MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE-BASED CREDIT SYSTEM(CBCS)SEMESTERPATTERN

Faculty of Engineering and Technology Graduate (UG) program

Food Processing and Technology-CURRICULUM
w.e.f.**AcademicYear2023-24**

B.Tech., B.Tech.(Hons.), B.Tech.(Hons.) with Research of Biomedical Engineering

SEMESTER (I and II)

MGMUNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Engineering and TechnologyGraduate (UG) program

BIOMEDICAL ENGINEERING-CURRICULUM

B.Tech. Biomedical Engineering

FIRST YEAR

SEMESTER-I

CURRICULUM

MGM University

Chhatrapati Sambhajinagar– 431003

(Template format as per discussion at 14/05/2023)

Name of the College/Institute: Institute of Biosciences and Technology **Faculty of Engineering and Technology**

Name of the Program :**(3/4 Years UG programme)** B.Tech. Biomedical Engineering

Program Type: UG B.Tech, Biomedical Engineering

Duration: - 04 Years (08 Semesters)

First Year (Semester I)																				
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**
				L	**T**	**P**			**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**			**ESE**	**PR**	
BSC	BBE42MML101	Engineering Graphics	Theory	2		-	2		10	10	10	-	20	-	50	-	8	-	20
BSC	BBE42MML102	Chemistry For Biology	Theory	2		-	2		10	10	10	-	20	-	50	-	8	-	20
ESC	BBE42MML103	Physics For Biology	Theory	2			3		20	20	20	-	40	-	100	-	16		40
ESC	BBE42MML104	Biology Concept, Connection and Innovation	Theory	2		-	3		20	20	20	-	40	-	100	-	16		40
AEC		Ability Enhancement Course	Theory	2	-	-	2		10	10	10	-	20	-	50	-	8		20
VSEC*	BBE42VSP101	Exploration lab I	Practical	-		4	2		-	-		30	-	20	50	-	-	8	20
BSC	BBE42MMP101	Graphics Lab	Practical	-		4	2		-	-		30	-	20	50	-	-	8	20
ESC	BBE42MMP102	Physics Lab	Practical	-		4	2		-	-		30	-	20	50	-	-	8	20
ESC	BBE42MMP103	Chem Bio Lab	Practical	-	-	4	2		-	-		30	-	20	50	-	-	8	20
CCA		Co-Curricular Activity	Practical		-	4	2		-	-		30	-	20	50	-	-	8	20
	Total (L-T-P) Hrs / week = 30			**10**		**20**	**22**								**600**				**240**

First Year (Semester II)																				
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**			**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**		**CA/MSE/TW**	**ESE**	**PR**	
BSC	BBE42MML105	Physiology of Microbes	Theory	2		-	2		10	10	10	-	20	-	50		8		20
BSC	BBE42MML106	Molecular Biology and Biochemistry	Theory	2		-	2		10	10	10	-	20	-	50		8		20
ESC	BBE42MML107	Material Science	Theory	3			3		20	20	20	-	40	-	100		16		40
ESC	BBE42MML108	Numerical and Computational Fundamentals-I	Theory	3		-	3		20	20	20	-	40	-	100		16		40
PCC		Cell Genetics And Evolution	Theory	2		-	2		10	10	10	-	20	-	50		8		20
VSEC*	BBE42VSP105	Case studies	Practical	-		4	2			-		30	-	20	50			8	20
ESC	BBE42MMP104	Bio-Computational Lab	Practical			4	2			-		30	-	20	50			8	20
ESC	BBE42MMP105	Micro Lab	Practical	-		4	2			-		30	-	20	50			8	20
BSC	BBE42MMP106	Mol Bio Lab	Practical	-	-	4	2			-		30	-	20	50			8	20
CCA		Co-Curricular Activity	Practical	-	-	4	2			-		30	-	20	50			8	20
	Total (L-T-P) Hrs / week = 32			**12**		**20**	**22**								**600**				**240**

*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

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

SYLLABUS OF SEMESTER FIRST WITH LAYOUT

First Year (Semester I)																				
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**
				L	**T**	**P**			**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**			**ESE**	**PR**	
BSC	BBE42MML101	Engineering Graphics	Theory	2		-	2		10	10	10	-	20	-	50		8	-	20
BSC	BBE42MML102	Chemistry For Biology	Theory	2		-	2		10	10	10	-	20	-	50		8	-	20
ESC	BBE42MML103	Physics For Biology	Theory	3			3		20	20	20	-	40	-	100		16		40
ESC	BBE42MML104	Biology Concept, Connection and Innovation	Theory	3		-	3		20	20	20	-	40	-	100		16		40
AEC		Ability Enhancement Course	Theory	2	-	-	2		10	10	10	-	20	-	50		8		20
VSEC*	BBE42VSP101	Exploration lab I	Practical	-		4	2			-		30	-	20	50			8	20
BSC	BBE42MMP101	Graphics Lab	Practical	-		4	2			-		30	-	20	50			8	20
ESC	BBE42MMP102	Physics Lab	Practical	-		4	2			-		30	-	20	50			8	20
ESC	BBE42MMP103	Chem Bio Lab	Practical	-	-	4	2			-		30	-	20	50			8	20
CCA		Co-Curricular Activity	Practical		-	4	2			-		30	-	20	50			8	20
	Total (L-T-P) Hrs / week = 30			**12**		**20**	**22**								**600**				**240**

ENGINEERING GRAPHICS

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Engineering Graphics **Course Code**- BBE42MML101
Credits-2+0(Theory) **Level of Study:** UG
Mode of delivery planned learning activities and teaching method: Lecture 2hrs/weekly
Recommended Year/Semester: B.Tech. Biomedical Engineering,Year1/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 mustbementioned in the roster form.
Objective: The aim of the course is to provide knowledge of
1. To impart and inculcate proper understanding of the theory of projection. 2. To impart the knowledge of reading a drawing. 3. To improve the visualization skill. 4. To teach basic utility of computer aided drafting (CAD) tool. 5. Apply the basic principles of projections in 2D drawings. 6. Apply the basic principles of projections in converting 3D view to 2D drawings. 7. Read a given drawing. 8. Visualize an object from the given two views. 9. Use CAD tool to draw different views of an object.
Learning Outcomes : Students can apply the basic principles of projections in 2D drawings. They can apply the basic principles of projections in converting 3D view to 2D drawings. They will be able to read a given drawing and will visualize an object from the given two views. They will be able to use CAD tool to draw different views.

