemical methods for microscopic examination, photography and interpretation of the results, laboratory rules and regulations.

Textbook

1. Complete Book of the Microscope, August 2012, by Kirsteen Robson
2. Introduction to Light Microscopy: Tips and Tricks for Beginners, June 2019, by Dee Lawlor.
3. Principles of Microscopy: Being a Handbook to the Microscope. Feb 2012 by Almroth Wright.

References

1. Light Microscopy in Biology: practical approach. (1989). A.J.Lacey. Oxford University Press.
2. Light Microscopy. (1992) D.J. Rawlins. BIOS Scientific Publishers.
3. Principle & Techniques of Microscopy In: The World of the Cell. 3rd ed. 2001
4. Histology: A text & Atlas. (2003). M.H. Ross, G.I. Kaye, W. Pawlina, Williams & Wilkins, 4th edition
5. Wheater's Functional Histology: A text & color atlas (2000). B. Young & J.W. Heath. Churchill Livingstone
6. Scanning Electrochemical Microscopy: A Comprehensive Review of Experimental Parameters from 1989 to 2015, David Polcari, Philippe Dauphin-Ducharme, and Janine Mauzerol