Biochemistry

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-1-0, (3)	Core	BT103101BT

[Pre-requisites: Basic Bioscience]

Course Objectives

To impart knowledge of structural and functional aspects of biomolecules, molecules of life, starting at simple building blocks and culminating in complex metabolism

Course Content

Unit-1:

Biochemistry of Water,Buffer in its biological significance, Henderson-Hasselbach equation; Homeostasis, Enzymes: Introduction, classification, kinetics,Regulation, catalytic mechanism and inhibition.

Unit-2:

Biomolecules:Introduction, Classification, Structure and function of Carbohydrates, Lipids, Nucleic acids, and Protein.

Unit-3:

Introduction to metabolism, Glycolysis, TCA cycle, Gluconeogenesis, Pentose Phosphate Pathway, Electron transport chain and Oxidative phosphorylation, Calvin cycle, Hatch and Slack cycle.

Unit-4:

Nitrogen metabolism in ureotelic organism, Biosynthesis and catabolism of essential amino acid, Purine and Pyrimidine biosynthesis and catabolism.Fatty acid biosynthesis, β- oxidation of fatty acid.

Course Materials

Required Text: Text books

1. Lehninger Principles of Biochemistry, D. L. Nelson and M. M. Cox, 4th Edn, WH Freeman and Company, 2005.

Optional Materials: Reference Books

1. Biochemistry, J.M. Berg, J.L. Tymoczko, and L. Stryer, 6th Edn., WH Freeman and Company, 2007.
2. Biochemistry, R. H. Garret and C. M. Grisham, 3rd Edn., Brooks Cole, 2004.
3. Biochemistry, D. Voet and J.G. Voet, 4th Edn., John Wiley & Sons Inc., 2011.

Biophysical Techniques

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-1-0, (3)	Core	BT103102BT

[Pre-requisites: Basic Biosciences]

Course Objectives

To introduce the concepts of biophysics and impart knowledge of various analytical techniques in application.

Course Content

Unit-1:

Introduction to Biophysical Technique: Introduction to Biophysical Techniqueused in biotechnology, chromatography: Principle, methodology and application of chromatographic techniques like Column Chromatography, Paper Chromatography, Thin Layer Chromatography, Gas Chromatography, High Performance Liquid Chromatography.

Unit-2:

Electrophoretic Techniques: Agarose Gel Electrophoresis, Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis, Capillary Electrophoresis, Isoelectric Focusing, Two-Dimensional Gel Electrophoresis.

Unit-3:

Microscopy and Spectrophotometry: Phase contrast microscopy, Confocal Scanning Microscope, Scanning & Transmission Electron Microscope (SEM & TEM), Atomic Force Microscopy, Double beam spectrophotometer, UV & Infrared spectrometer.

Unit-4:

Advance Biophysical Techniques: Atomic Absorption Spectrophotometer, Circular Dichroism, FT-IR/Raman Spectrometer, X-ray Diffractometer, Surface Plasma Resonance, Nuclear Magnetic Resonance..

Course Materials

Required Text: Text books

1. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker, 7th Edn, Cambridge University Press , 2010.
2. Physical Biochemistry by David Freifelder, 5th Edn, W. H Freeman and Company, 1982

Optional Materials: Reference Books

1. Biophysical Techniques by Iain D. Campbell, Oxford University Press; 1 edition, 2012 (ISBN: 9780199642144).
2. Methods in Modern Biophysics by BengtNölting, Springer, 2010 (ISBN 978-3-642-03022-2).

Bioprocess Calculations

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-1-0, (3)	core	BT103103BT

[Pre-requisites: Chemistry, Physics]

Course Objectives

1. Understand the material and energy balances of bioprocesses.
2. Perform material and energy balances on biochemical processes/equipment without and with reactions.
3. Perform unsteady state material and energy balances

Draw the flow diagram and solve the problems involving recycle, purge and bypass in a process or unit.

Course Content

Unit 1:

Introduction to Engineering Calculations: Physical Variables Dimensions and Units Systems of units in engineering concepts, procedure for steady state and material balance calculations with and without chemical reactions.

Unit 2:

Concept of limiting; excess reactants; fractional conversion; percentage of conversion; percentage yield; excess air calculations; material balances involving simultaneous equations; material balances involving recycle; by-pass; and purge streams; stoichiometry of substrate, product formation and microbial growth.

Unit 3:

Steady-state energy balances: General energy balance equations; enthalpy calculation procedures; enthalpy change in non-reactive processes; steam tables; procedure for energy balance calculations without reaction; energy balance worked examples without reaction; enthalpy change due to reaction. Solving simultaneous material and energy balances. Heat of reaction for processes with biomass production; Energy balance equation for cell culture; fermentation energy balances worked examples.