COURSE CONTENTS

THEORY

UNIT-I Introduction to Engineering Graphics
Introduction to Engineering Drawing: - Types of Lines, Labelling of drawings- Numerals and different types of letters .Dimensioning Systems as per IS conventions. Engineering Curves: Basic construction of Cycloid, Involutes and Helix (of cylinder) only. Introduction to Auto CAD: - Basic Drawing and Editing Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting and Printing

UNIT-II Projection of Points and Lines
Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application based problems on Projection of lines. Projection of Planes:- Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes)

UNIT-III Projection of Solids
(Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron and Cone only) Solid projection with the axis inclined to HP and VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method.

UNIT-IV Section of solids
Section of Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron & Cone

UNIT-V Orthographic projections

Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts Isometric Views: Isometric View/Drawing of blocks of plain and cylindrical surfaces using plain/natural scale only. (Exclude Spherical surfaces).

ReferenceBooks/Text Books

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
3. M.B Shah & B.C Rana, "Engineering Drawing", Pearson Publications
4. P.J. Shah, "Engineering Graphics", S Chand Publications.
5. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.
6. Prof. Sham Tickoo (Purdue University) &GauravVerma, "(CAD Soft Technologies) : Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi.

CHEMISTRY FOR BIOLOGY

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Chemistry For Biology **Course Code**- BBE42MML102
Credits-2+0(Theory) **Level of Study:** UG
Mode of delivery planned learning activities and teaching method: Lecture 2hrs/weekly
Recommended Year/Semester: B.Tech. Biomedical Engineering,Year1/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.
Objective: To enable student to understand the structure of atom and bonding, types of acids and bases and physical properties of liquids, heat mechanism, surface phenomenon, catalyst along with periodic trends and classification of elements.
LearningOutcomes: By studying this syllabus students are able to: 1. Understand the chemical composition of the matter in context to chemical bonding. 2.describe basic concepts of the thermodynamics and different thermo chemical reactions along with heat of reaction. 3. Explain surface phenomenon and use of catalyst in chemical reactions. 4. Identifies and use various types of acids and bases along with various physical properties of the liquids. 5. Classify various elements according to blocks of periodic table

COURSECONTENTS
Theory:

UNIT-I -Structure of Atom & Chemical Bonding Atom
Concept, Subatomic particles, Rutherford's nuclear atomic model, Bohrs atomic model its postulates and limitations, atomic orbitals, Hybridization and its type Planks quantum theory, quantum numbers, Heisenberg's uncertainty principle, Electronic configuration-Aufbau's principle, Pauli's exclusion principle and 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 (H2, N2,O2, F2) Valance shell electron pair repulsion theory (VSEPR) , Shapes of BeCl2, BF3, CH4, NH3 and H2O.

UNIT-II Chemical kinetics and energetic 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 typeEnthalpy of formation, Enthalpy of combustion, Enthalpy of Neutralization, Hess's law of constant heat summation.

UNIT-III -Surface chemistry catalysis
Adsorption and Absorption, Mechanism of adsorption, Types of adsorption- Chemisorption, Physiosorption, application of adsorption.
Catalysis-concept, Types of catalysis, characteristics of catalytic reaction, Promoters and Inhibitors (Poisoning), Enzyme catalysis Acid-Base catalysis, Intermediate compound formation theory and adsorption theory of catalysis.

UNIT-IV -Acids, Bases, Liquid state Acids

Types of acids (Hydracids, Oxy-acids, ic-acids, ous-acids, Hypo-ous acids, per-ic acids, pyroic acids) Protocity or Basicity of acids. Bases ,Types of bases (metal oxide & metal hydroxide) acidity of bases, Theories of Acid and Base : Arrhenius theory, Bronsted-Lowry theory, Lewis theory, PH ,POH, Buffer, Common ion effect. Liquid state: Characteristics of liquid, Boiling point, Freezing point, Surface tension, Viscosity.

UNIT-V-Periodic classification of elements

Modern periodic law, Long form of periodic table, Classification of elements, General characteristics of s, p, d & f block elements, Periodic trends: Atomic size, Ionic radii, Electronegativity, Ionization potential/ energy.

Referencebooks:

1. Essentials of Physical chemistry – B.S.Bahl, ArunBahl&G.D.Tuli
2.Physical Chemistry-P.W. Atkins ELBS, 5th edition
3.Physical chemistry – G.W Castellan
4.Advanced Physical chemistry – Puri& Sharma
5.Concise Inorganic Chemistry-J.D. Lee
6.Physical Chemistry by S. Glasstone.
7. Inorganic chemistry – D.F,Shriver& Atkins
8.Modern approach to chemistry – Y.R.Sharma. BaidyaNathBhuyan, SudarshanBarua.
9. Modern Inorganic Chemisry – R.C Aggarwal

PHYSICS FOR BIOLOGY

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Physics For Biology **Course Code**- BBE42MML103
Credits-2+0(Theory) **Level of Study:** UG
Mode of delivery planned learning activities and teaching method: Lecture 2hrs/weekly
Recommended Year/Semester: B.Tech. Biomedical Engineering,Year1/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.

Objective: The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The acquaintance of basic physics principles would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. This would create awareness about the vital role played by science and engineering in the development of new technologies. The courses would provide the necessary exposure to the practical aspects, which is an essential component for learning science.

LearningOutcomes: Through the 1st year basic physics course, students will be equipped with basic physical laws, principles and formalism to apply them in their core curriculum. Through laboratory sessions they will be exposed to basic error analysis and some phenomenological experiments which are essential for the understanding of the core curriculum.

