Eklavya University Damoh MP

M.Sc. I Semester

Biotechnology

Session 2020 onwards

School of Basic & Applied Science

EKLAVYA UNIVERSITY, DAMOH (M.P.)

Scheme of Examination M.Sc. (Biotechnology) I Sem

For batch admitted in Academic Session 2023-24

Subject wise distribution of marks and corresponding credits

S. No.	Subject Name	Subject Code	Paper Name	Maximum Marks Allotted											Total Marks	Contact Periods Per week			Total Credits
				Theory Slot									Practical Slot						
				End Semester				Mid term Examination				Quiz/ Assignment/ Attendence	End Sem	Lab Work/ Sessional		L	T	P	
				P1	P2	P3	P4	P1	P2	P3	P4								
1	Common	MCOVI20S101	Comprehensive Viva											50	50	0	0	4	4
		MPRES20S101	Presentation											50	50	0	0	4	4
2	Biotechnology	MBIOT20S101	Cell Biology (Paper- I)	30				15				5			50	3	0	0	3
		MBIOT20S102	Bioenergetics and Metabolism (Paper- II)		30				15			5			50	3	0	0	3
		MBIOT20S103	Microbiology (Paper- III)			30				15		5			50	3	0	0	3
		MBIOT20S104	Bioprocess Engineering and Instrumentation (Paper- IV)				30				15	5			50	3	0	0	3
		MBIOT20S105	Paper- I and II Practical I-Sitting (Practical - I)										30	20	50	0	0	2	2
		MBIOT20S106	Paper- III and IV Practical II- Sitting (Practical - II)										30	20	50	0	0	2	2

Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiencey Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

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School of Basic and Applied Scienc

Class	M.Sc. (Biotechnology)
Semester/Year	I Semester
Subject & Subject Code	Biotechnology - MBIOT20S101
Paper	Cell Biology – 101
Max. Marks	30

Credit			Total Credits
L	T	P	
3	0	0	3

Course Objectives:

Students will understand the structures and function of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles. Students will understand how these cellular components are used to generate and utilize energy in cells for various metabolic activities.

Course Outcome:

At the end of the course, learners will be able to:

1. Distinguish between the various process involved in plant and animal development.
2. Design the theoritical model of a cell.
3. Explain the organization of Genes and chromosomes, their morpholoogy and its aberrations.
4. Compare and contrast the events of cell cycle and its regulation.
5. Explain the communications within cells and among its surrounding environment.

Student Learning Outcomes (SLO):

On completion of this course, the students will be able to:

1. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Learn how these cellular components are used to generate and utilize energy in cells
3. Describe the cellular components underlying mitotic cell division.
4. 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.

Unit	Syllabus	Periods
UNIT - I	Diversity of cell size and shape; cell theory Structure of Prokaryotic and Eukaryotic cells Microscopic techniques of study of cells Cell fractionation and cytochemical methods	12
UNIT - II	Cell organelles (structural organization and functions): Plasma membranes, Cell wall, Mitochondria and chloroplast Nucleus, Endoplasmic reticulum ,Golgi apparatus, and lysosomes Passive and active transport Cellular energy transactions – role of mitochondria and chloroplast	12

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UNIT - III	Cell cycle – molecular events Chemical signaling between cells : hormones, neurotransmitter, cyclic AMP and calciumion Cell motility : structure and functions of microfilaments and microtubules	12
UNIT - IV	Cell junction: Types and functions Intracellular digestion : Ultrastructures and functions of lysosomes and peroxisomes Extracellular matrix of animals: Organization and functions Extracellular matrix receptors on animal cells: The integrins	12
UNIT - V	Cell division : mitosis and meosis Cell differentiation Life cycle and molecular biology of pathogens - AIDS and Hepatitis Biology of Cancer	12

REFERENCE BOOKS –

1. Benjamin Lewin, GeneVII, Oxford University Press, (2000).
2. Bruce Alberts, Alexander Johnson, JulianLewis, Martin Raff, Keith Roberts, Peter Walter, Molecular biologyoftheCell, 4th Edition. Garland publishing Inc. (2002).
3. Darnell, LodishandBaltimore, Molecular CellBiology, Scientific American PublishingInc. (2000).
4. Watson.J.D,Baker.T.A,Bell.S.P,Gann.A.Levine.M.Losick.R, Molecular BiologyofGene, 5th Edition. The Benjamin/CummingsPub.Co.Inc. (2003).
5. BrownT.A., GeneCloningand DNA analysis. 2nd Edition,ASMpress. (2004).
6. Sandy Primrose. Principles of Gene Manipulation and Genomics. 7th Ed., Blackwell Publishers. (2006).
7. GlickBR andPasternakJJ, MolecularBiotechnology, 2nd Ed.ASM press. (2003).
8. Uldis N.Streips,RonaldE.Yasbin.Modern Microbial Genetics.2nd EditionWiley-Liss,Inc.(2002).
9. Gardner E J, Simmons M J and Snupstad DP, Principles of genetics, 8th edition John Wiley & Sons, (2006).
10. Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Angelika Amon; Kelsey C. Martin, Stephen C. Harrison.Molecular Cell biology
11. David Baltimore and Harve Lodish. Molecular and Cell Biology. Macmilan learning. 2016

