Biotechnology

Allied Paper I- BIOLOGICAL CHEMISTRY(Semester I)

Sub.code	**23BBTA1**	**Instructional Hours: 3 h/week**	**Credit: 3**
Objectives	➢ Comprehend the importance of Chemistry and Biochemistry through the concept of acids and bases, and chemical bonding. ➢ Demonstrates the formation of different types of solutions, concentrations of solution sand preparation of buffer solutions ➢ Recall the Structure, Classification, Chemistry and Properties of Carbohydrates and Explain Various Biochemical Cycles involved in Carbohydrate Metabolism. ➢ Recall the Structure, Classification, Chemistry and Properties of Lipids, Nucleic acid and Explain Various Biochemical Cycles involved in Fatty acid and Nucleic acid Metabolism. ➢ Understand the Structure, Classification, Chemistry and Properties of proteins amino acids and Identify and explain nutrients in foods and the specific functions in maintaining health.		
Unit I	**Classification of organic compounds** -. Hybridization in methane, ethane, acetylene, and benzene. Definition with exampleselectrophiles, nucleophiles and free radicals. Types of reactions with an example: addition, substitution, elimination, condensation and polymerization. Electrophilic substitution reaction in benzene, nitration and sulphonation.		
Unit II	**Acids & Bases**: Properties and differences, Concepts of acids and basesArrhenius, Lowry-Bronsted and Lewis. Concentration of solution, ways of expressing concentrations of solutions – per cent by weight, normality, molarity, molality, mole fraction. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson-Hasselbalch equation, mechanism of buffer action of acidic buffer and basic buffer.		
Unit III	**Importance to Biochemistry:**the chemical foundation of life. Water: its unique properties, ionization of water, buffering action in biological system, properties and characteristics of water. Classification of carbohydrates. Properties of carbohydrates. Ring structure of sugars and conformations of sugars.		
Unit IV	**Lipids:**Classification of Lipids. Characteristics, Properties and Biological importance of lipids. **Nucleic acids:**Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA & RNA.		
Unit V	**Aminoacids and proteins:**Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. ATP production. Oxidative phosphorylation, Electron transport chain and Photophosphorylation.		
Text Books 1. P.L. Soni , A Text-book of Inorganic Chemistry, 11th Edition, S. Chand & Sons publications 2. AbhilashaShourie, Shilpa S, Chapadgoankar&Anamika Singh (2020) Textbook of Biochemistry 1st Edition 3. J.L. Jain, 2016, Fundamentals of Biochemistry, S. Chand publication, 7th edition.			

4. A.C. Deb, 2016, Fundamentals of Biochemistry, New central book agencies, 7th edition.
5. Satyanarayana .U, 2016, Biochemistry, MJ publishers 3rd edition (2006).

Reference Books

1. Lehninger (2013) Principles of Biochemistrty 4 th edition WH Freeman and Company NY
2. Murray et al., (2003) Harper's biochemistry 26 th edition Appleton and Lange Publishers Florida USA
3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, Principles of Biochemistry, W.C. Brown Publishers, 1995, 3rd edition.
4. LubertStryer (2007) Biochemistry –Stanford University 5 th Edition-W H Freemann and company San Francisco
5. BahlArun, Bahl B. S. (2016), A Textbook of Organic Chemistry, 22nd Edition, S. Chand & Sons publications

Web Resources

1. http/dwb4.unl.edu/chem869p/chem869plinks/s www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp
2. https://www.britannica.com › science › biochemistry
3. https://]ww.sciencedirect.com › topics › agricultural-and-biological-sciences https://biochemistry.org › education › careers › becoming-a-bioscientist › w

Allied Practical I-BIOLOGICAL CHEMISTRY(Semester I)

Sub. Code 23BBTAP1	**Practical**	**Instructional Hours: 2 h/week**	**Credit: 2**
Objectives	➢ Qualitatively analyze the carbohydratesand report the type based on specific tests ➢ Qualitatively analyze the amino acids and report the type based on specific tests. ➢ Quantify Glycine by sorensons formal titration method. ➢ Estimate Glucose, Cholesterol and Proteins.		
Unit I	**Qualitative analysis of carbohydrates** - Glucose, Fructose, Lactose, maltose, sucrose, starch & glycogen.		
Unit II	**Qualitative analysis of amino acids** - Tyrosine, Tryptophan, Arginine, Proline and Cysteine.		
Unit III	**Quantitative Estimation of proteins** – Bradford's method. Estimation of Glycine-Formal Titration.		
Unit IV	**Quantitative Estimation** of glucose		
Unit V	**Quantitative** Estimation of Cholesterol- Zak's method		

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers, 2011.
2. S. K. SawhneyRandhir, Singh, Introductory Practical Biochemistry, Alpha Science International Ltd, 2nd edition, 2005.
3. Irwin H.Segel, Biochemical calculations,Liss, Newyork,1991.

