



**MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY**

**CHOICE-BASED CREDIT SYSTEM(CBCS)
SEMESTER PATTERN**

**Faculty of Engineering and Technology Graduate (UG)
program**

**Biotechnology - CURRICULUM
w.e.f. Academic Year 2023-24**

**B.Tech, B. Tech. (Hons.), B. Tech. (Hons.) with Research of
Biotechnology**

SEMESTER (I and II)

**MGM UNIVERSITY, AURANGABAD
INSTITUTE OF BIOSCIENCES AND TECHNOLOGY**

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Engineering and Technology Graduate (UG) program

BIOTECHNOLOGY - CURRICULUM

B.Tech. Biotechnology

FIRST YEAR

SEMESTER-I

CURRICULUM

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

Name of the College/Institute: Institute of Bioscience and Technology
 Name of the Program : **(3/4 Years UG programme)** B.Tech. Biotechnology
 Program Type: UG B.Tech Biotechnology

Faculty of Engineering and Technology

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		CA/MSE/TW	ESE	PR	
BSC	BBT42MML101	Basic Cell Biology	Theory	3			3		20	20	20	-	40	-	100		16		40
BSC	BBT42MML102	General Biochemistry	Theory	3		-	3		20	20	20	-	40	-	100		16		40
ESC	BBT42MML103	Biology Concept, Connection and Innovation	Theory	2		-	2		10	10	10	-	20	-	50		08	-	20
ESC	BBT42MML104	Microbial Physiology	Theory	2		-	2		10	10	10	-	20	-	50		08	-	20
AEC		Ability Enhancement Course	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
VSEC	BBT42VSP101	Mini project	Practical	-		4	2					30		20	50		08		20
BSC	BBT42MMP101	Biochemistry Lab	Practical	-		4	2					30		20	50		08		20
ESC	BBT42MMP102	Cell Bio Lab	Practical	-		4	2					30		20	50		08		20
ESC	BBT42MMP103	Microbiology Lab	Practical	-	-	2	2			-		30	-	20	50			08	20
CC		Co-Curricular Activity	Practical		-	4	2			-		30	-	20	50			08	20
Total (L-T-P) Hrs / week = 30				12		18	22								550				220

First Year (Semester II)																					
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
									CA-I	MSE	CA-II	TW	ESE	PR	CA/MSE/TW		ESE	PR			
BSC	BBT42MML105	Enzymology	Theory	3			3		10	10	10	-	20	-	50		08		20		
BSC	BBT42MML106	Molecular Biology of Gene	Theory	3		-	3		10	10	10	-	20	-	50		08		20		
ESC	BBT42MML107	Immunology	Theory	2		-	2		20	20	20	-	40	-	100		16		40		
ESC	BBT42MML108	Numerical and Computational Fundamentals-I	Theory	2		-	2		20	20	20	-	40	-	100		16		40		
PCC		Mendel And Darwin Theory	Theory	2		-	2		20	20	20	-	40	-	100		16		40		
VSEC*	BFT4VSP105	Mini project	Practical	-		4	2					30	20	-	50		08		20		
ESC	BBT42MMP104	Immuno Lab	Practical			4	2					30									
ESC	BBT42MMP105	Computational Lab	Practical	-		4	2					30	20	-	50		08		20		
BSC	BBT42MMP106	Enzymo Lab	Practical	-	-	4	2			-		30	-	20	50			08	20		
CC		Co-Curricular Activity	Practical	-	-	4	2			-		30	-	20	50			08	20		
		Total (L-T-P) Hrs / week = 32		12		20	22								600				200		

*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)			
				L	T	P			Internal				External		Total	Internal		External	Total
									CA-I	MSE	CA-II	TW	ESE	PR		CA/MSE/TW	ESE	PR	
BSC	BBT42MM L101	Basic Cell Biology	Theory	3			3		20	20	20	-	40	-	100		16		40
BSC	BBT42MM L102	General Biochemistry	Theory	3		-	3		20	20	20	-	40	-	100		16		40
ESC	BBT42MM L103	Biology Concept, Connection and Innovation	Theory	2		-	2		10	10	10	-	20	-	50		08	-	20
ESC	BBT42MM L104	Microbial Physiology	Theory	2		-	2		10	10	10	-	20	-	50		08	-	20
AEC		Ability Enhancement Course	Theory	2	-	-	2		10	10	10	-	20	-	50		08		20
VSEC	BBT42VSP 101	Mini project	Practical	-		4	2					30		20	50		08		20
BSC	BBT42MM P101	Biochemistry Lab	Practical	-		4	2					30		20	50		08		20
ESC	BBT42MM P102	Cell Bio Lab	Practical	-		4	2					30		20	50		08		20
ESC	BBT42MM P103	Microbiology Lab	Practical	-	-	2	2			-		30	-	20	50			08	20
CC		Co-Curricular Activity	Practical		-	4	2			-		30	-	20	50			08	20
Total (L-T-P) Hrs / week = 30				12		18	22								550				220

BASIC CELL BIOLOGY

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:
Institute of Biosciences and Technology. Degree: B.Tech. Biotechnology Course Unit
Code: Course Title: Basic cell biology
Credits allocated: 3+0 Level of Study: UG

Recommended Year /Semester: B.Tech. Biotechnology Year 1/ Semester I

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

Course Objective:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Students will understand how these cellular components are used to generate and utilize energy in cells
3. Students will understand the cellular components underlying mitotic cell division
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

Course Outcomes:

COURSE CONTENT

THEORY

Unit I: Cells and Genome (8 Lecture)

Introduction to cell: Cells and Genome: The Universal features of cells on Earth, Genetic Information in Eukaryotes. The chemical component of a cell Proteins: The Shape and Structure of Proteins. Protein Function.