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School of Basic and Applied Sciences

Class	M.Sc. (Biotechnology)
Semester/Year	I Semester
Subject & Subject Code	Biotechnology- MBIOT20S102
Paper	Bioenergetics and Metabolism – 102
Max. Marks	30

Credit			Total Credits
L	T	P	
3	0	0	3

Course Objectives:

This course deals with characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetic and regulation of different metabolic processes in microorganisms. The candidate will gain knowledge about immunity, organs of immune system and various types of action taken by the cells involved. Types of antigens and immunoglobulins. Antigen- antibody reactions and immunological assays, MHC and its significance.

Course Outcome:

At the end of the course, learners will be able to:

1. Develop a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.
2. Develope how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells
3. Well conversant about multifarious function of proteins; and will also be able to calculate enzyme activity and other quantitative and qualitative parameters of enzyme kinetics; also will gain knowledge about lipids and nucleic acids.
4. Prepare buffers, study enzyme kinetics and calculate Vmax, Km, Kcat values.

Student Learning Outcomes (SLO):

1. They will understand the process of fermentation and process involved in manufacture of Biodiesel.
2. They will understand the methods used for the determination of amino acid and nucleotide sequence in proteins and DNA respectively.
3. Demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
4. Demonstrate a proficiency in developing relevant biochemical questions, carrying out laboratory investigations to answer those questions, and critically analyzing, interpreting, and presenting in oral and written form the results of their experiments.
5. Locate, critically analyze, interpret and discuss data, hypotheses, results, theories, and explanations found in the primary literature, applying knowledge from Chemistry and Biology.
6. Pupil will be understand various carbohydrate metabolic pathway in involved in energy generation
7. Understand the importance of enyzmatic reaction and the will gain critical knowledge about the KEGG pathway of various enzyme

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Unit	Syllabus	Perio
UNIT - I	Carbohydrates: Structure , classification , properties and functions. Carbohydrates derivatives : Peptidoglycans, Glycolipids and silica acid Lipids : Structure , classification , properties and functions. Lipids with specific biological functions : Lipoproteins and biological membrane, Micelles and liposomes.	12
UNIT - II	Amino acids : structure , classification , properties and functions Proteins: primary , secondary ,tertiary and quaternary structure Enzymes : classification, EC number, properties and application Vitamins and co factors : structure , sources and biological properties	12
UNIT - III	Nucleic Acids: structure and properties DNA : structure, experimental evidences as proof of genetic material, types of DNA DNA: Denaturation and Renaturation, degradation, modification, repair and recombination RNA : Structure , types and function, ribosome structures and functions.	12
UNIT - IV	Laws of thermodynamics and concept of free energy High energy phospho compounds , ATP cycle Carbohydrate metabolism : Glycogenesis , Gluconeogenesis , Glycolysis, Krebs cycle, Pentose phosphate pathway , Glyoxylate pathway redox reaction, redox potential, Gibbs free energy	12
UNIT - V	Lipid metabolism : biosynthesis and breakdown of fatty acid, regulation of lipid metabolism and associated in born errors Amino acid metabolism : Biosynthesis and breakdown Regulation of amino acids metabolism associated in born errors. Nucleic acid metabolism : biosynthesis and breakdown of purine and pyrimidines, regulation of metabolism , associated in born errors.	12

REFERENCE BOOKS –

1 Principles of Biochemistry by Nelson,Cox and Lehninger

2 Microbiology: An Introduction by Tortora, G.J., Funke, B.R and Case, C.L. Pearson Education, Singapore, (2004).

3 Biochemistry by Stryer

4 Biochemstriy by Garrett and Grisham

5 Biochemical calculations by Irwin H , Segel, John Wiley and Sons inc.

6 Biochemistry by DVoet and JG Voet, J. Wiley and Sons

7 Biochemistry by D Freifilder, W.H. Freeman and company

8 Laboratory techniques in biochemistry and molecular biology by Work and Work

9 A Biologists guide to principles and techniques of practical biochemistry by K.W. KH Goulding, ELBS edition, 1986

10 Harpers biochemistry by Murray.

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School of Basic and Applied Sciences

Class				M.Sc. (Biotechnology)
Semester/Year				I Semester
Subject & Subject Code				Biotechnology- MBIOT20S103
Paper				Microbiology– 103
Max. Marks				30
Credit			Total Credits	
L	T	P	3	
3	0	0		

Course Objectives:

The candidate will gain knowledge about the structure of bacteria, fungi, algae, protozoa and viruses along with the basic principles of microscopy. Student will understand basic of Control of microbial growth by physical and chemical methods. Use of antibiotics and their efficacy testing are emphasized. Cultivation of microbes is discussed. This course develops the concepts of methodology involved in studying the different components of microbial cell and various techniques and instruments involved In microbial product

Course Outcome:

At the end of the course, learners will be able to:

1: Gain knowledge on various sections of microorganisms; their structure extracellular and intracellular components, cultural characteristics and their growth conditions.