COURSE CONTENTS

THEORY

UNIT I: Acoustics and NDT

Ultrasonics - Ultrasonic Waves Productions (Piezoelectric and Magnetostriction method) – Detections (Acoustic Grating) Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time . NDT applications - Pulse Echo Method - Liquid Penetrant Method

UNIT II: Optics

Interference - Air Wedge – Michelson's Interferometer – Wavelength Determination– Interference Filter – Antireflection Coatings. Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating and Prism. Polarisation - Huygens Theory of Double Refraction – Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

UNIT III :Lasers and Fiber Optics

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – Optical resonators – Types of Lasers - NdYAG, CO2 laser, GaAs Laser

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)

UNIT IV: Wave Mechanics

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V: Nuclear Energy Source

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy -

Disintegration in fission – Nuclear Fusion (p-p and C-N cycle) – Nuclear Reactor: Materials Used in Nuclear Reactors. – PWR – BWR - FBTR

REFERENCEBOOKS/TEXTBOOKS

Text Books:
1. A S Vasudeva, Modern Engineering Physics, S. Chand & Co, New Delhi, 2006.
2. V Rajendran, Engineering Physics, TMH, New Delhi 2008.
Reference Books:
1. Richtmyer, Kennard and cooper , Introduction to Modern Physics, TMH, New Delhi 2005.
2. Ajay Ghatak, Optics, TMH, New Delhi, 2007.
3. Thiagarajan and Ghatak, Laser and Application, TMH, New Delhi, 2008.
4. Arthur Beiser, Concept of Modern Physics, TMH, New Delhi, 2008.
5. Avadhanulu M N and Kshir Sagar , A Text Book of Engineering Physics, S. Chand & Co, New Delhi, 2007.
6. R. Murugeshan, Modern Physics, S. Chand & Co, New Delhi, 2006.
7. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.

BIOLOGY CONCEPT, CONNECTION AND INNOVATION

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Biology Concept, Connection and Innovation **Course Code**- BBE42MML104
Credits-2+0(Theory) **Level of Study:** UG
Mode of delivery planned learning activities and teaching method: Lecture 2hrs/weekly
Recommended Year/Semester: B.Tech. Biomedical Engineering,Year1/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.
Objective: To provide an introduction to basic biological concepts including the metric system, physical and chemical properties of life, cell structure and function, cell reproduction, and metabolism. To unable student to do Critical thinking skills, study skills, and basic math skills are also included
LearningOutcomes: Students will get familiar with basic biology concept

COURSECONTENTS

Theory

UNIT-I The molecular basis of Life/ Cell

The science of biology, the scientific study of life, the nature of molecules and the properties of water, the chemical Building Block of life / chemistry of life, Cell structure and function, Membrane structure and function, Metabolism energy and enzymes, how cells harvest energy, Photosynthesis, Cell communication, how cell divide / cell division, Plant organization and function, Plant reproduction and responses, how cells release energy

UNIT II Genetics and Molecular biology

Sexual Reproduction and Meiosis, Patterns of inheritance, Human inheritance, Chromosome, mapping and the Meiosis-inheritance connection, DNA-The genetic material, Genes and how they work, DNA Replication, Binary fission and Mitosis, Control of gene expression, DNA Technology, Genomics, Cellular Mechanisms of development

UNIT III Cells and Energy

Cells: The working Units of Life, Features of Prokaryotic and Eukaryotic cell, chemical structure and functions of lipids, Cell Membranes, Cell communication and multicellularity, transduction pathway, Signal Receptors initiate a cellular response, Energy: types of energy, types of metabolism, Laws of thermodynamics, Role of ATP in biochemical energetics,

Enzymes: Introduction, Working of enzymes, Regulation of enzymes.

UNIT IV Genes and Heredity

The cell cycle and cell division, Inheritance, Genes and chromosomes, DNA and Its Role in Heredity, From DNA to Protein: Gene Expression, Gene Mutation and Molecular Medicine, Regulation of Gene Expression.

UNIT V Genomes

Genomes, Recombinant DNA and B. Tech. Biomedical Engineering, Differential gene Expression in Development, Genes its development and Evolution

REFERENCE:

1. Biology -Concepts & Applications by Cecie Starr Christine A. Evers Lisa Starr
2. BIOLOGY- Concept and investigation by MariëlleHoefnagels
3. Campbell Biology: Concepts & Connections by Martha R. Taylor, Eric J. Simon, Jean L. Dickey, Kelly A. Hogan, Jane B. Reece
4. Life: The Science of Biology by David E. Sadava , David M. Hillis, et al.
5. Biology by Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos , Susan Singer

GRAPHICS LAB

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Graphics Lab **Course Code**- BBE42MMP101
Credits-0+2(2Practical) **Level of Study:UG**
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester:B.Tech-Biomedical Engineering,Year1/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.
Objective-This is a lab course that covers diode and transistor I-V characteristics and its related basic devices. The students will get hands on experience on diode and transistor-based circuits. In addition to this, they will get exposure on Boolean logic operations as well as electronic instrumentation
Learning outcomes- The students will learn the basic operation of various electronics devices/components and some measurements. To realize the I-V characteristics of Diodes, Transistor, and about simple electronic components/circuits. Develop understanding of digital logic devices and verify digital logics using universal logic ICs.

COURSE CONTENT

Practical-

1. To plot diode characteristics
2. To plot BTT haracteristics
3. To Study Opaque Inncoting amp
4. To study half adder
5. To verify thrtrut table of Rs- FF
6. To StudyAM/FM
7. To Study the Diode Applications of Half wave Rectifier
8. To Study the Diode Applications of Full wave Rectifier
9. To obtain V-I characteristics of Zener Diode with Graph
10. To Study of Zener diode as voltage regulator.
11. To Study of Bridge rectifier with regulation efficiency and ripple factor.
12. To Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter
13. 13. To Study Various kinds of Signal wave forms and Measure their Frequencies
14. To Study Transistor Input/Output Characteristics of JFET
15. To Study Transistor Input/Output Characteristics in CE, CB, CC Configuration
16. To Study of Logic Gates and realization of Boolean functions using Logic Gates.
17. To identify various components with specifications

PHYSICS LAB

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
\Course Title- Physics Lab **Code**- BBE42MMP102
Credits-0+2(2Practical) **Level of Study:UG**
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester:B.Tech-Biomedical Engineering,Year1/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.
Objective- This is a lab course that covers concepts of physics
Learning outcomes- At the end of the course students will be able to
Demonstrate experiments allied to their theoretical concepts.
Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer.
Participate as an individual and as a member or leader in groups in laboratory sessions actively.
Analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiments.

COURSE CONTENT

List of Practical

Experiments on Waves & Oscillations:
1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)
3. Determination of Q factor using LCR Circuit.
4. Calibration of an oscillator using Lissajous Figure.

