

SEMESTER- I

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N1BT2	Basic biochemistry	45

Course Outcomes: On completion of this course, students would be able to:

CO1: Understand biomolecules

CO2: Know the amino acids and peptides

CO3: Understand the sugars and polysaccharides

CO4: Understanding the structure of nucleic acids

CO5: Know the structure of lipids and their functions

Unit	Contents	Hrs
Unit I	Introduction to biomolecules Biomolecules in their cellular environment: The cellular basis of life. Cellular structures - prokaryotes and eukaryotes. Chemical principles in biomolecular structure. Major classes of biomolecules. Role of water in design of biomolecules	09
Unit II	Amino acids and peptides Amino acids and peptides: Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides	09
Unit III	Sugars and polysaccharides: Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role.	09
Unit IV	Nucleosides, nucleotides and nucleic acids: Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides	09
Unit V	Lipids Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments. Vitamins – water and fat soluble,	09

Reference Books: format (Title, Author, Publisher, Edition)

- Suggested readings: 1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13; 978-1-4641-0962-1 / ISBN:10-14641-0962-1.

- 2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.
- Practical's: General Biochemistry Practical *(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)
- 1. General safety procedures in a laboratory. Use of auto pipettes. Making solutions and buffer preparation - acetate and tris buffers.
- 2. Qualitative tests for biomolecules - carbohydrates, lipids, amino acids, proteins, bases and nucleic acids.
- 3. Separation of amino acids by paper chromatography.
- 4. Separation of sugars/bases by TLC and their identification.
- 5. Estimation of ascorbic acid in fruit juice'

SEMESTER- I

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N1BT3	Microbial biotechnology	45

Course Outcomes: On completion of this course, students would be able to:

CO1: Students will be able to isolate and identify pathogenic bacteria from clinical samples

CO2: Students will gain hands-on experience in applied microbiology, including isolation of environmental microbes

CO3: Will able to know to control the growth and spread of microorganisms

CO4: Students will be able to culture, isolate and maintain microorganisms

CO5: Will get well acquainted with industrial microbiology and terminology

CO^: Students will get exposure to medical microbiology

Unit	Contents	Hrs
Unit I	Fundamentals and Evolution of Microbiology: Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria. Microbial Diversity: Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses	09
Unit II	Cultivation and Maintenance of microorganisms: Nutritional categories of bacteria, methods of isolation, culturing methods, Purification and methods preservation of bacterial cultures.	09
Unit III	Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. Microbial Metabolism: Metabolic pathways, catabolic and biosynthetic pathways Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.	09

Unit IV	Control of Microorganisms: By physical, chemical and chemotherapeutic Agents Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. Food Microbiology: Important microorganism in food Microbiology: Molds, Yeasts, bacteria. Major food born infections and intoxications, Preservation of various types of foods. Fermented Foods.]Introduction to Industrial Microbiology 1. Definition of terminologies related to fermentation and food microbiology. 2. Food Microbiology a) Hazard Analysis and Critical Control Points(HACCP) b) Food Preservation Methods: Pasteurization, Drying Method.	09
Unit V	Medical microbiology: Types of infections with respect to mode of transmission, clinical specimen for diagnosis. Respiratory tract infection (Tuberculosis, COVID-19, Gastrointestinal tract infection (Cholera, Gastroenteritis) Urinary tract infection. Common Antibiotics and their mode of action a) Penicillin b) Streptomycin c) Tetracycline	09
Practicals1: Microbiology 1. Sterilization methods 2. Preparation of microbiological media 3. Isolation of bacteria by streak, spread, and pour plate method 4. Isolation of soil bacteria 5. Simple staining and differential staining (Gram's staining) 6. Bacterial growth curve Suggested reading: 1. Keith Struthers, Clinical Microbiology ,Second Edition-Taylor and Francis 2. Anantnarayana and Paniker's, Text book of Microbiology,10th edition 3. Dr. C. P. Baveja, Text book of Microbiology,5 th edition 4. Toratora, Funke, Case, Microbiology: An Introduction 10 th edition . 5. Finch R., Greenwood D., Whitley R. and Norrby S. R. (2010) Antibiotic and 6. Chemotherapy. 9th Edition. Elsevier. ISBN: 9780702040641 Franklin T.J and Snow G. A. (1989). 7. Biochemistry of Antimicrobial Action. Springer. First Edition. ISBN: 978-94-009- 0825-3 12. 8. Dubey R.C. and Maheshwari D.K . (2002).Practical Microbiology. S. Chand and company limited .New Delhi India 9. Atlas R.M. (2007) Basic and Practical Microbiology .United kingdom: 10. Gupta V. (2017). The food safety and standards act 9th edition. Commercial Law Publishers(India) Private Limited 11. Alias A K., Paliyath G. and Bhat R. (2012). Progress in Food Preservation. United Kingdom: Wiley. ISBN: 9780470655856 32 CBCS: 2024-25 [NEP 2020] S.Y.B.Sc.-Microbiology 12. Banwart G. J. (1989). Basic Food Microbiology. 2nd edition. Chapman and Hall International Thompson Publishing. .		