Unit II: Internal Organization of the cell (8 Lecture)

Membrane Structure: The Lipid Bilayer, Membrane proteins, Membrane transport of small molecules and the electrical properties of membranes: Principles of membrane transport,

Transporters and active membrane transport, Channels and the electrical properties of membranes.

Unit III: Ways of Working with Cells (8 Lecture)

Analysing cells, molecules, and systems: Isolation cells and Growing them in culture, Purifying Proteins, Analyzing Proteins, Analyzing and Manipulating DNA. Electron Microscope, Compound Microscope.

Unit IV: Cell Signaling (8 Lecture)

The Principals of Cell Signaling, signaling through G- protein- Coupled Receptors. The Cell Cycle, Cell Death, Cell Junction and the Extracellular Matrix

Unit V: Pathogens and Infection (8 Lectures)

The Innate and Adaptive Immune Systems. Antigens, Antibody, Antigen-Antibody interaction, ELISA.

Reference Book/ suggested Reading/ Textbook

1. Molecular Biology of the Cell (6th Edition) ...
2. The Cell: A Molecular Approach (7th Edition) ...
3. Essential Cell Biology (4th Edition) ...
4. Mitochondria and the Future of Medicine (1st Edition) ...
5. The Double Helix (1st Edition) ...
6. The Epigenetics Revolution (1st Edition)

General Biochemistry

University: MGM University, Aurangabad	Faculty: Engineering and Technology
Institute: Institute of Biosciences and Technology.	Degree: B.Tech. Biotechnology
Course Code:	Course Title: General Biochemistry
Credits allocated: 3+0	Level of Study: UG

Recommended Year /Semester: B.Tech. Biotechnology Year 1/ Semester I

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

Course Objective:

- 1.The student will have an understanding of the metabolic processes by which energy is produced in cells and amino acids, lipids, purines and pyrimidines, and carbohydrates are synthesized.
- 2.The student will be able to describe the roles of vitamins in metabolic processes and enzyme activity.

Course Outcomes:

1. The learning outcomes are designed to help learners understand the objectives of studying Biochemistry that is, to analyse, appreciate, understand the basic concepts of chemical reactions that occur in living systems
2. The student will be able to identify the structural elements of proteins, the basic features of enzyme catalysis and regulation, and the function of hemoglobin in oxygen binding and transport.
3. The student will be able to describe the basic structural features of nucleic acids

COURSE CONTENTS

THEORY

Unit I: Introduction: Biochemistry & it's scope (8 Lectures)

Cellular Biochemistry - Cell-structure – plant and animal, composition and function of cell organelle Carbohydrates: Occurrence, Classification & Structures; Physicochemical and Metabolic functions.

Unit II: Biological role of carbohydrates (8 Lectures)

Metabolism of carbohydrates - glycolysis and respiration, production of ATP, brief description of electron transport chain, oxidative and substrate phosphorylation Proteins: Occurrence, Classification & Structures; Physicochemical & Metabolic functions.

Unit III: Metabolism of proteins (8 Lectures)

Breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation, urea cycle; Lipids: Occurrence, Classification & Structure; Physicochemical and metabolic functions.

Unit IV: Biological Role of Lipid (8 Lectures)

classification and biosynthesis; Biological role of lipids; breakdown of triglycerides and phospholipids; β -oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids.

Unit V: Nucleic Acids (8 Lectures)

Classification, structure & biosynthesis of nucleic acid; Metabolism RNA and DNA metabolism. Vitamins; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes, Minerals; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes.

TEXT BOOK

1. Fundamentals of Biochemistry Jain JL, Jain S and Jain N S. Chand Publication, India 2016
2. Biochemistry Satyanarayana Elsevier, 2013
3. Lehninger Principles of Biochemistry David L. Nelson and Michael M. Cox 6th Ed. Macmillan Learning, NY, USA. 2012
4. Outlines of Biochemistry Conn EE and Stumpf PK 4 th Edition Wiley Eastern Ltd, Pune (India)

Reference Book/ suggested Reading/ Textbook:

1. Wardlaw's Perspectives in Nutrition: A Functional Approach Gaile Moe, Danita Kelley, Byrd-Bredbenner Jacqueline Berning and Carol Mc Graw-Hill, Inc., NY, USA. 2013
2. Biochemistry Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer 4th Ed. John Wiley and Sons, Inc., NY, USA. 2011
3. Handbook of Nutrition and Food Donald Voet and Judith G. Voet 2nd Ed. CRC Press, Boca Raton, FL, USA. 2008
4. Biochemistry & Molecular Biology of Plants Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones John Wiley and Sons, Inc., NY, USA. 2002

Biology Concept, Connection, Innovation and Application

University: MGM University, Aurangabad

Faculty: Engineering and Technology

Institute: Institute of Biosciences and Technology. Degree: B.Tech. Biotechnology Course

Code:

Course Title: Biology Concept,
Connection, Innovation and Application

Credits allocated: 2+0

Level of Study: UG

Recommended Year /Semester: B.Tech. Biotechnology Year 1/ Semester I

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

Course Objective:

- 1.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.
- 2.To enable student to do Critical thinking skills, study skills, and basic math skills are also included.