Experiments on Classical Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Quantum Physics-I:
8. Determination of Planck's constant using photoelectric cell.
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Stefan's Constant

Recommended Text Books for Physics Lab

1. & Oscillations:Vibration, Waves and Acoustics- Chattopadhyay and Rakshit
2. Classical & Modern Optics:A text book of Light- K.G. Mazumder & B. Ghosh (Book & Allied Publisher)
3. Quantum Mechanics-I:Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
4. Solid State Physics-I:Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

CHEM BIO LAB

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech- Biomedical Engineering
Course Title- Chem Bio Lab **Code**- BBE42MMP103
Credits-0+2(2Practical) **Level of Study:UG**
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester:B.Tech-Biomedical Engineering,Year1/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.
Objective- This is a lab course that covers detection methods of different samples
Learning outcomes- Students will know the organisms and their nature by doing this practical also will be aware about the chemical reactions related to proteins
.

COURSE CONTENT

Practical-

1.To Study instruments and Glasswares.
2. To estimate amount of protein by Biuret reagent.
3. To study the different phases of bacterial growth.
4. To differentiate between Gram positive and Gram negative bacteria.
5. To prepare stained temporary mount of onion peel and to record the observation.
6. Positive Staining .
7. Negative Staining.
8. Isolation of microorganisms by serial dilution method from soil.
9. Demonstration of technique for pure culture of microorganism.
10. To separate mixture of amino acid by paper chromatography.
11. To separate mixture of lipid by TLC.
12. To study the osmosis using potato osmometer.
13. To determine the viscosityof the given liquid using Ostwald viscometer.
14. To determine the surface tension of the given liquid using stalagmometer
15. To prepare 0.1 N NaOH solution & standardize it by the given 0.1N oxalic acid solution.
16. To prepare 0.1 N H2C2O2 solution & standardize it by the given 0.1N KMNO4solution.
17. Qualitative test for carbohydrates.
18. Blood staining.

MGMUNIVERSITY,AURANGABAD

INSTITUTEOFBIOSCIENCESANDTECHNOLOGY

CHOICEBASEDCREDITSYSTEM(CBCS)

SEMESTERPATTERN

FacultyofEngineeringandTechnology
Graduate (UG) program

BIOMEDICAL ENGINEERING-CURRICULUM

B.Tech. Biomedical Engineering

FIRST YEAR

SEMESTER-II

CURRICULUM

SYLLABUS OF SEMESTER SECOND WITH LAYOUT

First Year (Semester II)																					
Course	**Course code**	**Course Title**	**Type**	**Teaching period per week**			**Credit**	**Duration of exam**	**Evaluation Scheme**							**Minimum Passing**			
									Internal				**External**		**Total**	**Internal**	**External**			
				L	**T**	**P**			**CA-I**	**MSE**	**CA-II**	**TW**	**ESE**	**PR**		**CA/MSE/TW**	**ESE**	**PR**	**Total**
BSC	BBE42MML105	Physiology of Microbes	Theory	2		-	2		10	10	10	-	20	-	50		8		20
BSC	BBE42MML106	Molecular Biology and Biochemistry	Theory	2		-	2		10	10	10	-	20	-	50		8		20
ESC	BBE42MML107	Material Science	Theory	3			3		20	20	20	-	40	-	100		16		40
ESC	BBE42MML108	Numerical and Computational Fundamentals-I	Theory	3		-	3		20	20	20	-	40	-	100		16		40
PCC		Cell Genetics And Evolution	Theory	2		-	2		10	10	10	-	20	-	50		8		20
VSEC*	BBE42VSP105	Case studies	Practical	-		4	2			-		30	-	20	50			8	20
ESC	BBE42MMP104	Bio-Computational Lab	Practical			4	2			-		30	-	20	50			8	20
ESC	BBE42MMP105	Micro Lab	Practical	-		4	2			-		30	-	20	50			8	20
BSC	BBE42MMP106	Mol Bio Lab	Practical	-	-	4	2			-		30	-	20	50			8	20
CCA		Co-Curricular Activity	Practical	-	-	4	2			-		30	-	20	50			8	20
	Total (L-T-P) Hrs / week = 32			**12**		**20**	**22**								**600**				**240**

Physiology of Microbes

University-MGMUniversity, AURANGABAD **Faculty**-EngineeringandTechnology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle- Physiology of Microbes **Course Code**- BBE42MML105
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester:B.Tech-Biomedical Engineering,Year1/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.
Objective- After completing this rotation, the intern will be able to: Describe and explain microbes and their growth in different media. Microbes characteristics and growth pattern
Learning outcomes- Upon successful completion, students will have the have the theoretical background and understanding of microbial physiology that is necessary to conduct microbiological laboratory research.

COURSECONTENTS

THEORY

UNIT I- MICROBIAL NUTRITION

Nutritional types; Requirement of Nutrients for microbes and classification of microorganisms based on carbon, energy and electron sources viz. Photoautotrophs; Photoorganotrophs; Chemo-lithotrophs (ammonia, nitrate sulphur, hydrogen, iron oxidizing bacteria); Chemo-organotrophs. Primary and secondary active transport; Passive and facilitated diffusion

UNIT II- MEDIA TYPE AND PRESERVATION

Components; criteria and role of macro and micro-nutrients. Natural, Synthetic, Complex, Selective media & Differential Media; Methods for culturing aerobic and anaerobic bacteria; Colony and broth culture characteristics; Maintenance and preservation of Microorganisms.

UNIT III- MICROBIAL GROWTH AND PHOTOSYNTHESIS

Growth in Microbes (growth phases, generation time, growth curve). Measurement of cell mass and cell number; Factors affecting microbial growth; Continuous and batch cultures; Synchronous and Diauxic growth curve. Physical factors influencing growth: Temperature; PH; Atmospheric Pressure; Salt Concentration. Chemical factors: heavy metal (copper), surfactants.