SEMESTER- I

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N1BT4	Cell Biology	45

Course Outcomes: On completion of this course, students would be able to:

CO1: Understand the Cell

CO2: Knowing the details of cell organelle

CO3: Understand the functioning of organelle

CO4: Understanding the extracellular matrix and function

CO5: Cancer biology

Unit	Contents	Hrs
Unit I	Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation. Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.	09
Unit II	Cell organelle Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules*, Microfilaments, Intermediate filaments. Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion	09
Unit III	Lysosomes: Vacuoles and micro bodies: Structure and functions Ribosomes: Structures and function including role in protein synthesis. Mitochondria: Structure and function, Genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis Nucleus: Structure and function I chromosomes and their structure	09
Unit IV	Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.	09
Unit V	Cancer: Carcinogenesis, chemical and physical agents that promoting carcinogenesis, characteristics and cell cycle in molecular basis of cancer.	09

Practicals1: Cell Biology Practical *(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Study the effect of temperature and organic solvents on semi permeable membrane.
2. Demonstration of dialysis.
3. Study of plasmolysis and de-plasmolysis
4. Cell fractionation and determination of enzyme activity in organelles using sprouted seed or any other suitable source.
5. Study of structure of any Prokaryotic and Eukaryotic cell.
6. Cell division in onion root tip/ insect gonads.
7. Preparation of Nuclear, Mitochondrial & cytoplasmic fractions

Suggested reading:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009.
5. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

•

SEMESTER- II

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N2BT2	Basics of Molecular Biology	45

Course Outcomes: On completion of this course, students would be able to:

CO1: Discuss the most significant discoveries and theories through the historical progress of biological scientific discoveries, and their impacts on the development of molecular biology.

CO2: Describe the general principles of gene organization in both prokaryotic and eukaryotic organisms.

CO3: Elucidate the mechanisms of DNA replication, RNA synthesis and processing, and protein synthesis.

CO4: Compare and contrast the fundamental structure, properties and processes in which nucleic acids play a part between prokaryotes and eukaryotes

CO5: Illustrate how gene expression is regulated at the transcriptional and post-transcriptional level

CO6: Students will get exposure to medical microbiology

Unit	Contents	Hrs
Unit I	Basic concepts in Molecular Biology :History of significant discoveries in Molecular Biology. Central dogma – DNA as genetic material. Evidence to prove DNA as genetic material- Griffith's transforming principle; Avery, McLeod and McCarty's experiment; Hershey and Chase experiment. Chargaff's law. Watson and Crick model of DNA (B form). Other different forms of DNA- A,Z . Physical Properties of DNA- Denaturation , Renaturation , hyper and hypochromic effect, Cot curve significance.	09
Unit II	DNA Replication Meselson-Stahl's experiment to prove semi-conservative model of replication. DNA replication in prokaryotes and eukaryotes. Types of DNA polymerases , enzymes and proteins associated with DNA replication. Mechanism of replication- Initiation, Elongation and Termination. Other modes of replication: rolling circle replication, D-loop mechanism.	09
Unit III	Genetic code and Transcription; Genetic code properties; initiation and termination codon; Wobble hypothesis. Transcription in prokaryotes and eukaryotes. RNA polymerases; mechanism of transcription- initiation, elongation and termination. Types of RNA – rRNA, mRNA, tRNA, snRNA. .	09

Unit IV	Protein Synthesis; Translation in prokaryotes and eukaryotes. components of ribosomes, tRNA, mRNA, Mechanism of translation; initiation, elongation and termination.	09
Unit V	Gene regulation; Regulation of gene expression- regulatory proteins, promoters, enhancers. Operon concept- negative and positive regulation- Lac, Trp , Ara operon- structure and function.	09
Practicals1: Molecular biology 1. Isolation of DNA from bacteria, blood. 2. Agarose gel electrophoresis 3. Molecular weight determination. 4. Isolation of total RNA 5. Visualization of Nucleic acid. Suggested reading: 1. Friefelder, David And George M. Malacinski “Essentials Of Molecular Biology” 6th Edition, Panima Publishing, 1993. 2 2. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc. 3. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia. (VI 4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) 4.Molecular Biology of the Gene Edition.). Cold Spring Harbour Lab. Pearson Pub. 5. Darnell, Lodish and Baltimore. Molecular Cell Biology, Scientific American Publishing Inc, 2000 .		

SEMESTER- II

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N2BT3	Bioenergetics and metabolism	45

Course Outcomes: On completion of this course, students would be able to:

CO1: To learn basic concepts of Bioenergetics, the importance of high energy compounds, electron transport chain, synthesis of ATP, mechanisms of oxidative phosphorylation and photophosphorylation

CO2: To understand the fundamentals of cellular metabolism of carbohydrates their association with various metabolic diseases.

CO3: To acquire knowledge related to the intermediary metabolism and the role of TCA cycle in central carbon metabolism.

CO4: To learn biosynthesis and degradation of Lipids, fatty acids and cholesterol, Metabolism of lipoproteins and Ketone bodies.