Reference Books

1. Dr. O P Panday, D N Bajpai, Dr. S Giri, PRACTICAL CHEMISTRY, S Chand, Revised edition 2016.
2. Hands Thacher Clarke, A hand book of Oraganic: Qualitative and quantitative Analysis, 2007.
3. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry Lab manual, S.Viswanathan Co. Pvt. Ltd., 1998.

Allied Paper II FUNDAMENTALS OF MICROBIOLOGY(Semester II)

Sub. Code 23BBTA2	**Theory**	**Instructional Hours: 3 h/week**	**Credit: 3**
Objectives	➢ Understand the classification of Microorganisms and structure of bacteria. ➢ Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms. ➢ Categorize the methods of sterilization and identify the significance of culture media in the growth of different microbes. ➢ Exhibit knowledge in analyzing the importance of Bio insecticides, Bio fertilizers prebiotics and probiotics. ➢ Distinguish between normal flora and pathogens and describe the role of microbes in food intoxications.		
Unit I	History of Microbiology, Classification of bacteria, fungi, virus, protozoa and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology.		
Unit II	Structure of bacteria - Bacterial growth and measurement of growth, Media – types and preparation- plating methods - staining methods (Gram's, capsule, spore, LCB mount)- methods of preservation and storage of microbes. Culture of fungi, virus and algae.		
Unit III	Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL.		
Unit IV	Bioinsecticides - Bacillus thuringiensis, Baculoviruses- Biofertilizers - Azospirillum and blue green algae - single cell protein – prebiotics and probiotics - Dairy products (Cheese and Yoghurt).		
Unit V	Microbial Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria).		

Text Books

1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition.,McGraw – Hill, New York.
2. Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co.
3. Ananthanarayanan, Paniker, Kapil, Textbook book of Microbiology, 9th edition, Orient BlackSwan, 2013.
4. Prescott, Harley, Klein, Microbiology, 10th Edition, McGraw – Hill, 2016.
5. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Editions) (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC

Reference Books

1. Madigan, Martinko, Bender, Buckley, Stahl, Brock Biology of Microorganisms, 14th edition, 2017.
2. Gillespie, Bamford, Medical Microbiology and Infection at a Glance, 4th edition, 2012.
3. Boyd, R.F. (1998). General Microbiology,2nd Edition., Times Mirror, Mosby CollegePublishing, St Louis.
4. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw

Hill Inc.New York.

Web Resources

1. Horst W. Doelle (2004). Microbial Metabolism and Biotechnology. Proceedings of an Eseminar organized by the International organization for Biotechnology and Bioengineering (IOBB)
2. http://www ejb.org/content.
3. www. Biotech.kth.se Electronic Journal of biotechnology
4. https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-tomicrobiology/a-brief-history-of-microbiology
5. https://bio.libretexts.org/@go/page/9188

ALLIED PRACTICAL II -FUNDAMENTALS OF MICROBIOLOGY (Semester II)

Sub. Code 23BBTAP2	**Practical**	**Instructional Hours: 2 h/week**	**Credit: 2**
Objectives	➢ Describe the general Laboratory safety & Sterilization Techniques. ➢ Develop Skills in Media Preparation, Isolation & Serial Dilution Techniques and Pure Culture Techniques. ➢ Microscopically analyze the morphological features of Bacteria and fungi and define various Staining Techniques. ➢ Perform the Motility of organisms. ➢ Able to characterize and identify bacteria using Biochemical tests.		
Unit I	Sterilization techniques – Preparation of Media		
Unit II	Inoculation techniques- Pour plate, spread plate Isolation of bacteria from various sources and dilution techniques.		
Unit III	Staining techniques: Simple, Gram's, Capsule (Negative), Spores, Preparation of temporary mounts- Lacto phenol cotton blue staining.		
Unit IV	Motility tests: Hanging drop technique.		
Unit V	Biochemical characterization - catalase, oxidase, IMVIC test and TSI. Antibiotic sensitivity test (demonstration).		

Text Books

1. James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996.
2. Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.
3. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
4. Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.
5. R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing.