Course Outcomes:

Specific skills and competencies expected of students who complete this course include:

- 1.Describe basic physicochemical concepts that underlie the structure and function of cells
- 2.Describe the structure and function of the four classes of biomolecules
- 3.Describe the structure and function of eukaryotic cells and their organelles
- 4.Describe the processes by which substances move into and out of cells
- 5.Describe the structure and function of enzymes
- 6.Discuss energy transfer in cells and the pathways of cellular respiration
- 7.Describe DNA replication, protein synthesis, mitosis and meiosis
- 8.Analyse, synthesize, evaluate and apply information
- 9.Apply mathematical, logical and scientific principles and methods
- 10.Demonstrating higher level critical thinking skills, solving problems, and following directions
- 11.Directing their own learning activities to meet course objectives

COURSE CONTENTS

THEORY

Unit I: The molecular basis of Life/ Cell (6 Lectures)

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 (6 Lectures)

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 (6 Lectures)

Cells: The working Units of Life, Features of Prokaryotic and Eukaryotic cell, chemical structure and functions of lipids, Cell Membranes, Cell communication and multicellularity, Signal 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 (6 Lectures)

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 (6 Lectures)

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

Reference Book/ suggested Reading/ Textbook:

1. Biology -Concepts & Applications by Cecie Starr Christine A. Evers Lisa Starr
2. BIOLOGY- Concept and investigation by Mariëlle Hoefnagels
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

Microbial Physiology

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:

Institute of Biosciences and Technology. Degree: B.Tech. Biotechnology

Course Code:

Course Title: Microbial Physiology

Credits allocated: 2+0

Level of Study: UG

Recommended Year /Semester: B.Tech. Biotechnology Year 1/ Semester I

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

Learning Outcomes:

After completion of the lecture component of the course, successful students will:

1. Demonstrate an understanding of cellular superstructure and the functional components of cells.
2. Demonstrate an understanding of how organisms build and maintain a proton motive force.
3. Comprehend the how cells metabolize the nutrients necessary for life including carbon, nitrogen, sulphur and phosphorus.
4. Appreciate how biochemical pathways and processes are integrated into a network, which provides robustness to life.
5. Comprehend how cellular physiology is altered by interactions between microbes and the environment.
6. Appreciate that the diversity of life is driven by the metabolic diversity of microbes.

Objective:

Students are expected to gain a fundamental understanding of the organization and metabolism of microbial cells to further comprehend the robust and diverse nature of life.

COURSE CONTENTS

THEORY

Unit I: Microbial Growth (6 Lectures)

Definition of growth, balanced and unbalanced growth, growth curve, the mathematics of growth-generation time, specific growth rate, batch and continuous culture, Synchronous growth, diauxic growth curve. pH-classification based on pH ranges and adaptations

Unit II: Microbial Transport and Metabolism (6 Lectures)

Diffusion – Passive and facilitated, Primary active and secondary active transport, Group translocation (phosphotransferase system), symport, antiport and uniport, electrogenic and electro neutral transport. Chemolithotrophic metabolism- Carbondioxide fixation: Calvin cycle and reductive TCA cycle. physiology of bacterial photosynthesis: light reactions, cyclic and non- cyclic photophosphorylation.

Unit III: Enzymes and Regulation (6 Lectures)

Enzymes: Importance, structure and classification of enzymes. Apoenzyme and cofactors. Prosthetic group, coenzyme and metal cofactors. Active site and its salient features. Mechanism of enzyme action. Activation energy, Lock and key hypothesis, induced fit. Enzyme kinetics and inhibition, Effect of pH and temperature on enzyme activity. irreversible and reversible inhibition: competitive and non-competitive inhibition. Activity: allostery, covalent modification and feedback inhibition.

Unit IV: Microbial energetics and Nitrogen Fixation (6 Lectures)

Concept of aerobic respiration, anaerobic respiration and fermentation. Central metabolic pathways: EMP pathway, ED pathway, PP pathway, and TCA cycle. Gluconeogenesis. Nitrogen Fixation – Physiology of nitrogen cycle. Assimilatory and dissimilatory nitrate reduction, biological nitrogen fixation. Nitrogen fixers and mechanism of nitrogen fixation.

Unit V: Microbial Respiration (6 Lectures)

Components of respiratory chain, and their inhibitors. Anaerobic respiration, denitrification, nitrate/nitrite respiration. Oxidative phosphorylation: ATP synthesis and ATP synthase. Uncouplers, Chemical coupling, conformational coupling

Reference Book/ suggested Reading/ Textbook:

1. Atlas RM. (1989). Microbiology: Fundamentals and Applications. 2nd Edition, MacMillan Publishing Company, New York.
2. Conn EE and Stumpf PK. (1976). Outlines of Biochemistry. John Wiley & Sons.
3. Gallon JR and Chaplin AE. (1987). An Introduction to Nitrogen Fixation. Cassell Education Ltd.

4. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
5. Lehninger A. (1982). Biochemistry. Worth Publ.
6. Moat AG and Foster JW. (2002). Microbial Physiology. John Wiley and Sons

MINI PROJECT

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:
Institute of Biosciences and Tech. Degree: B.Tech. Biotechnology
Course Code: Course Title: Micro Project
Credits allocated: 0+2 (1 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Project 2 hrs / weekly
Recommended Year /Semester: B.Tech. Biotechnology, Year 1/ Semester I

Project Assessment:

Ideas of project:

Defining projects 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.

Attendance:

In ongoing semester attendance are important for students. They are expected to do their project in the semester that is timetabled. The criteria of attendance are given below.

BIOCHEMISTRY LAB

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:

Institute of Biosciences and Tech.

Degree: B.Tech. Biotechnology

Course Code: BBL-117

Course Title: Biochemistry Lab

Credits allocated: 0+2 (Practical)

Level of Study: UG

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

Recommended Year /Semester: B.Tech. Biotechnology, Year 1/ Semester I

Detail syllabus

1. Qualitative analysis of carbohydrates (Glucose, Fructose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Preparation of buffer solution and measurement of pH.
5. Study of enzymatic hydrolysis of Starch.
6. Determination of Salivary Amylase activity.
7. Amino acids and protein qualitative tests
8. Estimation of proteins by Lowry's method
9. Lipids Qualitative test
10. Separation of amino acids by TLC
11. To study the Fehling and Benedict test for carbohydrates
12. To study Sumner's Method for reducing sugar
13. To study Anthron method
14. Quantification of RNA by Orcinol method
15. To estimate amount of protein by Biuret method.

Cell Biology Lab

University: MGM University, Aurangabad Faculty: Engineering and Technology
Institute: Institute of Biosciences and Tech. Degree: B.Tech. Biotechnology
Course Code: Course Title: Cell biology Lab
Credits allocated: 0+1 (1Practical) Level of Study: UG
Mode of delivery, planned learning activities and teaching method: Practical 2 hrs / weekly
Recommended Year /Semester: B.Tech. Biotechnology, Year 1/ Semester I

COURSE OBJECTIVES:

1. To demonstrate various techniques to learn the morphology, identification and propagation of cells and microbes.
2. To learn the staining techniques and culturing of microorganism.

COURSE OUTCOMES:

Students will be able to

1. Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism.
2. Identify the various stages of mitosis

Detail syllabus

1. Identification of different stages of meiosis in onion buds
2. Identification of different stages of mitosis in onion tips
3. Visualisation of nuclear fraction by Acetocarmine stain
4. Staining and visualisation of mitochondria by Janus green stain
5. ABO blood grouping
6. RH factor determination
7. Widal test, Syphilis Fast Latex Agglutination Test
8. Immune precipitation test: single radial immunodiffusion, Double immune diffusion
9. Immune electrophoresis.
10. Make a differential count and subset population in lymphocyte (B & T lymphocytes)
11. Cell permeability testing- osmotic fragility

12. Isolation of cell organelle by differential centrifugation techniques from plant / animal sources Isolation of mitochondrial DNA
13. Isolation of chloroplast DNA
14. Cell motility studies (bacteria, algae, cyanobacteria, protozoans,)
15. Cell death /apoptosis studies using flow-cytometry demonstration
16. Isolation and identification of mutagens of plant origin (demonstration/ video)
17. Isolation of mitochondria from cauliflower
18. Study lipid solubility of membrane
19. Effect of detergent on RBC
20. Study osmosis in blood sample

References :

1. Biotechnology: A laboratory Skills Course, J. Kirk Brown 2011
2. Methods in Biotechnology, SB Hong, MB Rashid, LZ Santiago-Vazquez 2017

Microbiology Lab

University: MGM University, Aurangabad

Faculty: Engineering and Technology

Institute: Institute of Biosciences and Tech.

Degree: B.Tech. Biotechnology Course

Code:

Course Title: Microbiology Lab

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

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

Recommended Year /Semester: B.Tech. Biotechnology, Year 1/ Semester I

Detail syllabus

2. To study laboratory rules
3. To study compound microscope
4. To study autoclave
5. To Study Hot air oven
6. To study lab equipment
7. To study centrifuge
8. To study laminar air flow
9. To study water bath
10. To study incubator shaker
11. To study spectrophotometer
12. To prepare bacterial culture media
13. To study streak plate and
14. To spread plate method
15. To study pour plate method
16. Simple staining
17. Negative staining
18. Gram staining.
19. Lactophenol Cotton Blue staining for fungi.
20. To study the preparation of Potato Dextrose Agar for cultivation of fungi.
21. To study storage of microorganism.
22. To study the growth curve of E.coli
23. To perform IMViC test

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.