UNIT IV- METABOLIC DIVERSITY AMONG MICROORGANISMS

Respiration, Photosynthesis, acetogenesis, methanogenesis, nitrogen fixation, and hydrocarbon transformation in microorganisms

UNIT V- CHEMOTHERAPEUTIC AGENTS AS GROWTH INHIBITORS

Chemotherapeutic agents as growth inhibitors, General mode of action of various chemotherapeutic agents: Sulfonamides, antibiotics (penicillin, streptomycin, Polymixin)

TEXT BOOKS

1. Pelczar Jr, M J, Chan E C S., Krieg N R, (1986) Microbiology, 5th edn, McGrawHill Book Company, NY
2. 2. Ingraham J L, and Ingraham, C L, (2000) Introduction to Microbiology, 2nd edn, Brooks/Cole, Singapore
3. 3. Black J G, (2002) Microbiology: Principles and Explorations, 5th edn, John Wiley and Sons, Inc. NY

MOLECULAR BIOLOGY AND BIOCHEMISTRY

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle- Molecula Biology and Biochemistry **Course Code**- BBE42MML106
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- The course is an introduction to molecular biology and genetics and methods used within these fields. The subject content is the following. The structure of the genome: chromosomes, chromosomal structure, and extrachromosomal inheritance. The molecular basis of transmission of genetic information: nucleic acids and proteins. DNA replication, DNA repair, mutations, recombination, transposition, transcription, and translation and about various molecules, lipids their structure, carbohydrate and vitamins.
Learning Outcomes: By the end of the programme students will: gain knowledge about the DNA, its structure, how recombination takes place, the mechanism of protein formation and details about membrane lipids, vitamins and carbohydrate .

COURSECONTENTS

THEORY

UNIT I: DNA REPLICATION

Prokaryotic and eukaryotic DNA replication – mechanism of replication, enzymes and necessary proteins in DNA replication. DNA Mutation and Repair - mutation subtypes, mismatch, base-excision and nucleotide excision. DNA recombination - homologous, non - homologous and site-specific.

UNIT II: TRANSCRIPTION

Prokaryotic and eukaryotic transcription - RNA polymerases - general and specific transcription factors- regulatory elements. Mechanism of transcription regulation and transcription termination. Post-transcriptional modification - 5’ cap formation- 3’end processing and polyadenylation- splicing editing- nuclear export of mRNA- mRNA stability.

UNIT III: TRANSLATION

Genetic code - Prokaryotic and eukaryotic translation - translational machinery. Mechanism of initiation - elongation and termination. Regulation of translation.

UNIT IV: BASICS OF BIOCHEMISTRY

Building blocks of lipids - fatty acids, glycerol, Storage lipids - triacyl glycerol and waxes; Structural lipids in membranes – glycerophospholipids;sulpholipids, ether lipids, sphingolipids and sterols, structure, distribution and role of membrane lipids.

UNIT V: VITAMINS AND CARBOHYDRATES

Structure and active forms of water soluble and fat-soluble vitamins; Deficiency diseases and symptoms. Monosaccharides - structure of aldoses and ketoses; Ring structure of sugars, of sugars, epimers and enantiomers;Formation of disaccharides, reducing and non-reducing disaccharides; Polysaccharides – homo- and heteropolysaccharides.

References:

1. Molecular Biology –David Frifelder
2. Genes IX –Benjamin Lewin
3. Molecular biology of the gene J. D. Watson and et. al.,
4. Molecular Biology of the Cell –Bruce Alberts and et. al.,

MATERIAL SCIENCE

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle- Material Science **Course Code**- BBE42MML107
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- To provide a comprehensive idea about the components, properties and function of immune systems
Learning outcomes- After completing the course, the student will be able (i) to analyze the results of an immuno assay including clinical diagnostic reports. (ii) to design immune assay as per the requirement (iii) to analyze the immune response by accounting the contribution of participating cells and other factors.

COURSE CONTENTS

THEORY

UNIT I: Crystal Structures and Diffraction:

Introduction to crystal structures: crystal lattices, unit cells, and crystal systems. Miller indices and crystallographic notation. X-ray diffraction and its application to determine crystal structures.
Reciprocal lattice and its significance in diffraction. Neutron and electron diffraction techniques.

UNIT II:Mechanical Properties of Materials:

Introduction to how materials respond to mechanical forces and stresses- Stress and strain: definitions, relationship, and components.Elastic deformation and Hooke's law. Plastic deformation: yield criteria, strain hardening, and stress-strain curves. Fracture mechanics and types of fractures. Fatigue behavior, crack propagation, and endurance limit.

UNIT III:Phase Thermodynamics and Transformations

Thermodynamic principles governing phase equilibria and transformations in materials. Laws of thermodynamics: energy, entropy, and Gibbs free energy. Phase diagrams: interpretation, lever rule, and tie lines. Binary phase diagrams: eutectic, peritectic, and solid solutions. Diffusion and kinetics of phase transformations. Heat treatment processes: annealing, quenching, and tempering.

UNIT IV:Materials Characterization Techniques:

Introduction to various techniques used to analyze and understand materials at different scales.
Optical microscopy and electron microscopy: principles and applications. X-ray diffraction for crystallography and phase identification. Scanning probe microscopy: AFM and STM. Spectroscopic techniques: IR, UV-Vis, NMR, and Raman. Thermal analysis methods: DSC and TGA.

UNIT V: Electronic and Magnetic Properties of Materials:

The behavior of materials concerning their electronic structure and properties. Energy bands in solids: valence and conduction bands. Band gap and semiconductor behavior. Intrinsic and extrinsic semiconductors. Carrier transport: electron and hole mobility. Magnetic properties: ferromagnetism, antiferromagnetism, and paramagnetism.

REFERENCEBOOKS/TEXTBOOK

Crystal Structures and Diffraction:

1. "Introduction to Solid State Physics" by Charles Kittel
2. "X-Ray Diffraction" by B.E. Warren
3. "Introduction to Crystallography" by Donald E. Sands

Mechanical Properties of Materials

1. "Mechanical Behavior of Materials" by Thomas H. Courtney
2. "Materials Science and Engineering: An Introduction" by William D. Callister Jr. and David G. Rethwisch
3. "Fundamentals of Materials Science and Engineering" by William F. Smith and Javad Hashemi

Thermodynamics and Phase Transformations:

1. "Phase Transformations in Metals and Alloys" by David A. Porter, Kenneth E. Easterling, and Mohamed Sherif
2. "Physical Metallurgy Principles" by Robert E. Reed-Hill and Reza Abbaschian

Materials Characterization Techniques:

1. "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods" by Yang Leng
2. "Introduction to Scanning Transmission Electron Microscopy" by R.F. Egerton
3. "Introduction to Solid State NMR Spectroscopy" by Melinda J. Duer

Electronic and Magnetic Properties of Materials:

1. "Introduction to Solid State Physics" by Charles Kittel
2. "Electronic Properties of Materials" by Rolf E. Hummel
3. "Solid State Physics" by Ashcroft and Mermin

NUMERICAL AND COMPUTATIONAL FUNDAMENTALS - I

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle- Numerical and Computational Fundamentals-I**Course Code-** BBE42MML108
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- The main topics covered in this course will be sets, relations and functions, propositions, principles of counting, permutations and combinations, generating functions, graphs and planar graphs, trees, recurrence relations and some topics in group theory.
Learning outcomes- The main topics covered in this course will be calculus, polyomials, permutations and combinations, python basics.