Unit 4:

Introduction to unsteady-state material and energy balances. Models of Unsteady state material and energy balance and their solutions; unsteady state mass and energy balances, unsteady state material and energy balances on reactive and non-reactive process, heat of mixing and solution, integrated balances.

Course Materials

Required Text: Text books

1. Bhatt B.I, and Vora S.M, Stoichiometry, 4th Edition, Tata McGraw -Hill, 2005.
2. Himmelblau, D.H, Basic Principles and Calculations in Chemical Engineering, 6th Edition, Prentice Hall India, 2003.

Optional Materials: Reference Books

1. Pauline M. Doran, Bioprocess Engineering Principles, Elsevier, South Asia Edition, 2005
2. Hougen, O.A, Watson, K.M and Ragatz R.A, Chemical Processes Principles (Part- 1): Material and Energy Balances, 2nd Edition, Asia Publication House, 2001.

Object Oriented Methodology

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-1-0, (3)	EPR	BT103104IT

[Pre-requisites: Programming in C, Computer Programming (C++)]

Course Objectives

1. To provide a detailed understanding of the object-oriented concept.
2. Understanding inheritance and exception handling.
3. To relate practical and theoretical concepts with the help of java, GUI and UML programming.

Course Content

Unit-1: Object-Oriented Concepts

Introduction to class and instances, An Overview of Java, Data types, Variables and Arrays, Operators, Expressions, Control statements, String handling. Package definition, Types of interfaces & Streams, File operations.

Unit-2: Inheritance, Polymorphism & Exception Handling

Inheritance, Polymorphism, method overriding, access specifiers, Fundamentals of exception handling, Exception types, Multithreading, Java thread model, creating threads, thread priorities, synchronizing threads, inter-thread communication.

Unit-3: Socket Programming & GUI

Introduction to socket programming, Graphical User Interface Components, Threads, Multithreading, Java Database Connectivity, Networking, Collections, GUI Programming: MVC Architecture, Event Handling, Applets, and Swing: Applet design, AWT packages, Applet event handling, parameters to applets.

Unit-4: Object-Oriented Modelling

Building blocks of UML, Structural & Behavioral Modeling. UML Diagrams: Modeling Requirements, Use Case Diagrams, Sequence Diagrams, Class Diagram, Activity Diagram, Statechart Diagram, Deployment Diagram.

Course Materials

Required Text: Text books

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
3. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005

Optional Materials: Reference Books

1. An Introduction to programming and OO design using Java, J. Nino, and F.A. Hosch, John Wiley &Sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
4. Practical Object-Oriented Design with UML - Mark Priestley, 2nd Edition, Tata McGraw-Hill, 2003.
5. Object-Oriented Design with UML and JAVA - K. Barclay, J. Savage, Elsevier, 2008.
6. The Unified Modeling Language User Guide - Booch, G., Rumbaugh, J., and Jacobson, I, 2nd Edition, Pearson, 2005.

Microbiology

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	3-1-0, (3)	Core	BT103105BT

[Pre-requisites: Basic Biosciences]

Course Objectives

1. To understand the roles and characteristics of microorganisms.
2. To study in detail the growth and diversity of microorganisms.
3. To evaluate the metabolic pathways and analyze how microorganisms cause diseases.
4. To insight appropriate methods for control of the growth of micro-organisms.

Course Content

Unit 1

Introduction to Microbiology: History, Types of microbes, General characteristics and morphology of prokaryotic and eukaryotic microbes, Concepts of species and hierarchical taxa, classical & molecular methods of taxonomy of microorganisms. - Microscope and Microscopy - preparation of Light-Microscope examinations

Unit 2

Microbial growth and metabolism: Culturing of microorganisms, Culture Media, Isolation of pure culture. Microbial growth. Growth curve and quantitative measurement of microbial Growth. Introduction to metagenomics approach to study unculturable microbes. Nutritional types, Microbial Metabolism: Aerobic and anaerobic respiration, Microbial fermentation, Photophosphorylation in microbes, Nitrogen fixation by microorganism.

Unit 3

Introduction to viruses: General characteristics, Bacteriophages and Eukaryotic viruses- General structure, symmetry and infection cycle. Microbial pathogenicity and host-pathogen interaction.

Unit 4

Applied Microbiology: Mode of action of antibiotic. Probiotics, Nutraceuticals from microbes. Microbial fermented products. Control of microorganisms - physical agents and chemical agents.