Reference Books

1. Atlas.R (1997). Principles of Microbiology, 2nd Edition, Wm.C.Brown publishers.
2. Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1st Edition). Elsevier India.
3. Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS.
4. Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.
5. Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications.

Allied Paper III BIOINSTRUMENTATION (Semester III)

Sub. Code 23BBTA3	**Theory**	**Instructional Hours: 3 h/week**	**Credit: 3**
Objectives	➢ Practice, experiment with and apply the basic instruments in the laboratory. ➢ Predict the functionality of Beer – Lambert's law in identifying and quantifying a biomolecule. ➢ Employ the separation techniques for separating biomolecules based on chromatography and electrophoretic techniques. ➢ Understand the clinical important isotopes and detection of isotopes. ➢ Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation.		
Unit I	pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope.		
Unit II	Spectra – Absorption and Emission Spectra – Beer Lambert's law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR).		
Unit III	Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Agarose Gel Electrophoresis – SDS- PAGE.		
Unit IV	Radioactivity – Isotopes – Clinically important isotopes – Measurement of Radioactivity – GM Counters, Scintillation Counters – Autoradiography – Applications. SOPs for Radioactive materials.		
Unit V	Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient centrifugation – Ultra Centrifuge.		

Text Books

1. Upadhyay and UpadhyayNath. (2009). "Biophysical Chemistry", Principles and Techniques. Himalaya Publishing House.
2. L.Veerakumari, (2006) "Bioinstrumentation" MJP publishers , Kindle Edition.
3. SkoogD.A.F.James Holler and Stanky,R.Crouch, (2007) "Instrumental Methods of Analysis" Cengage Learning. Palanivelu P, 2000. Analytical Biochemistry & Separation Techniques, 4th edition, Twenty first century publications.
4. Prakash M, 2009. Understanding Bioinstrumentation, 1st edition, Discovery Publishing House Pvt Ltd.

Reference Books

1. Keith Wilson,John Walker,(2010).Principles and techniques of Biochemistry and Molecular Biology"(7th edition).Cambridge University Press.
2. David L.Nelson, Michael M Cox.Lehninger(2008)."Principles of Biochemistry",Fifth edition W.H.Freeman,Newyork.
3. Khandpur R S, 2014. Handbook of Biomedical Instrumentation, 3rd edition, McGraw Hill Education (India).
4. L.A Geddes and L.E.Baker (2008) "Principles of Applied Biomedical Instrumentation" Wiley India Third Edition. Sharma B K, 2005. Instrumental Methods of Chemical Analysis, 24th Edition, GOEL Publishing House.

ALLIED PRACTICAL III - BIOINSTRUMENTATION (Semester III)

Sub. Code 23BBTAP3	**Practical**	**Instructional Hours: 2 h/week**	**Credit: 2**
Objectives	➢ Practice, experiment with and apply the basic instruments in the laboratory such as weighing balance, pH meter, shaker, incubator etc. in various research processes. ➢ Predict the functionality of Beer – Lambert's law in identifying and quantifying biomolecules. ➢ Employ the separation techniques for separating biomolecules based on paper chromatography. ➢ Employ the separation techniques for separating biomolecules based on Thin layer chromatography. ➢ Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation.		
Unit I	Preparation of Buffer (Phosphate Buffer) Determination of pH of biological samples using pH meter		
Unit II	UV spectra of Nucleic acids and proteins.		
Unit III	Chromatography analysis of sugar and amino acids by paper chromatography.		
Unit IV	Chromatography analysis of lipids by Thin layer chromatography.		
Unit V	Fractionation of biological material into its various components by Centrifuge.		

Text Books

1. Sharda University Abstract Laboratory Manual for Bio-instrumentation, Biochemistry, Microbiology, Cell Biology and Enzyme Technology.2018
2. Bhomwik (2011),Analytical techniques in Biotechnology – A complete laboratory manual, MGH Publisher, ISBN-13 : 978-0070700130.