COURSECONTENTS

THEORY

UNITI: Permutation and Combination

Introduction, Quadratic equation, Factorization method, Completing square method, Formula method.

Permutation and Combination:Introduction, Factorial notation, Permutation, Combination.

UNIT II: Vector Calculus

Vector Calculus: Dot product,Cross product,Gradient, Divergence and Curl, Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem.

UNIT III: Polynomial

Linear transformations and their matrix representations, Rank and Nullity; systems of linear equations, Characteristic polynomial, Eigenvalues and Eigenvectors, Diagonalization, Minimal Polynomial.

UNIT IV: Python Basics I

Python Introduction, Data types: Numbers, Strings, Lists, Loop, Functions

UNIT V: Python Basics II

Operators in python, Biostatistics, Data Input and Output

References

Suggested ReadingBook:

1. PythoninNutshell,AlexMartelli,O'Reilly.
2. ObjectiveMathematicsforJEEMain15thEditionbyAnoopSrivastava(Author)

CELL GENETICS AND EVOLUTION

University-MGMUniversity, AURANGABAD **Faculty-**Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree-**B.Tech. Biomedical Engineering
CourseTitle- Cell Genetics And Evolution **Course Code-** BBE42MML108
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- To make students know regarding inheritance.
Learning outcomes-. Upon successful completion, students will have the have the theoretical background and understanding of working of cell. How DNA is involved in inheritance. The DNA replication models and segregation of alleles.

COURSECONTENTS

THEORY

UNIT I- CELL RESPIRATION

Catabolic Pathways and Production of ATP, Redox Reactions: Oxidation and Reduction, Stages of Cellular Respiration, Oxidation of Pyruvate to Acetyl CoA, Citric Acid Cycle, Pathway of Electron Transport, Chemiosmosis: The Energy-Coupling Mechanism, Fermentation and anaerobic respiration, Comparing Fermentation with Anaerobic and Aerobic Respiration

UNIT II- LINKAGE AND CHROMOSOMES

Morgan's first mutant, Sex-linked genes- The Chromosomal Basis of Sex, Inheritance of X-Linked Genes, X Inactivation in Female Mammals, Genetic Recombination and Linkage- Recombination of Unlinked Genes: Independent Assortment of Chromosomes, Recombination of Linked Genes: Crossing Over, Linkage map, Abnormal Chromosome Number, Alterations of Chromosome Structure, Genomic Imprinting, Human Disorders Due to Chromosomal Alterations

UNIT III- NUCLEIC ACIDS AND INHERITANCE

Evidence That DNA Is the Genetic Material, Structural Model of DNA, Semiconservative mode of replication, Origins of replication in E. coli and eukaryotes, Initiation of DNA replication, Antiparallel elongation, Proofreading and Repairing DNA

UNIT IV- MENDELIAN GENETICS

Mendel's Experimental, Quantitative Approach, The Law of Segregation, Mendel's Model, The Law of Independent Assortment, The Multiplication and Addition Rules Applied to Monohybrid Crosses, Degrees of Dominance, Pedigree Analysis, Recessively Inherited Disorders, Dominantly Inherited Disorders

UNIT V- EVOLUTION

Lamarck's Hypothesis of Evolution, Darwin's Research, Gene Pools and Allele Frequencies, HardyWeinberg Equation, Natural Selection, Genetic Drift, Sexual Selection, Balancing Selection

Reference Books

1.Biology- A Global Approach Biology, ELEVENTH EDITION, Campbell Urry Cain Wasserman Minorsky Reece, Harlow, Essex, England : Pearson Education Limited, 2018

2.Biological Science Sixth Edition Global Edition Scott Freeman, Kim Quillin, lizabethalliSon , michael black ,Pearson Education Limited 2017

BIOCOMPUTATIONAL LAB

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle- Biocomputational Lab **Course Code**- BBE42VSP105
Credits-2+0(3Theory) **Level of Study:**UG
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- To develop an understand the principles of various fields of genetics and basic python.
Learning Outcomes: Students will acquire knowledge of basic genetics and python.

COURSECONTENTS

Practical
Genetics

1. To detect UV and dark repair mechanism
2. Mitosis in onion root tip
3. To detect UV and dark repair mechanism
4. Human Karyotypes with chromosome disorder (picture baseg. Down syndrome)
5. Creating Punnett Squares and Predicting Genetic Crosses: Select simple genetic traits (e.g., Mendelian traits) and create Punnett squares to predict offspring ratios.
6. Cross individuals with known genotypes and observe if the offspring match the predicted ratios.

Computational

1. Introduction to Python interpreter and basic arithmetic operations.
2. Exploring different numeric data types: integers, floats, and complex numbers.
3. Performing arithmetic calculations and assignments with numbers.
4. Converting between data types and utilizing basic mathematical functions.
5. Creating and manipulating strings using various methods and operators.
6. String indexing and slicing to extract substrings.
7. Using string methods for manipulation (e.g., upper(), lower(), split(), replace()).
8. Formatting strings using f-strings or format().
9. Creating lists and understanding list indexing and slicing.
10. Modifying lists: adding, removing, and changing elements.
11. Utilizing list methods like append(), extend(), and insert().
12. Iterating through lists using loops and list comprehension.
13. Writing for loops to iterate through a sequence (e.g., range) and perform actions.
14. Using while loops for conditional repetition.
15. Combining loops with data structures like lists for various tasks.
16. Implementing nested loops for more complex iterations.
17. Defining functions with and without parameters.
18. Utilizing return statements to pass values back from functions.
19. Using operators (+, -, *, /, %, //) within functions.
20. Creating custom functions to perform specific tasks.
21. Descriptive statistics: calculating mean, median, mode, and standard deviation.
22. Probability and distributions: simulating coin tosses, rolling dice, etc.
23. Hypothesis testing: conducting t-tests or chi-square tests with sample data.
24. Correlation and regression: analyzing relationships between variables.

25. Reading data from files (e.g., CSV, text files) using Python's built-in functions.
26. Writing data to files for storage or analysis.
27. Parsing and extracting specific information from data files.
28. Using context managers (with statement) to handle file operations safely.