2: Know about the different parts and working mechanisms of basic light microscope up to electron microscopes with deep knowledge of sample preparation and staining techniques.

3: Acquire knowledge on sterilization techniques with adequate information on aseptic conditions.

4: Know about different classes of antibiotics and their mode of actions, treatment strategies and detection of resistant forms of bacteria from clinical settings.

5: Microbial culture media and pure culture techniques for aerobic and anaerobic bacteria.

Student Learning Outcomes (SLO):

Students will able to learn about:

Laboratory Skills: Microbiology students will master the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment. Safe practice in microbiology using appropriate protective and emergency procedures.

Problem-Solving Skills: Microbiology majors will be competent problem-solvers. They will be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information. Microbiology students should be able to analyze and interpret results form a variety of microbiological methods, and apply these methods to analogous situations.

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Unit	Syllabus	Period
UNIT - I	Microorganisms characteristic types and evolution Morphology and fine structure of bacteria : Cell wall and cytoplasmic membrane lipds Pure culture techniques and sterilization Construction of culture media and microbial staining techniques	12
UNIT - II	Control of microorganism by physical and chemical agents. Microbial growth : Definition , mathematical expression, measurement cell and factors affecting the microbial growth, nutrition, pH, Temperature transport of nutrients across the bacterial membrane. photosynthic bacteria	12
UNIT - III	Principles of disease and epidemiology , mechanism of pathogenecity Bacterial disease: Staphylococcal and Clostridial food poisioning, Salmonellosis, Shigellosis, and Anthrax Fungal diseases: Histoplasmosis, Aspergillosis, Erygotism, Viral diseases: Influenza , Chicken pox, Hepatitis B, Polio mylitis COVID-19	12
UNIT - IV	Virus : Isolation , Cultivation, classification and multiplication DNA viruses: SV 40 RNA viruses: Retro viruses and Lenti virus Mycoplasma and Diseases caused by them	12
UNIT - V	Bacterial genetic system: Transformation , Transduction and conjugation Recombination, Plasmids and transposones. Bacterial genetic map with refrence to *E.coli* Genetic systems of yeast and neurospora Chemotherapy : Antimicrobial agents, sulphur drugs, Antibiotics; Penicillins and Cephalosporins. Broad-spectrum antibiotics, antibiotics from prokaryotes, antifungal antibiotics, mode of action and resistance to antibiotics Exploitation of microorganisms: Traditional microbial process utilizing Yeast acid bacteria, Lactic acid bacteria and Butyric acid bacteria	12

REFERENCE BOOKS –

1. G.M. Cooper. (2015). The cell: A Molecular Approach. 7th Edition. Sinauer Associates.
2. Alberts, B., Johnson, A.D., Lewis, J., Morgan, D., Raff, M., Roberts, K., Walter, P. (2014). Molecular Biology of Cell. 6th Edition. WW. Norton & Co.
3. Campbell, M.K. (2012) Biochemistry, 7th ed., Published by Cengage Learning.
4. Campbell, P.N. and Smith, A.D. (2011). Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
5. Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012). Biochemistry: A short course, 2nd ed., W.H.Freeman.
6. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011) Biochemistry, W.H.Freeman and Company
7. Nelson, D.L. and Cox, M.M. (2008). Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
8. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
9. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell. 8th edition.Pearson Education Inc. U.S.A.
10. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
11. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing. San Francisco.

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School of Basic and Applied Sciences

Class			M.Sc. (Biotechnology)
Semester/Year			I Semester
Subject & Subject Code			Biotechnology- MBIOT20S104
Paper			Bioprocess Engineering and Instrumentation – 104
Max. Marks			30
Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

The course is aimed to provide basic information about upstrem and downstream process involved production of various microbial products. The course is aimed at introducing the students to the field of Bioinformatics and enable them understand the concepts of statistics in biology. To impart practical exposure to Bioinformatics tools and data bases.

Course Outcome:

At the end of the course, learners will be able to understand:

1. Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
2. Principles of a number of analytical fermentors and bioreactors which the students have to use during the study
3. Use of various instruent like spectrocsope which wil unable them to study the quality of various bioproducts
4. Several separation techniques which may be required to be handled later as biotchnologist in the fermentation industry.

Student Learning Outcomes (SLO):

Students will:

1. Know the theory behind fundamental of fermentors and various components and types.
2. Be familiar with widely used techniques for mass production using fermentor.
3. Know basic concepts of upstream and downstream process.
4. Be able to describe statistical methods and probability distributions relevant for molecular biology data.
5. Know the applications and limitations of different bioinformatics and statistical methods.
6. Be able to perform and interpret bioinformatics and statistical analyses with real molecular biology data.