Reference Books

1. P. Palanivelu (2017), Analytical Biochemistry and Separation techniques – A laboratory manual, (5th Edition), Twentyfirst century publishers, ISBN: 978- 81-908489-0-9

Allied Paper IV - BIOINFORMATICS AND BIOSTATISTICS (Semester IV)

Sub. Code 23BBTA4	**Theory**	**Instructional Hours: 3 h/week**	**Credit: 3**
Objectives	➢ Acquire knowledge about the Developments and Applications of Bioinformatics. ➢ Gain knowledge about the importance of the bioinformatics, databases, tools and software of bioinformatics and explain different types of Biological Databases. ➢ Understand the basics of sequence alignment, sequence analysis and Protein structure prediction method. ➢ Demonstrate the basic methods of data collection, graph construction and sampling techniques and Calculate measures of central tendency.		
Unit I	**Introduction to Bioinformatics** – Genome, Transcriptome and Proteome, Gene prediction rules and software. Nucleic acid Databases – Primary and Secondary Databases – Structure Database – CATH, SCOP – Data base Searching – BLAST and FASTA, BLOSSUM.		
Unit II	**Sequence analysis** (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction - Homology modeling of proteins, visualization tools (RASMOL).		
Unit III	**Multiple Sequences alignment** – method of multiple sequences alignmentEvolutionary analysis, clustering methods Phylogenic trees - Methods to generate phylogenetic tree-Tools for multiple sequences alignment and phylogenetic analysis.		
Unit IV	**Statistics** – collection, classification, tabulations of Statistical Data – Diagrammatic and graphical representation of data.		
Unit V	**Measures of central tendency** – Mean, Median, mode, Dispersion, range, Quartile deviation, Mean deviation, Standard deviation and Measures of Skewness.		

Text Books

1. Pennington, S.R. and Punn, M.J. 2002.Proteomics: from protein sequence to function. Viva books Pvt. Ltd.
2. Shuba G.,2010. Bioinformatics., Tata McGraw Hill publishing. India.
3. Rastogi, S.C, Mendiratta, N,Rastogi, P., 2004. Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.
4. N.Gurumani (2011) "An Introduction to Biostastistics" MJP Publishers
5. VerbalaRastogi .(2011).”Fundamentals of Biostatistics”, Ane books Pvt Ltd Publishers,Chennai.

Reference Books

1. Attwood, T.K. and Parry-Smith, D.J.2008. Introduction to Bioinformatics. Pearson Education.
2. David Mount., Bioinformatics: sequence and genome analysis, second edition., Taylor & Francis, UK; 2009.
3. D.R.Westhead. Instant Notes in Bioinformatics., second edition., Taylor & Francis, UK; 2009.
4. Zar,(J.H.2010).”Biostatistical Analysis” Fifth Edition, Pearson Education Pvt Ltd, Indian Branch, NewDelhi. P.N.Arora and P.K. Malhan.(2013)"Biostatistics"Himalaya publishing House.

Allied Practical IV- BIOINFORMATICS AND BIOSTATISTICS

Sub. Code 23BBTAP4	**Practical**	**Instructional Hours: 2 h/week**	**Credit: 2**
Objectives	➢ Analyse the Biological databases. ➢ Able to perform BLAST and FASTA. ➢ Represent data in to graphical form. ➢ Test the level of significance of biological data and interpret the results. ➢ Determine averages of the biological data.		
Unit I	Biological databases (NCBI, Swissprot and PDB)		
Unit II	BLAST FASTA.		
Unit III	Identification of functional domains in nucleotide binding proteins using a domain analysis server like SMART.		
Unit IV	Preparation of bar diagram, line diagram and pie diagram using MS EXCEL. Calculation of Central tendency- mean, geometric mean, median using MS EXCEL		
Unit V	Calculation of dispersion – Mean deviation, quartile deviation and standard deviation using MS EXCEL.		

Text Books

1. Pennington, S.R. and Punn, M.J. 2002.Proteomics: from protein sequence to function. Viva books Pri. Ltd.
2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2ndedition. Bios Scientific Publishers Ltd Misener, S. and Krawetz. S.A. 2000. Bioinformatics: Methods and Protocols. Humana press.
3. Attwood, T.K. and Parry-Smith, D.J.1999. Introduction to Bioinformatics. Pearson Education Asia.
4. Primrose, S.B. 1998. Principle of genome analysis. 2ndedition. Blackwell Science.

Reference Books

1. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G. 1998. Biological sequence analysis. Cambridge University Press.
2. Friedman, C.P. and Wyatt. J.C. 1997. Computers and Machine: Evaluation methods in medicinal information. Springer-verlag, New York.

Web Resources

1. Bishop, M.J. and Rawhings. C.J. 1997. DNA and protein sequence analysis: A practical approach. Oxford University press. New press. Kolodne
2. Kolodner, R.M. 1997. Computer in Health care: Computerizing large integrated health networks. Springer – Verlag, New York