MICRO LAB

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle-Micro Lab **CourseCode**- BBE42MMP105
Credits-0+2(2Practical) **Levelof Study:UG**
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- To develop an understand the principles of various fields of microbiology. To identify the cellular and molecular basis of bacterial cells.
Learning outcomes- To demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments

COURSECONTENTS

Practical

1. Preparation of laboratory nutrient media (Nutrient agar/broth, MacConkey's agar).
2. Enumeration of bacteria from fermented food / soil / water by: i. Spread plate method ii. Pour plate method
3. Isolation of bacteria by streak plate technique (Colony and cultural characteristics)
4. Microscopic examination of bacteria
5. Pure culture method
6. Serial dilution and plating
7. To study the effect of different parameters on growth of E. coli: pH, temperature, sodium chloride concentration
8. Isolation and identification of Algae from soil
9. To determine presence of chlorine ions
10. Isolation of phosphate solubilizing bacteria from soil
11. Membrane filtration technique for enumerating microbes in water samples.
12. Disc diffusion method (Kirby-Bauer) for testing antibiotic susceptibility
13. Catalase test for detection of catalase enzyme activity in bacteria
14. Oxidase test to determine the presence of cytochrome c oxidase in bacteria
15. Indole test and citrate utilization test for differentiation in bacteria
16. Measurement of bacterial growth using optical density (spectrophotometry).
17. Plating methods for quantifying viable bacterial counts (CFU/mL).
18. Staining techniques: Gram staining for bacterial cell morphology.
19. Isolation of bacteria from a mixed culture using streak plate method.
20. Minimum inhibition count

MOL BIO LAB

University-MGMUniversity, AURANGABAD **Faculty**-Engineering and Technology
Institute-Institute of Biosciences and Technology **Degree**-B.Tech. Biomedical Engineering
CourseTitle-Mol Bio Lab **CourseCode**- BBE42MMP106
Credits-0+2(2Practical) **Levelof Study:UG**
Mode of delivery planned learning activities and teaching method: Practical 4hrs./weekly
Recommended Year/Semester: B.Tech.Biomedical Engineering,Year1/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.
Objective- 1. To isolate DNA and RNA from different sources. 2. To estimate concentrations of DNA and RNA using different methods
Learning outcomes- The student will be able to 1. Isolate DNA from bacterial, plant and animal cells and RNA from yeast cells. 2. Estimate concentrations of DNA and RNA by conventional methods and UV absorption methods. 3. Determine the melting temperature(Tm) of DNA

COURSECONTENTS

Practical

1. Measurement of volumes using pipettes and micropipettes.
2. Tests for carbohydrates: Benedict's test, iodine test.
3. Tests for proteins: Biuret test.
4. Tests for lipids: Sudan III test, emulsion test.
5. Estimation of glucose using the Folin-Wu method.
6. Estimation of total protein concentration using the Bradford assay.
7. Determination of enzyme activity using the spectrophotometric assay.
8. Preparation of buffer solutions of different pH values.
9. Measuring and adjusting pH using a pH meter.
10. Study the denaturation of egg white proteins by heat or chemicals.
11. Thin-layer chromatography (TLC) for separation of amino acids or pigments.
12. Extraction and quantification of chlorophyll from plant leaves.
13. Estimation of total antioxidant capacity using the ABTS assay.
14. Immobilization of an enzyme onto a support matrix and testing its activity.
15. Isolation of proteins from a complex mixture using methods like salting out or dialysis.

Recommended Books:

1. Hawk’s Physiological chemistry
2. Practical Biochemistry by T Plummer
3. Practical Biochemistry by J Jayaraman
4. Klemir and others: practical Biological chemistry.
5. Practical Biochemistry – Koch and Hank Dunn and Drell
6. Practical Biochemistry-Sawhney (2000)
7. Varley’s Practical clinical Biochemistry – Ed. Alan W.Gowenlock (Heinemann Medical Books, London
8. https://faculty.ksu.edu.sa/sites/default/files/bch361_handnote_1.pdf

ListofOptionstoselectfromBucketofCoursesprovidedinvariouscategories(SampleofFacultyofBasicandAppliedSciences):

Major
FoodTechnologyand Processing

	Minor optionsWithinFacultyofBasic Sciences	**Biotechnology**
		Biomedical Engineering

MinoroptionsfromOtherFaculty	**Faculty ofEngineering andTechnology**	**Faculty of SocialSciences andHumanities**	**FacultyofDesign**	**Faculty of ManagementandCommerce**
	ArtificialIntelligence(AI)	Journalism and MassCommunication	Product Design	Operations and SupplyManagement
	Machine Learning(ML)	Film Making	VisualCommunicati on	HumanResource(HR)
	DataAnalytics	Photography	ContemporaryArts	FinanceManagement
	Robotics	Psychology	InteriorDesign	Marketing
	IndustrialAutomatio n	Economics	Fashion Technology	Accounting

IKS (As per the UGC guidelines.VisitLink:https://iksindia.org/English-BGSamposhan-Kendram-1-updated.pdf)* **	**Facultyof**	**AEC (to bediscussed anddevelopedby committee ofDean)***	

Holisticmedicineandwellness			CommunicativeEnglish	
Indianpsychologyandyoga	*****CoursesFor referencepurposeonly**		CommunicationandSoft Skills	***CoursesForreferencepurposeonly**
Indiansportsandmartial arts			German	
Architecturalengineering,townplanning, civil engineering, VaastuandShilpaShastra			French	
Sustainableagricultureandfoodpreservationmethods			Spanish	

VSEC (Respectivedepartments willpreparethelist)	**Facultyof**		**CC(Twocoursestobefinalized for I & IISemester)*** **		**VEC (to be discussed and developed bycommitteeof Dean) *** **
			NSS	*****Courses Forreferencepurposeonly**	UniversalHumanValues
			DigitalAwareness		
			PersonalityDevelopment		GandhianStudies
			Yoga		
			NCC		ValueEducation