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Unit	Syllabus	Periods
UNIT - I	Introduction to Bioprocess Engineering. Isolation, preservation and maintenance of Industrial Microorganisms. Kinetics of microbial growth and death, Media for industrial fermentation. sterilization safety in fermentation laborartory.	12
UNIT - II	Strain improvement of industrially important microorganism. Bioreactors: Principle, Kinetics, Types, design, analysis and application. Types of fermentation process: batch, fed batch and continous Bioreactions.	12
UNIT - III	Measurement and control of bioprocess parameters. Downstream processing : Introduction, removal of microbial cells and solid matter, foam preparation, precipitation, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane process, drying, and crystallization Safety consideration in downstream processing Bioprocess economics	12
UNIT - IV	Spectrophotometry: UV, Visible, Fluorescence and IR Centrifugation, Chromatography and Electrophoresis NMR and X-Ray crystallography: Principle, Instrumentation and applications Flow cytometry.	12
UNIT - V	Radioactivity: Radioisotopes, Half life, Geiger- Muller counter, Liquid scintillation counter, Crystal scintillation counter and Gamma counter Importance of information resources (need, purpose and objectives) Internet Information resources Major Bioinformatics databases.	12

REFERENCE BOOKS –

1. Mount D., Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, New York. (2004).
2. Baxevanis, A.D. and Francis Ouellellette, B.F., Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins. Wiley India Pvt Ltd. (2009). 3. Teresa K. Attwood, David J. Parry-Smith, Introduction to Bioinformatics. Pearson Education. (1999).
4. Jean-michel Claverie Cedric Notredame. Bioinformatics for Dummies. Publisher: Dummies (2007).
5. Arthur M. Lesk.Introduction to bioinformatics. Oxford University Press.(2004)
6. Dan E. Krane and Michael L. RaymerFundamental Concepts of Bioinformatics (2002)
7. KRANE .Fundamental Concepts of Bioinformatics, (2003)
8. Teresa Attwood.Introduction to Bioinformatics . (2007)
9. Biochemical Engineering Fundamentals, Baily, J.E and Ollis, D.F,McGrew hills book company Newyork
10. Principles of fermentation Technology, Stanbury, P.F. and Whitaker, A, Pergamon Press, Oxford

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School of Basic & Applied Sciences

Class	M.Sc. (Biotechnology)				
Semester/Year	I Semester				
Subject & Subject Code	Practical Biotechnology- MBIOT20S105				
Paper	Paper- I and II, Practical I Sitting	L	T	P	Total C
Max. Marks	50= (30+20)	0	0	2	2

PRACTICALS

1 Study of various types of microscopes.

2 Fixation of tissue, paraffin block preparation and microtomy.

3 Study of various Histochemical techniques.

4 Sub cellular fractionation and marker enzymes.

5 Study of various stages of Mitosis and meiosis.

6 Study of cell division in onion root tip.

7 Measurement of dimension (size) of the given microorganism/ spores through micrometry.

8 To draw the image of microorganism/ spore using camera lucida.

9 Titration of amino acids.

10 Colorimetric determination of pK.

11 Qualitative estimation of carbohydrate.

12 Quantitative estimation of carbohydrates by DNSA method.

13 Production of extracellular enzyme Amylase by microorganisms.

14 Determination of acromic point of amylase by iodine.

15 Separation of amino acid by paper chromatography.

16 Reaction of amino acids, sugars and lipids.

17 Quantitaion of proteins and sugars.

18 Analysis of oils – iodine number, saponification value, acid number.

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School of Basic & Applied Sciences

Class	M.Sc. (Biotechnology)				
Semester/Year	I Semester				
Subject & Subject Code	Practical Biotechnology- MBIOT20S106				
Paper	Paper- III and IV, Practical II Sitting	L	T	P	Total
Max. Marks	50= (30+20)	0	0	2	2

PRACTICALS

1 Preparation of liquid and solid media for growth of microorganisms.

2 Isolation and maintanence of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of microorganisms.

3 Isolation of pure cultures from soil and water.

4 Growth; Growth curve; measurement of bacteria population by Turbidometery and Serial dilution methods. Effect of temperature, pH, Carbon and Nitrogen sources on growth.

5 Microscopic examination of bacteria, yeast moulds and study of organism by gram staining, acid fast staining for spores.

6 Study of mutations by Ames test.

7 Assay of antibiotics and demonstration of antibiotic resistance.

8 Bacterial transformation.

9 Biochemical charateristaion of selected microbes.

10 One step growth curve of coliphage.

11 Isolation of Industrially important microorganism for microbial process.

12 Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.

13 a) Determination of growth curve of a supplied microorganism and also determine substrate degradation profile.
(b) Compute specific growth rate(m), growth yield (Yx/s) from the above.