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INSTITUTE OF BIOSCIENCES AND TECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Engineering and Technology
Graduate (UG) program

BIOTECHNOLOGY - CURRICULUM

B.Tech Biotechnology

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				
				L	T	P			Internal				External		Total	Internal		External		Total
									CA-I	MSE	CA-II	TW	ESE	PR		CA/MSE/TW	ESE	PR		
BSC	BBT42MML105	Enzymology	Theory	3			3		10	10	10	-	20	-	50		08		20	
BSC	BBT42MML106	Molecular Biology of Gene	Theory	3		-	3		10	10	10	-	20	-	50		08		20	
ESC	BBT42MML107	Immunology	Theory	2		-	2		20	20	20	-	40	-	100		16		40	
ESC	BBT42MML108	Numerical and Computational Fundamentals-I	Theory	2		-	2		20	20	20	-	40	-	100		16		40	
PCC		Mendel And Darwin Theory	Theory	2		-	2		20	20	20	-	40	-	100		16		40	
VSEC*	BFT4VSP105	Mini project	Practical	-		4	2					30	-	20	50		08		20	
ESC	BBT42MMP104	Immuno Lab	Practical			4	2					30	-	20						
ESC	BBT42MMP105	Computational Lab	Practical	-		4	2					30	-	20	50		08		20	
BSC	BBT42MMP106	Enzymo Lab	Practical	-	-	2	2			-		30	-	20	50			08	20	
CC		Co-Curricular Activity	Practical	-	-	4	2			-		30	-	20	50			08	20	
		Total (L-T-P) Hrs / week = 30		12		18	22								600				200	

ENZYMOLGY

University- MGM University, Aurangabad Faculty- Engineering and Technology Institute-
Institute of Biosciences and Technology Degree- B.Tech. Biotechnology
Course Code- BTB 122 Course Title- Enzymology
Credits- 3+0 (4 Theory) Level of Study: UG

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

Recommended Year /Semester: B.Tech. Biotechnology, 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

Objective:

Primary goals of this course is to provide the students with detailed knowledge in enzyme activity and kinetics, their mechanism of action and regulation and about the way of enzyme application and exploitation.

Outcomes:

The course include deepening knowledge in the areas of purification and isolation of enzymes, classification of enzymes and cofactors, kinetics and regulation of enzymes and their applications in industry, therapeutics and diagnosis.

THEORY

UNIT I: CLASSIFICATION AND ENZYME ACTION (6 lectures)

Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Introduction to Biocatalysis, differences between chemical and biological catalysis. Active site, Enzyme specificity. Principles of energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models.

Fundamentals of

enzyme assay, enzyme units.

UNIT II: ENZYME KINETICS AND INHIBITION (6 lectures)

Kinetics of single substrate enzyme - catalysed reactions - Michaelis - Menten equation, importance of V_{max} , K_m , MM equation, and turnover number; Lineweaver - Burk plot, Kinetics of Allosteric enzymes - MWC and KNF models Hill' equation coefficient. Kinetics

of multi - substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism. Enzyme inhibition-Classification (a) competitive (b) noncompetitive (c) uncompetitive (d) substrate

UNIT-III: MECHANISM OF ENZYME CATALYSIS (8 lectures)

Enzyme specificity, Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, proximity and orientation effects, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lysozyme, and ribonuclease.

UNIT-IV: REGULATION (8 lectures)

Partial Proteolysis, Phosphorylation, adenylation, disulphide reduction, Allosteric regulation (1) sigmoidal kinetics (2) symmetry model (3) concerted model (4) kinetics and functions of allosteric enzymes (a) phosphofructokinase (b) glycogen phosphorylase

UNIT-V: INDUSTRIAL USES OF ENZYMES (8 lectures)

Sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Clinical enzymology - Enzymes as thrombolytic agents, antiinflammatory agents, digestive aids. Therapeutic use of asparaginase, streptokinase. Diagnostic enzymes. Immobilization of enzymes and their applications. Abzymes

References

1. Understanding enzymes: Palmer T., Ellis Harwood Ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.
8. Text of Biochemistry, West and Todd.

MOLECULAR BIOLOGY OF GENE

University- MGM University, Aurangabad Faculty- Engineering and Technology
Institute- Institute of Biosciences and Technology Degree- B.Tech. Biotechnology
Course Code- BTB- 123 Course Title- Molecular Biology of Gene
Credits- 3+0 (4Theory) Level of Study: UG

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

Total Hours:

Recommended Year /Semester: B.Tech. Biotechnology, 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

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. Examples of gene regulation.

Learning Outcomes:

After the course, the student should be able to:

1. account for structure, formation and function of DNA, RNA and proteins describe the principles of gene regulation in prokaryotic and eukaryotic cells
2. describe the consequences of different types of mutations and DNA-repair systems, recombination, restriction enzymes, operons and gene expression.
3. use some and understand several modern molecular methods to elucidate molecular and genetic questions
4. critically analyse, evaluate and compile results from laboratory exercises reason about ethical aspects of genetics

COURSE CONTENTS THEORY

UNIT I: DNA REPLICATION (8 lectures)

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 (8 lectures)

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 (8 lectures)

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

UNIT IV: REGULATION OF ACTIVITY OF GENES AND GENE PRODUCTS IN PROKARYOTES (8 lectures)

General aspects of Regulation, The lactose system and the operon model, The Galactose operon, The Arabinose operon, The Tryptophan operon, Relative positions of Promoters and Operators, Regulons, Regulation of Translation, Regulation of the synthesis of Ribosomes, Unregulated changes in gene expression, Feedback Inhibition.