Unit	Contents	Hrs
Unit I	Principles of thermodynamics; Free energy, enthalpy and entropy, Free energy changes in biological transformations in living systems. Redox potential, phosphate group transfer potential and ATP, High-energy compounds, oxidation and reduction reactions.	09
Unit II	Bioenergetics; Oxidative phosphorylation, Mitochondria ultrastructure, Energy harnessing cascade from nutrients, Reducing equivalents, Electron transport and its carriers-Complex I, II, III, IV; Mitchell's Hypothesis—experimental verification, Determination of P:O ratio, ATP synthesis by F1-FO ATP synthase, E. Racker's experiment. Relation of proton movement and ATP synthesis. Experimental demonstration of the movement of ATP synthase. Oxidation and reduction enzymes, utilization of oxygen by oxygenase's, superoxide dismutase and catalase. respiratory control, Mechanism, and theories of oxidative phosphorylation. Respiratory chain inhibitors and uncouplers of oxidative phosphorylation. Microsomal electron transport system. Bioluminescence.	09
Unit III	Carbohydrate metabolism : Approaches for studying intermediary metabolism. Glucose as fuel, glucose transporters, Glycolysis, and its regulation. Substrate cycling, TCA cycle – function and regulation, Glyoxylate cycle, Gluconeogenesis, and its regulation, HMP shunt and its significance, Uronic acid pathway, Glycogen metabolism and its regulation with special reference to phosphorylase and glycogen synthase, Metabolism of fructose, galactose and lactose, Biogenesis of amino sugars, peptidoglycans, glycosyl aminoglycans and glycoproteins. Inborn errors of carbohydrate metabolism.	09

Unit IV	Lipid metabolism – Oxidation of fatty acids, Biosynthesis of fatty acids and regulation; Metabolism of arachidonic acid; formation of prostaglandins, thromboxanes, leukotrienes, Biosynthesis of triglycerides..	09
Unit V	Metabolism of phospholipids , sphingolipids. Biosynthesis of cholesterol and its regulation, Formation of bile acids. Role of liver and adipose tissue in lipid metabolism. In born errors of lipid metabolism .	09

Practicals1: Molecular biology

1. Isolation of casein from milk
2. Preparation of lactalbumin from milk
3. Estimation of reducing sugar by DNSA (dinitrosalicylic acid) method
4. Titration of glucose by Benedict's method
5. Estimation of urea by Diacetylmonoxime method
6. Estimation of creatinine in serum
7. Estimation of cholesterol by ZAK's method

Suggested reading:

1. Principles of Biochemistry, White. A, Handler, P and Smith.
2. Biochemistry, Lehninger A.L.
3. Biochemistry, David E. Metzler.
4. Biochemistry, Lubert Stryer.
5. Text of Biochemistry, West and Todd.

SEMESTER- II

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses of BSC Biotechnology AEDP

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
N2BT2	Plant biotechnology	45

Course Outcomes: On completion of this course, students would be able to:

CO1: The introduction of culturing of plants In vitro

CO2: Various methods of plant tissue culture.

CO3: Isolation of protoplasts and information of cybrids, hybrids.

CO4: Role of bacteria in promotion of growth in bacteria

CO5: Illustrate the application of transgenic plants and tissue culture in field

Unit	Contents	Hrs
Unit I	Introduction to plant biotechnology , Cryo and organogenic differentiation, Types of culture: Seed, Embryo, Callus, Organs, Cell and Protoplast culture. Micropopagation Axillary bud proliferation, Meristem and shoot tip culture, callus culture, organogenesis, embryogenesis, advantages and disadvantages of micropopagation. .	09
Unit II	In vitro haploid production Androgenic methods: Anther culture, Microspore culture androgenesis Significance and use of haploids, Ploidy level and chromosome doubling, diploidization, Gynogenic haploids, factors effecting gynogenesis, chromosome elimination techniques for production of haploids in cereals.	09
Unit III	Protoplast Isolation and fusion Methods of protoplast isolation , Protoplast development, Somatic hybridization, identification and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations. Somaclonal variation Nomenclature, methods, applications basis and disadvantages.	09
Unit IV	Plant Growth Promoting bacteria. Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation, Biocontrol of pathogens, Growth promotion by free-living bacteria.	09
Unit V	Transgenic and application: Production of transgenic plants and their applications, examples of transgenic plants, application of plant tissue culture in forestry, ornamental plants, disease free plants, production of secondary metabolites, natural products and application in agriculture	09

Practicals1: Plant biotechnology

1. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
2. Preparation of complex nutrient medium (Murashige & Skoog's medium)
3. To selection, Prune, sterilize and prepare an explant for culture.
4. Significance of growth hormones in culture medium.
5. To demonstrate various steps of Micropropagation.
- 6.. Germplasm maintenance.

Suggested reading:

1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
2. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.
3. Gardner, E.J. Simmonns, M.J. Snustad, D.P. 2008 8th edition Principles of Genetics. Wiley India.
4. Raven, P.H., Johnson, GB., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
6. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rd edition. Benjamin Co.
7. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3rd edition)
8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.