14 Comparative studies of Ethanol production using different substrates.

15 Microbial production of Citric acid using Aspergillums niger.

16 Microbial production of antibiotics (penicillin).

17 Production and estimation of Alkaline Protease.

18 Sauer Krant fermentation.

19 Use of Alginate for cell immobilization.

20 Seperation by chromatography.

21 Analysis by electrophoresis.

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Eklavya University Damoh MP

M.Sc. II Semester

Biotechnology

Session 2020 onwards

School of Basic & Applied Science

EKLAVYA UNIVERSITY, DAMOH (M.P.)

Scheme of Examination M.Sc. (Biotechnology) II Semester

For batch admitted in Academic Session 2023-24

Subject wise distribution of marks and corresponding credits

S. No.	Subject Name	Subject Code	Paper Name	Maximum Marks Allotted											Total Marks	Contact Periods Per week			Total Credits
				Theory Slot									Practical Slot						
				End Semester				Mid term Examination				Quiz/ Assignment/ Attendance	End Sem	Lab Work/ Sessional		L	T	P	
				P1	P2	P3	P4	P1	P2	P3	P4								
1	Biotechnology	MBIOT20S201	Molecular Biology (Paper- I)	30				15				5			50	3			3
		MBIOT20S202	Enzyme Technology (Paper- II)		30				15			5			50	3			3
		MBIOT20S203	Immunology (Paper- III)			30				15		5			50	3			3
		MBIOT20S204	Plant and Environmental Biotechnology (Paper- IV)				30				15	5			50	3			3
		MBIOT20S205	Paper- I and II Practical I-Sitting (Practical - I)										30	20	50			2	2
		MBIOT20S206	Paper- III and IV Practical II- Sitting (Practical - II)										30	20	50			2	2

Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiencey Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

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School of Basic and Applied Scienc

Class	M.Sc. (Biotechnology)
Semester/Year	II Semester
Subject & Subject Code	Biotechnology- MBIOT20S201
Paper	Molecular Biology– 201
Max. Marks	30

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize on the molecular mechanisms of DNA replication, repair, protein synthesis. The course will explain about the detailed process of translation and transcription.

Course Outcome:

At the end of the course, learners will be able to:

1. Gain an understanding of chemical and molecular processes that occur in and between cells and will be able to describe and explain processes and their meaning for the characteristics of living organisms.
3. Gain insight into the most significant molecular and cell-based methods used today to expand our understanding of biology.
4. Gain in-depth knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.

Student Learning Outcomes (SLO):

Students will:

1. Exhibit a knowledge based on genetics, cell and molecular biology, and anatomy and physiology
2. Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology
3. Exhibit clear and concise communication of scientific data
4. Engage in review of scientific literature in the areas of protein translation

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Unit	Syllabus	Period
UNIT - I	Nature of Gene : Evolution of Gene Concept. Chemical Nature of Gene, Relationship in prokaryotes and eukarytes. Genome : Concept size, C- Value paradox and organization. Gene Matation Physical and Chemical Mutagenesis. DNA Damage and Repair : Types and Biological Repair Mechanisms.	12
UNIT - II	Nucleic Acid as genetic information carrier DNA Replication Machinery in Prokaryotes and its comparision with Eukaryotes. Enzymology of DNA Replication : DNA Polymerases : Primases. Ligases Helicases; Topoisomerases, Gyrases and Single stranded Binding Proteins. Regulation of DNA Replication Inhibitors of DNA Replication.	12
UNIT - III	Transcription in Prokaryotes: Initiation, elongation and termination Control of transcriptional initiation in prokarotes Structure and functions of RNA Polymerase; Sigma factors; Structure and functions of Promoter. Control of transcriptional termination in prokaryotes, Intrinsic termination and Rho factor dependent termination, attenuation and anti termination. Prokaryotic gene expression (Lac, Gal, Arab, Trp Operon)	12
UNIT - IV	Initiation of Transcription in Eukaryotes, Structure and propertics of RNA polymerase, structure and properties of Promoter, Transcription factors Response elements. Post - transcriptional Modification and Processing in Eutaryotes 5' and 3' modification of mRNA, Processing of pre mRNA and pre RNA transcript. Genetic Code Evidence and propertiecs, Wobble hypothesis and amino acyl tRNA synthetases. Translation in prokaryotes its comparsion with eukaryotes, regulation of translation by small RNA morelucles.	12
UNIT - V	Post - translational Modification Types and Significance. Regulation of Gene- Expression in Eukaryotes. RNA Editing Gene Alteration DNA Methylation and gene regulation Regulation of gene expressionof hormones. Regulation of gene expression at translations level.	12