UNIT V: REGULATION IN EUKARYOTES (8 lectures)

Regulatory strategies in Eukaryotes, Gene alteration (Gene loss, Gene amplification, Gene rearrangement: the joining of coding sequences in the immune system) Transcriptional Control by hormones, Regulation mediated through Transcription factors, Regulation of enhancer activity, Methylation, Regulation of processing, Translational control, Regulation of gene expression in plant cells by light.

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.,

IMMUNOLOGY

University- MGM University, Aurangabad Faculty- Engineering and Technology Institute-
Institute of Biosciences and Technology Degree- B.Tech. Biotechnology
Course Code- Course Title- Immunology
Credits- 2+0 (4 Theory) Level of Study: UG
Mode of delivery planned learning activities and teaching method: Lecture 2hrs / weekly
Recommended Year /Semester: B.Tech. Biotechnology, Year 1/ Semester II

Course Objective

1. Students should gain an understanding of basic aspects of the structure and functions of the immune system.
2. Students should describe the applied aspects of immunology such as defense mechanism, allergy and auto immunity.
3. Students should understand the cellular and molecular interaction of the immune responses.

Course Outcomes: The primary goal is to make Current understanding of the cellular and molecular interactions in the inductions, expression, and regulation of the cellular and humoral immune responses; recent knowledge and applications concerning immunity to various microbial infections as well as antigen-antibody interactions; and detection of cell-mediated immune response.

COURSE CONTENTS THEORY

UNIT I- IMMUNE SYSTEM (8 lectures)

Introduction to biology of the immune system, Organs and cells of immune system. Innate and acquired immunity, Primary and Secondary lymphoid organs

UNIT II- ANTIGENS AND ANTIBODIES (8 lectures)

Nature of Antigen and Antibody, Antigen-Specificity, avidity, affinity, cross reactivity, haptens, adjuvants, epitopes, Basic structure of antibodies ii) Classes of antibodies and biological activity iii) Polyclonal antibodies, Antigen-antibody interactions – Principles and applications

UNIT III- RECOGNITION OF ANTIGENS (8 lectures)

Major Histocompatibility Complex, Antigen processing and presentation, B- cell Maturation, Activation and Differentiation, T- cell receptor – Structure and role, T- cell Maturation, Activation and Differentiation

UNIT IV-IMMUNE EFFECTOR MECHANISMS (8 lectures)

Cytokines- - IL-1, IL-2, IL-4, IFNs and TNFs, Cytokine secretion by TH1 and TH2 cells, Complement pathways- Classical, alternate and lectin pathways , Biological consequences of complement activation, Complement fixation tests, Cell-mediated cytotoxicity of T cells, NK cells, ADCC

UNIT V- ANTIGEN-ANTIBODY INTERACTIONS (8 lectures)

Antigen-antibody interactions –Principles and applications, Precipitation, Immunoelectrophoresis, Agglutination, Radioimmunoassay, ELISA, Immunofluorescence, Monoclonal antibodies (Hybridoma Technique).

Reference Books

1. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
2. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication
3. Cellular & Molecular Immunology, 7th Edition, Abul K. Abbas & Andrew H. Lichtman & Shiv Pillai, 2011

NUMERICAL AND COMPUTATIONAL FUNDAMENTALS I

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:

Institute of Biosciences and Technology. Degree: B. Tech-Biotechnology (UG)

Course Code-

Course Title: Numerical and Computational
Fundamentals –I

Credits- 2+0 (4Theory)

Level of Study: UG

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

Recommended Year /Semester: B. Tech-Biotechnology, 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 Objective:

1. To develop an understanding of basic mathematical tools and their application.
2. To model real world problems into mathematical expressions using numerical representation.

Course Outcomes:

1. Use knowledge of content and mathematical procedures to solve problems.
2. Understand the fundamental ideas and application of Calculus.

COURSE CONTENTS

THEORY

UNIT I: Introduction: (8 Lectures)

Numbers, Strings, Lists, Loop, Functions, Data Structures, List, Tuples, Dictionaries, Packages, pip, The dir() Function

UNIT II: Data analysis (8 Lectures)

Biostatistics, Data Input and Output, Formatted String Literals, The String format() Method

UNIT III: Machine Learning (8 Lectures)

Population studies, Distribution, ANOVA, Regression, multivariate analysis

UNIT IV: Quadratic Equations (8 Lectures)

Introduction, Quadratic equation, Factorization method, Completing square method, Formula method, Nature of roots.

UNIT V: Permutation and Combination (8 Lectures)

Introduction, Factorial notation, Permutation, Combination.

Suggested Reading Book:

1. Class XI Mathematics, NCERT
2. Class X Mathematics, NCERT

MENDEL AND DARWIN THEORY

University: MGM University, Aurangabad Faculty: Engineering and Technology Institute:
Institute of Biosciences and Technology. Degree: B. Tech- Biotechnology (UG)
Course Code- BTB-125 Course Title: Mendel and Darwin Theory
Credits allocated: 4+0 (Theory) Level of Study: UG
Mode of delivery planned learning activities and teaching method: Lecture 2 hrs/weekly
Recommended Year /Semester: B. Tech- Biotechnology (UG) 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 Objective:

1. To develop an understanding of basics of evolution and ideas of evolution.
2. To understand about the cause of heredity and variation.