TENTATIVE COURSE STRUCTURE III SEM TO VIII SEM

Second Year (Semester III)																							
Course Type	**Course code**	**Course Title**	**Type**	**Teaching period per week**			**Credits**	**Duration of Exam**	**Evaluation Scheme (Marks**						**Total**	**Minimum Passing (Marks)**					**Total**
				L	**T**	**P**			**Internal**				**External**			**Internal**					
									CA1	**MSE**	**CA2**	**TW**	**ESE**	**PR**		**CA/MSE/TW**			**ESE**	**PR**	
PCC	BBE42MML201		Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML202		Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML203		Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
MDM			Theory/Practical	2	-	-	2		10	10	10	-	20	-	50				8		20
OE			Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
OE			Practical	-	-	4	2			-		30	-	20	50					8	20
AEC			Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
EEMC			Theory/Practical	2	-	-	2			-		30	-	20	50					8	20
VEC			Theory	2			2		10	10	10	-	20	-	50				8		20
FP			Practical	-	-	4	2					30	-	20	50					8	20
PCC	BBE42MMP202		Practical		-	4	2					30	-	20	50					8	20
		Total = 28		**16**		**12**	**22**								**650**						**260**

Second Year (Semester IV)

Course Type	Course code	Course Title	Type	Teaching period per week			Credit	Duration of Exam	Evaluation Scheme (Marks						Total	Minimum Passing (Marks)					Total
									Internal				External			Internal			External		
				L	T	P			CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBE42MML204	Food Preservation, Energy Generation And Conservation	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML205	Food Quality Assurance, HACCP and Hygiene	Theory	2		-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML206	Numerical And Computational Fundamentals-III	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
MDM		Genomics and Proteomics	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
OE		Unit Operation in Food Processing	Theory	2		-	2		10	10	10	-	20	-	50				8		20
VSEC	BBE42VSP201	Mini Project	Project/Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
EEMC		EEMC Entrepreneurship Economics Management Course	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
VEC		Value Education Course	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MMP203	Food Lab	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
PCC	BBE42MMP204	Food Quality Lab	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
PCC	BBE42MMP205	Food Preservation Lab	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
		Total = 30		**14**		**16**	**22**								**550**						**220**

Third Year (Semester V)

Course Type	Course code	Course Title	Type	Teaching period per week			Credit	Duration of Exam	Evaluation Scheme (Marks							Minimum Passing (Marks)					
									Internal				External		Total	Internal			External		Total
				L	T	P			CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBE42MML301	Cereals, Legumes, Pulses And Oil Seeds Processing Technology	Theory	3	-	-	3		20	20	20	-	40	-	100				16		40
PCC	BBE42MML302	Food Defence And Sustainability	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PCC	BBE42MML303	Numerical And Computational Fundamentals-IV	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PEC		1. Confectionary and Snacks Technology	Theory	2		-	2		10	10	10	-	20	-	50				8		20
PEC		1. Confectionary and Snacks Lab	Project/Practical			4	2		-	-	-	30	-	20	50					8	20
MDM		1. Plant Tissue Engineering	Theory	2	-		2		10	10	10	-	20	-	50				8		20
MDM		1. Plant Lab Or Mini Project	Project/Practical		-	4	2		-	-	-	30	-	20	50					8	20
OE		Advances in Food Innovation	Theory	2	-		2		10	10	10	-	20	-	50				8		20
PCC	BBE42MMP301	Food Lab	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
PCC	BBE42MMP302	Food Processing Lab	Practical		-	4	2					30	-	20	50					8	20
		Total =30		**14**		**16**	**22**								**600**						**240**

Third Year (Semester VI)

Course Type	Course code	Course Title	Type	Teaching period per week			Credit	Duration of Exam	Evaluation Scheme (Marks							Minimum Passing (Marks)					
									Internal				External		Total	Internal			External		Total
				L	T	P			CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBE42MML304	Fruits, Vegetables, Spices And Plantation Crop Processing Technology	Theory	2	-	-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML305	Food Law Ethics And CSR	Theory	2		-	2		10	10	10	-	20	-	50				8		20
PCC	BBE42MML306	Food Rheology, Texture and Sensory Science	Theory	2		-	2		10	10	10	-	20	-	50				8		20
PEC		Instrumentation and Process Control	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PEC		Food Processing Equipment Design	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PEC		Food Instrumentation and Equipment Design Lab	Practical		-	4	2		-	-	-	30	-	20	50					8	20
MDM		Animal Tissue Engineering	Theory/Practical	2	-		2		10	10	10	-	20	-	50				8		20
VSEC	BBE42VSP301	Mini Project	Project/Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
PCC	BBE42MMP303	1. Seminar (Research Paper Based) OR 2. Food Product Design	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
PCC	BBE42MMP304	Processing And Evaluation Lab	Practical	-	-	4	2					30	-	20	50					8	20
		Total = 30		**14**		**16**	**22**								**600**						**240**

Fourth Year (Semester VII)

Course Type	Course code	Course Title	Type	Teaching period per week			Credit	Duration of Exam	Evaluation Scheme (Marks							Minimum Passing (Marks)					
									Internal				External		Total	Internal			External		Total
				L	T	P			CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBE42MML401	Nutraceutical and Functional Food	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PCC	BBE42MML402	Food Fermentation	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PCC	BBE42MML403	Bakery, Confectionary, Snacks And Beverage Processing Technology	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PCC	BBE42MML404	Food Defence And Sustainability	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PEC		Food Packaging Technology	Theory	2		-	2		20	20	20	-	40	-	100				16		40
PEC		Food Plant Sanitation	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PEC		Food Plant Sanitation	Practical	-	-	4	2		20	20	20	-	40	-	100				16		40
MDM		Molecular Pharming And Biopharmaceuticals	Theory/Practical	2		-	2		10	10	10	-	20	-	50				8		20
MDM		Advanced Topics in Molecular Biology	Theory	2		-	2		20	20	20	-	40	-	100				16		40
		Total = 25		**21**		**4**	**23**														

Fourth Year (Semester VIII)

Course Type	Course code	Course Title	Type	Teaching period per week			Credit	Duration of Exam	Evaluation Scheme (Marks							Minimum Passing (Marks)					
									Internal				External		Total	Internal			External		Total
				L	T	P			CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
RM	BBE42RML401	Research Methodology	Theory	2	-	-	2		20	20	20	-	40	-	100				16		40
RM	BBE42RMP402	Research Methodology	Practical	-	-	4	2		-	-	-	30	-	20	50					8	20
P	BBE42PP401	Project	Practical	-	-	8	4		-	-	-	30	-	20	50					8	20
OJT	BBE42JTI401	On Job Training	Internship			24	12														
		Total =					**20**														