REFERENCE BOOKS –

1 Gene VII (7th) ed 2000) By Benjamin Lewin.

2 Molecular Biology (2nd ed. 2001) By P.C. Turner A.G. Mc Lennan A.D. Bates and M.R.H. White.

3 Concepts in Eukaryotic DNA Repantion (1999) By M.L. Depamhilis.

4 Cell and Molccular Biology Concepts and Experments (3rd ed 2002) Gerald karp.

5 Tre Cell A Molecular Apparoach (2nd ed, 2000) By G.M. Gooper.

6 Chromatin and Gene Regulation (2001) By B.M. Turmer.

7 An Introduction to Genetic Analysis (6th ed. 1999) By Griffiths et al.

8 Gemome (1999) By T.A. Brown

9 Molecular Cell Biology (5th ed. 200) By Lodish at

10 Concepts of Genetics (5th ed 1997) By Klug and Cummings.

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School of Basic and Applied Sciences

Class	M.Sc. (Biotechnology)
Semester/Year	II Semester
Subject & Subject Code	Biotechnology- MBIOT20S202
Paper	Enzyme Technology – 202
Max. Marks	30

Credit			Total Credits
L	T	P	
3	0		

Course Objectives:

The major learning objective of the course is to understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. At the conclusion of the course students should be able to describe the methods used in enzyme kinetics.

Course Outcome:

At the end of the course, learners will be able to:

Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms

2. Apply biochemical calculation for enzyme kinetics
3. Compare methods for production, purification, characterization and immobilization of enzymes
4. Discuss various application of enzymes that can benefit human life
5. Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.
6. Plot graphs based on kinetics data.

Student Learning Outcomes (SLO):

Students will:

1. Understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis.
2. Understand the mechanisms of enzyme regulation in the cell.
3. Describe and use the equations of enzyme kinetics.
4. Describe the methods used in enzyme kinetics.
5. Describe the principles of enzyme inhibition.
6. Describe the mechanisms of enzyme catalysis.

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Unit	Syllabus	Per.
UNIT - I	Enzyme: Nomenclature, classification and EC number Mechanism of enzyme action and properties of enzymes as catalysts. Sub - cellular localization and organization of enzymes. Enzyme specificity : evidences for enzyme substrate complex	12
UNIT - II	Role of metal ions in enzyme catalysis Mechanism of enzyme action with examples. Membrane bound enzymes : Lipid protein interaction and effect of fluidity on enzyme activity. Rapid reaction techniques	12
UNIT - III	Enzyme kinetics : Equilibrium and steady state theory, rate equation and determination of km and Vmax. Factors affecting rate of enzyme reaction : pH, temperature and pressure. Enzyme inhibition: reversible and irreversible inhibition Rapid reaction techniques	12
UNIT - IV	Isoenzymes Allosteric enzymes. Models of allostery, types and kinetics Regulation of enzymes. Clinical and industrial application of enzymes	12
UNIT - V	Immobilisation: Principle and kinetics of immobilized systems Enzyme immobilization: and applications Ribozymes and their applications Enzyme engineering	12

REFERENCE BOOKS –

1 The nature of enzymology by R.L. Foster.(1980)
2 Enzymes by Dixon and Webb (1979)
3 Fundamentals of Enzymology by Price and Stevens (1982)
4 Enzyme Catalysis and Regulation by Hammes
5 Enzyme Reaction Mechanisms by Walsch (1981)
6 The Enzymes Vol I and II by Boyer.
7 Enzyme Structure and Mechanism by Alan Fersht.(1977)
8 Enzyme Assays: A Practical Approach by Eisenthal and Danson.

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EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्

School of Basic and Applied Sciences

Class	M.Sc. (Biotechnology)
Semester/Year	II Semester
Subject & Subject Code	Biotechnology- MBIOT20S203
Paper	Immunology – 203
Max. Marks	30

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

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 disease condition.

Course Outcome:

At the end of the course, learners will be able to:

1. Conceptualized the protective role of the immune system of the host and developed an understanding of the basic components as well as the mechanisms underlying the immune system and its response to pathogenic microorganisms.
2. Are able to conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction (precipitation test in the agarose)
3. Design a model of Immunoglobulins.
4. Illustrate various mechanisms that regulate immune responses and maintain tolerance.
5. Apply basic techniques for identifying antigenantibody interactions.
6. Elucidate the reasons for immunization and aware of different vaccination.

Student Learning Outcomes (SLO):

Students will:

1. Define central immunological principles and concepts outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate
elucidate.
2. The genetic basis for immunological diversity and the generation of adaptive immune responses
outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses identify the main mechanisms of inflammation.
3. Outline key events and cellular players governing mucosal immunity
4. Understand the principles governing vaccination and the mechanisms of protection against infectious diseases
5. Understand and explain the basis of immunological tolerance, autoimmunity and transplantation
6. Understand and explain the basis of allergy and allergic diseases.
7. Understand and explain the immune system in cancer; tumor immunology and principles of immunotherapy