Course Materials

Required Text: Text books

1. Microbiology by Pelzar, Chan &Kreig [1986] McGraw Hill. 2.
2. Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark: Brock Biology of Microorganisms, Pearson, 13th Edition, 2011.

Optional Materials: Reference Books

1. John L. Ingraham, Catherine A. Ingraham: Introduction to Microbiology, A case History Approach, Thomson Brooks/Cole, 3rd Edition, 2004
2. Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton: Prescott, Harley, and Klein's Microbiology, McGraw Hill Higher Education, International Edition, 7th Edition, 2007

Mathematics-III

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mathematics	4-0-0, (4)	EPR	BT103001MA

[Pre-requisites: Mathematics-I, Mathematics-II]

Course Objectives

To enable the students to apply the knowledge of Mathematics in various fields:

1. Introduce the Fourier Series and Fourier Transform
2. Introduce the concepts of Laplace Transform and its application in solution of differential equations and improper integral
3. Able to form and solve the partial differential equation using different analytical techniques with application in solution of wave and Laplace equations
4. Introduce to Z –Transform with application in solution of difference equations.

Course Content

Unit-1: FOURIER SERIES AND FOURIER TRANSFORM

Expansion of function as Fourier series, Functions having points of discontinuity, Change of interval, Even & Odd functions, Half-range series, Harmonic analysis, Fourier Transformation, Inverse transformation, Finite cosine and sine transform.

Unit-2: LAPLACE TRANSFORM

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives and integrals, Multiplication by t^n , Division by t, Evaluation of Integrals, Periodic functions, Inverse Laplace transform, Convolution theorem, Application of Laplace transform to find the solutions of ordinary differential equations.

Unit-3: PARTIAL DIFFERENTIAL EQUATION

Formation, Solutions by direct integration method, Linear equations of first order, Homogeneous linear equations with constant coefficients, Non-homogeneous linear equations, Method of separation of variables with applications in finding the solution of wave, heat and Laplace equations.

Unit-4: GROUP THEORY

Definition and examples, Permutation group, Cyclic group, Subgroup, Cosets, Langrange's theorem, some theorems on subgroup, Homomorphism and Isomorphism of groups, Normal subgroup, Quotient group, Fundamental theorems of homomorphism on groups.

Course Materials

Required Text: Text books

1. Higher Engineering Mathematics by B. S. Grewal - Khanna Publishers.
2. Advanced Engineering Mathematics by Erwin Kreyszig - John Wiley & Sons.
3. Contemporary Abstract Algebra by Joseph A. Gallian, Narosa Publishing House.

Optional Materials: Reference Books

1. Advanced Engg. Mathematics by R. K. Jain and S. R. K. Iyengar–Narosa Publishing House.
2. Higher Engineering Mathematics by B. V. Ramana, McGraw Hill.

Biochemistry and Microbiology Laboratory

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Biotechnology	0-0-2, (2)	Core	BT103401BT

[Pre Requisite-Basic Biosciences Lab]

Course Objectives (CO)

Understand explicitly the concepts
Develop their skills in the preparation, identification and quantification of microorganisms and their biochemical analysis
To experimentally verify the theoretical concepts

Course Content

1. Isolation and enumeration of microbes from Soil/water/air sample.
2. Isolation of pure culture using streak plate and pour plate methods.
3. Staining Techniques (Simple, Gram staining, spore staining, Staining of fungal cell and Identification.)
4. Biochemical Characterization of Bacteria (Indole test, methyl red test, vogesproskaeur test, citrate utilization, starch hydrolysis, urease test, catalase test, oxidase test)
5. Storage/preservation of micro-organisms
6. Estimation of protein in the given microbial culture by Lowry method.
7. Estimation of reducing sugar in given microbial culture by Dinitrosalicylic acid method.
8. Separation of protein by polyacrylamide gel electrophoresis technique.
9. Estimation of nucleic acid in given sample.
10. Purification of protein by gel filtration technique.

Course Materials

Required Text: Text books

1. Laboratory Manual in Biochemistry by Jayaraman
2. Practical Microbiology by Aneja

Optional Materials: Reference Books

1. Biochemical Methods by Sadasivam and Manickam

OOM Lab using JAVA & UML

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	0-0-2, (2)	EPR	BT103402IT

[Pre-requisites: Programming in C, Computer Programming (C++)]

Course Objectives

1. To provide a detailed understanding of the object-oriented concept.
2. Understanding inheritance and exception handling.
3. To relate practical and theoretical concepts with the help of java, GUI and UML programming

Course Content

1. List of 10 -15 Assignment/Practical will be allotted by the Instructor in the respective Lab.