Course Outcomes:

1. Use knowledge of genetics in the improvement of various traits.
2. Understand the fundamental ideas about the evolution

COURSE CONTENTS THEORY

UNIT I: Origin and Evolution of Life (8 Lectures)

Origin of Life, The meaning of evolution, Ideas of evolution before Darwin, Evidences of Evolution, Theories of Evolution: Lamarck's theory, Theory of germplasm, Darwin's theory. Modern views of Darwinism. Genetic basis of adaptation, Species concept.

UNIT II: Inheritance (8 Lectures)

Heredity and Variation, Genetics terms and symbol, Pre mendelian ideas of inheritance, John Gregor Mendel, Theories of inheritance: Law of dominance, Law of segregation and law of Independent assortment. Rediscovery of Mendel's work.

UNIT III: Traits and Alleles (8 Lectures)

Post mendelin era: other pattern of inheritance. Incomplete dominance, Multiple alleles, epistasis, polygenic traits, Pleiotropy.

UNIT IV: Chromosomal Theory (8 Lectures)

Parallelism between genes and chromosomes, Chromosomal theory of inheritance, Linkage and recombination

UNIT V: Chromosomal Variation (8 Lectures)

Genetic variation, Sex linked inheritance, Basics of sex determination, chromosomal mapping.

Reference

1. Principles of Genetics: Robert H. Tamarin 7th ed. Tata McGraw Hill Publication. 2002.
2. Principles of Genetics: Gardner Simmons.
3. Genetics by Strictberger.

MINI-PROJECT

University- MGM University, AURANGABAD Faculty- Engineering and Technology

Institute- Institute of Biosciences and Technology Degree B. Tech-BioTechnology (UG)

Course Code-BBL-128

Course Title- Micro project

Credits-0+2

Level of Study: UG

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

Total Hours:

Recommended Year /Semester: B. Tech.. Biotechnology, 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.

Objective- Students will get familiar to the topic in detail. They will have hands on different instruments. They will develop technical handling skills.

Learning outcomes- Students will gain knowledge about need of research in particular field and the idea development of how the lacuna can be erased that can be of social benefit.

COURSE CONTENTS

Practical

1. Synopsis
2. Project work
3. Thesis Writing
4. Presentation

IMMUNO LAB

University- MGM University, Aurangabad Faculty- Engineering and Technology Institute-
Institute of Biosciences and Technology Degree- B.Tech. Biotechnology
Course Code- BBL-127 Course Title- Immuno –Enzymo Lab
Credits-0+1 Level of Study: UG

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

Recommended Year /Semester: B.Tech. Biotechnology, 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.

Objective and Outcome: The students will be able to identify the cellular and molecular basis of immune responsiveness. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease.

COURSE CONTENTS

Practical

1. Blood staining.
2. Blood Grouping.
3. Rh factor detection .
4. Serum and plasma separation.
5. Radial immuno diffusion.
6. Antibiotics sensitive by paper disc Method .
7. Double diffusion.
8. Widal test.
9. To study immuno electro to detect Ag -Ab interaction.
10. Isolation of H and O Antigen from S.typhi.
11. Isolation of immunoglobulin by Ammonium sulphate precipitation.
12. Extraction and isolation of IgG ab from hen's egg.
13. Serum immunoelectrophoresis
14. Western blotting 15.

COMPUTATIONAL LAB (Mol Bio)

University- MGM University, AURANGABAD Faculty- Engineering and Technology
Institute- Institute of Biosciences and Technology Degree- B.Tech. Biotechnology
Course Title- Computational Lab Course Code- BBL-127
Credits- 2+0 Level of Study:UG

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

Recommended Year /Semester: B.Tech. Biotechnology, 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.

Objective and Outcome: To understand the classification & nomenclature of enzymes and the factors effecting enzymatic reaction. The students will be able to identify the cellular and molecular basis of immune responsiveness. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease.

COURSE CONTENTS

Practical

- 1.Basic Electrical Engineering Practical
- 2.To identify different electrical measuring instruments
- 3.To measure voltage and current in electrical Circuit by voltmeter and ammeter.
- 4.To measure Power in electrical Circuit by Wattmeter
- 5.To Measure Electrical Energy in electrical circuit by Energy meter.
- 6.To determine Series equivalent of resistance
- 7.To determine parallel equivalent of resistance
- 8.Charging and discharging test on capacitor
- 9.To check insulation by Using insulation tester
- 10.Test circuit using series lamp and millimetre
- 11.To check earth resistance by Using the earth tester
- 12.For the given magnetic material find the B-H curve and hysteresis loop.
- 13.Use Faraday's first law of electromagnetic induction to analyses the behaviors of

statically induced E.M.F. and Dynamically induced E.M.F in the given circuit.

ENZYMOLAB

University- MGM University, Aurangabad Faculty- Engineering and Technology

Institute- Institute of Biosciences and Technology Degree- B.Tech. Biotechnology

Course Code- Course Title- Enzymo Lab

Credits-0+2 Level of Study: UG

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

Recommended Year /Semester: B.Tech. Biotechnology, 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.