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Unit	Syllabus	Per.
UNIT - I	Immune response : Innate and adapitve immune response Hematopoiesis , Primary and Secondary lymphoid organs, Cells of the immune system : Antigen presenting cells , Lymphocytes and their subsets Antigens, Heptanes, Factors affecting immunogenicity , properties of T and B Cell cpitope Superantigens.	12
UNIT - II	Major histocompatibility systems : Structure OF MHC I and II molecule, Polimorphism distribution, variation and function Organization of MHC complex In Mouse, Humans Association of MHC with disease Recognition of antigens by I and II Cells Antigen processing, Role of MHC molecule in antigen presentation and Costimulatory signals. T-cell receptor complex, T- cell accessory membrane molecules, activation of T-Cells Organization and arrangement Of T - receptor genes. B- Cell receptor complex, Activation of B Cells Immunoglobulins : Molecular Structure, types and function Antigenic determinants on immunoglobulins	12
UNIT - III	Molecular mechanism of antibody diversity : organization of genes coding for constant and variable regions of heavy chains and light chains , Mechanisms of antibody Diversity, Class switching . Antibody engineering, Antigen- Antibody interaction , avidity & affinity messurcement Monoclonal antibodies : Production , characterization and application in diagnosis , therapy and basis rescarch Complement systems, components , activation pathways , regulation of activation pathways Complement deficiencies , Role complement systems in immune responses.	12
UNIT - IV	Cytokines structure and functions. Cytotoxic T-Cells and their mechanism of action , NK cell and mechanism of target cell destruction. antibody dependent cell mediated cytotoxicity Immunoregulation mediated by antigens, antibodies ,immune complexes , MHC Hypersensitivity, Definition. IgE mediated hypersensitivity , mechanism of mast cell degranulation, mediators of type –I reaction, and consequences, type II reaction, Immune complex mediated hypersensitivity and Delayed type hypersensitivity	12
UNIT - V	Autoimmunity and mechanism of action Immunodeficiency syndromes; Primary immunodefeciencies, Secondry immunodefiencies , their diagnosis and therapeutic approaches, Vaccines, active and passive immunization, Whole organism vaccines , Macromolecules as vaccines; recombinant – vector vaccines, DNA vaccines, synthetic peptide vaccines, and sub – unit vaccines . Immunodiagnostics. Precipitation techniques, Agglutionation, Fluorescence tecniquses, ELISA,RIA, Western blotting and Immunohistochemical techniquces.	12

REFERENCE BOOKS –

1. Bernard, Davis B. Dulbecco, Eisen and Ginsberg. Microbiology including immunology and molecular Genetics. 3rd Edition
2. Roitt I. Essential Immunology. 10th Ed. Blackwell Science.
3. Kuby. Immunology. 4th edition. W. H. Freeman & company.
4. Ellen Strauss, James Strauss. Viruses and Human Disease 2nd Edition.Academic Press 5. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kuby, J. (2006). Kuby Immunology. New York: W.H. Freeman.
6. Brostoff, J., Seaddin, J. K., Male, D., & Roitt, I. M. (2002). Clinical Immunology. London: Gower Medical Pub.
7. C.H. Walker, R.M. Sibly, S.P. Hopkin, D.B. Peakall, (2012), Principles of Ecotoxicology (4th Edition); CRC Press

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EKLAVYA UNIVERSITY
सूक्ष्म मार्गये लक्ष्य संधान

School of Basic and Applied Sciences

Class	M.Sc. (Biotechnology)
Semester/Year	II Semester
Subject & Subject Code	Biotechnology- MBIOT20S204
Paper	Plant and Environmental Biotechnology – 204
Max. Marks	30

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

The course aims to provide to the students an overview of the plant biochemical and physiological processes that could be exploited both to reduce the environmental impact of modern agricultural practices and to develop innovative strategies and tools to use plants for environmental monitoring and soil/sediment remediation.

Course Outcome:

At the end of the course, learners will be able to:

1. Have developed a fairly good knowledge and understanding of different types of environments and habitats where microorganisms grow including the microbiomes of the human gut and animal gut.
2. Are able to identify the important role microorganisms play in maintaining healthy environment by degradation of solid/liquid wastes; how these activities of microorganisms are used in sewage treatment plants, production of activated sludge and functioning of septic tanks
3. Have understood the significance of BOD/COD and various tests involving use of enumerating fecal *E.coli* for assessing quality of water.
4. Have developed the practical skills for conducting experiments to assess the BOD/COD of wastewaters and their interpretation; practically assess the portability of drinking water by the use of standard microbiological tests.

Student Learning Outcomes (SLO):

Students will:

1. At the end of the course the student will acquire the basic and advanced knowledge elements to understand.
2. The major mechanisms controlling nutrient and metal homeostasis in plants and will be also able to exploit.
3. The plant potential for the environmental management and improvement. Moreover, the student will be also able to analyze and solve basic problems related to the nutrient use efficiency of the plants, approaches that could find application in the development of agriculture biotechnologies.
4. Identify the pros and cons of various approaches to monitoring environment;
5 Be aware of common bio-indicators and how they are used;
6. Understand concepts in effective study design and apply them to a monitoring question of concern.