Objective and Outcome: To understand the classification & nomenclature of enzymes and the factors effecting enzymatic reaction. The students will be able to identify the cellular and molecular basis of immune responsiveness. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease.

COURSE CONTENTS

Practical

- 1) Assay of amylase.
- 2) Assay of urease.
- 3) Assay of catalase .
- 4) Effect of pH, temp and substrate concentration on enzyme activity.
- 5) Estimation of glucose by DNS method.
- 6) Estimation of glucose by Benedictis trimetric method.
- 7) Estimation of total carbohydrate.
- 8) Test for lipids -Salkowski test, Lieberman-Burchard test.
- 9) Estimation of Amino Acid by Ninhydrin Method.
- 10) Estimation of protein by Biuret Method.

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

Major
Biotechnology

Minor options Within Faculty of Basic Sciences	Food Processing Technology
	Biomedical Engineering

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	Yoga 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 of Biomolecules	Faculty of Biotechnology
Indian psychology and yoga		Communication and Soft Skills		Instrumentation In Biotechnology	Faculty of Biotechnology
Indian sports and martial arts		German		Introduction to Fermentation Technology	Faculty of Biotechnology
Architectural engineering, town planning, civil engineering, Vaastu and Shilpa Shastra		French		Principles of Developmental Biology	Faculty of Biotechnology
Sustainable agriculture and food preservation methods		Spanish			

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		Gandhian Studies
		Personality Development		Value Education
		Yoga		
		NCC		

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	ESE	PR		
									CA1	MSE	CA2	TW	ESE	PR						CA/MSE/TW
PCC	BBT42MML201	Microbe infection And Immunity	Theory	2			2		10	10	10	-	20	-	50				08	20
PCC	BBT42MML202	Genetics And Evolution	Theory	2		-	2		10	10	10	-	20	-	50				08	20
PCC	BBT42MML203	Numerical And Computational Fundamentals-II	Theory	2			2		10	10	10	-	20	-	50				08	20
MDM		Multidisplinary project	Theory/Practical	2	-	-	2		10	10	10	-	20	-	50				08	20
OE		Open elective I	Theory	2			2		10	10	10	-	20	-	50				08	20
OE		Open elective II	practical			4	2					30	20	-	50				08	20
AEC		Ability Enhancement Course	Theory	2			2		10	10	10	-	20	-	50				08	20
EEMC			Theory/Practical	2	-		2		10	10	10	-	20		50				08	20
VEC		Value Education course	Theory	2	-		2		10	10	10	-	20		50				08	20
FP	BBT42MMP201	Field project	Practical			4	2					30		20	50				08	20
PCC	BBT42MMP202	Genetics Lab	Practical			4	2					30		20	50				08	20
		Total = 28		16		12	22								650					260

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)					
				L	T	P			Internal				External		Total	Internal			External		Total
									CA 1	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBT42MML301	Plant Tissue Engineering	Theory	3			3		20	20	20	-	40	-	100				16		40
PCC	BBT42MML302	Cell Signalling	Theory	3		-	3		20	20	20	-	40	-	100				16		40
PCC	BBT42MML303	Numerical And Computational Fundamentals-IV	Theory	2			2		10	10	10	-	20	-	50				08		20
MDM		Food Safety And Microbial Standards	Theory	2	-	-	2		10	10	10	-	20	-	50				08		20
MDM		Food safety Lab	Practical		-	4	2					30	20	-	50				08		20
PEC		Program elective course I : : protein engineering and design	Theory	2			2		10	10	10	-	20	-	50				08		20
PEC		Program elective course : project	Project /Practical			4	2					30	20	-	50				08		20
OE		Open elective	Theory	2			2		10	10	10	-	20	-	50				08		20
PCC	BBT42MMP301	Computational Lab	Practical			4	2					30		20	50					08	20
PCC	BBT42MMP302	Plant Lab	Practical			4	2					30		20	50					08	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)					
				L	T	P			Internal				External		Total	Internal			External		Total
									CA I	MSE	CA2	TW	ESE	PR		CA	MSE	TW	ESE	PR	
PCC	BBT42MML304	Python	Theory	2			2		10	10	10	-	20	-	50				08		20
PCC	BBT42MML305	Animal Tissue Engineering	Theory	2			2		10	10	10	-	20	-	50				08		20
PCC	BBT42MML306	Molecular Cytogenetics	Theory	2			2		10	10	10	-	20	-	50				08		20
PEC		Programme Elective Course : Cancer cell biology	Theory	3			3		20	20	20	-	40	-	100				16		40
PEC		Programme Elective Course :Nanobiotechnology	Theory	3			3		20	20	20	-	40	-	100				16		40
PEC		Programme Elective Course: Nanobiotech Lab	Practical			4	2					30	20	-	50				08		20
MDM		Bioethics ,Biosafety and Regulatory Affairs	Theory	2	-	-	2		10	10	10	-	20	-	50				08		20
VSEC	BBT42VSP301	Micro Project	Practical		-	4	2					30	20	20	50				08		20
PCC	BBT42MMP303	Python Lab.	Practical			4	2					30		20	50				08		20
PCC	BBT42MMP304	Animal Tissue Lab	Practical			4	2					30		20	50				08		20
		Total = 30		14		16	22								600						240