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Unit	Syllabus	Period
UNIT - I	Conventional plant Breeding Introduction to cell and tissue culture; tissue culture as a technique to produce novel plants and hybrids. Tissue culture media (composition and preparation), Initiation and maintenance of callus and suspension culture; single cell clones. Organogenesis, somatic embryogenesis; transfer and establishment of whole plants in soil. Shoot-tip culture: rapid clonal propagation and production of virus -free plants.	12
UNIT - II	Embryo culture and embryo rescue. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids cybrids. Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Cryo preservation, slow growth and DNA banking for germplasm conservation.	12
UNIT - III	Environment: basic concepts and issues. Environmental pollution: types of pollution, methods for the measurement of pollution. Air pollution and its control through Biotechnology. Water pollution and its control: waste water treatment, physical, chemical and biological treatment processess.	12
UNIT - IV	Microbiology of waste treaments, aerobic process. Microbiology of waste treaments, Anaerobic processes. Treatment scheme for waste waters of dairy, distillery, tannery, sugar, antibiotic industries. Solid waste source and management (composting etc); Vermiculture.	12
UNIT - V	Microbiology of degradation of xenobiotics in environment - Ecology considerations decay behaviour and degradative plasmid. Ecotoxicology - an introductory view Bioremediation of contamination. Biopesticides in integrated pest management (IPM)	12

REFERENCE BOOKS –

1. Bhojwani, S. S. (1990). Plant Tissue Culture: Applications and Limitations, Elsevier, Amsterdam.
2. Brown, T. A (2007). Genomes. BIOS Scientific Publishers Ltd.
3. Clark, D. P (2005). Molecular Biology: Understanding the Genetic Revolution. Academic press.
4. Malacinski, G. M (2006). Essentials of Molecular Biology. 4th edition. Narosa Publishing House.
5. Primrose, S. B and Twyman, R. M (2007). Principles of Gene Manipulation and Genomics. Blackwell Publishing, Oxford, UK.
6. Singh, B. D. (2007). Biotechnology: Expanding Horizons. Kalyani Publishers.
7. Slater, A., Scott, N and Fowler, M (2003). Plant Biotechnology: the Genetic Manipulation of Plants. Oxford University Press.

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School of Basic & Applied Sciences

Class	M.Sc. (Biotechnology)				
Semester/Year	II Semester				
Subject & Subject Code	Practical Biotechnology- MBIOT20S205				
Paper	Paper- I and II, Practical I Sitting	L	T	P	TotalC
Max. Marks	50= (30+20)	0	0	2	2

PRACTICALS

1 Isolation of genomic DNA & Plasmid DNA.
2 Electrophoresis of DNA Linear, circular and super coiled.
3 Demonstration southerm blotting and Northern blotting.
4 Isolation of RNA.
5 Isolation of poly A + RNA.
6 Isolation of DNA and demonstration of apoptosis of DNA laddering.
7 Prearation of probes.
8 In vitro transcription study.
9 In Vitro translation study.
10 Metabolic labeling of proteins and immunopresicpitiation.
11 Protein DNA interaction.
12 Urease estimation by tritrimetric method.
13 Urease estimation by colorimetric method.
14 Acid phosphatase estimation.
15 Alkaline phosphatase estimation.
16 Determination of optimum time, optimum temperature & optimum pII.
17 Determination of Km value.
18 Acetylcholine esterase/pseudocholinesterase estimation.
19 Enzyme purification.
20 Measurement of activity of amylase under different conditions.
21 Extraction of enzymes from various sources.

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School of Basic & Applied Sciences

Class	M.Sc. (Biotechnology)				
Semester/Year	II Semester				
Subject & Subject Code	Practical Biotechnology- MBIOT20S206				
Paper	Paper- I and II, Practical II Sitting	L	T	P	Total C
Max. Marks	50= (30+20)	0	0	2	2

PRACTICALS

1 Blood Film Preparation and identification of cell.
2 lymphpid organs and their microscopic organization.
3 Immunization and production of polyclonal antibodies.
4 Double diffusion and Immune- electrophoresis.
5 Purification of I gG from serum.
6 Separation of mononuclear cells by Ficoll- Hypaque
7 Con- A induced proliferation of thymocytes (by MTT method).
8 Western- blotting .
9 Indirect ELISA, sandwich ELISA and Competitive ELISA .
10 Praparation of antibody –enzyme conjugates.
11 Isolation of lymphocytes and its culture.
12 Preparation of media.
13 Surface sterilization.
14 Organ culture.
15 Protoplast isolation and culture.
16 Callus preparation, Organogenesis, transfer of plants to soil.
17 Detection of coliforms for determination of the purity of potable water.
18 Determination of biological oxygen demand (BOD) of a sewage sample.
19 Determination of chemical oxygen demand (COD) of a sewage water.
20 Estimation of heavy metals in water/soil.
21 Insecticide residue examination by TLC.
22 Insecticde degradation by bacteria and fung.
23 Identification of permanent slides of fungi and bacteria.

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