

**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY,
LUCKNOW, UTTAR PRADESH**



**EVALUATION SCHEME & SYLLABUS
FOR
B. TECH. 2nd YEAR**

BIOINFORMATICS

Based On

AICTE Model Curriculum & NEP2020

(Effective from the Session: 2025-26)

B. TECH BIOINFORMATICS CURRICULUM STRUCTURE

SEMESTER- III														
Sl. No.	Subject Code	Subject	Category	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BOE3** / BAS304	Science Based Open Elective/BSC (Maths III/Math IV/ Maths V)	ES/BS	3	1	0	20	10	30		70		100	4
2	BAS301/ BVE301	Technical Communication/ Universal Human values	VA/ HS	2	1	0	20	10	30		70		100	3
3	BBI301	Fundamentals of Biochemistry	PC	3	1	0	20	10	30		70		100	4
4	BBI302	Applied Microbiology and Immunology	PC	3	1	0	20	10	30		70		100	4
5	BBI303	Computational Biology	PC	2	1	0	20	10	30		70		100	3
6	BBI351	Basic Biochemistry Lab	PC	0	0	2				50		50	100	1
7	BBI352	Applied Microbiology and Immunology Lab	PC	0	0	2				50		50	100	1
8	BBI353	Computational Biology Lab	PC	0	0	2				50		50	100	1
9	BCC301/ BCC302	Cyber security/Python programming	VA	2	0	0	20	10	30		70		100	2
10	BCC351	Internship assessment/Mini Project *	PC							100			100	2
		Total		15	5	6								25

*Summer Internship (4-week) / NPTEL Course (4-week) conducted during summer break after II semester will be assessed during III semester.

- **Mathematics-III** for CE / ENV and allied branches
- **Mathematics-IV** for Computer/Electronics/Electrical & allied Branches, Mechanical & Allied Branches, Textile/Chemical & allied Branches
- **Mathematics-V** for Bio Technology / Agriculture Engineering/ Bioinformatics

SEMESTER- IV

Sl. No .	Subject Code	Subject	Category	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BOE4** / BAS404	Science Based Open Elective/BSC (Maths III/ Math IV/ Math V)	VA/ HS	3	1	0	20	10	30		70		100	4
2	BAS401/ BVE401	Technical Communication / Universal Human values	PC	2	1	0	20	10	30		70		100	3
3	BBI401	Principles of Molecular Genetics	PC	3	1	0	20	10	30		70		100	4
4	BBI402	Database Systems and Bioinformatics	PC	3	1	0	20	10	30		70		100	4
5	BBI403	Programming in C and C++	PC	2	1	0	20	10	30		70		100	3
6	BBI451	Basic Molecular Genetics Lab	PC	0	0	2				50		50	100	1
7	BBI452	Database Systems and Bioinformatics Lab	PC	0	0	2				50		50	100	1
8	BBI453	Programming in C and C++ Lab	PC	0	0	2				50		50	100	1
9	BCC401/ BCC402	Cyber security/Python Programming	PC	2	0	0	20	10	30		70		100	2
10	BVE451/ BVE452	Sports and Yoga II/NSS II	VA	0	0	3				100			100	0
		Total		15	5	9								23

THIRD SEMESTER (DETAILED SYLLABUS)
B. TECH (BIOINFORMATICS)

BBI 301		
FUNDAMENTALS OF BIOCHEMISTRY		
Course outcome		Bloom's knowledge Level
At the end of this course student will be able to		
CO1	Recall and describe the basic concepts of chemical bonds, pH, buffers, and biomolecules such as carbohydrates, lipids, and proteins	K1
CO2	Explain the key metabolic pathways of carbohydrates and their regulation including diabetes-related biochemical aspects.	K2
CO3	Understand and summarize the metabolism of amino acids, ammonia, and the urea cycle, along with related disorders.	K2
CO4	Describe fatty acid and nucleic acid metabolism and identify associated disorders.	K3
CO5	Explain and analyze the mechanisms of oxidative phosphorylation, shuttle pathways, and the chemiosmotic theory.	K4
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION TO BIOCHEMISTRY: Introduction to Chemical Bonds, pH, Buffers, Carbohydrates, Lipids, Proteins.	08
II	METABOLISM OF CARBOHYDRATES: Introduction to Metabolism-Glycolysis-Citric acid cycle Gluconeogenesis- Glycogen metabolism- Glycogenesis Glycogenolysis- Biochemical aspects of Diabetes Mellitus.	08
III	PROTEIN METABOLISM: Introduction-Metabolism of amino acids-Transamination Deamination-Metabolism of ammonia-Urea cycle-Biosynthesis of amino acids-Disorders of tyrosine (phenylalanine) metabolism.	08
IV	FATTY ACID METABOLISM AND NUCLEIC ACID METABOLISM: Introduction-Fatty acid oxidation-Ketone bodies & Ketogenesis- Biosynthesis of Fatty acids-Eicosanoids- Cholesterol Biosynthesis- Lipoproteins-Disorders of Lipid metabolism-Nucleic acids: Biosynthesis of Purine and Pyrimidines-Degradation of purine nucleotides and pyrimidine nucleotides-Disorders of Purine and pyrimidine metabolism.	08
V	OXIDATIVE PHOSPHORYLATION: Introduction-Bioenergetics, High energy compounds, Biological oxidation-Electron transport chain, Oxidative phosphorylation, Chemiosmotic theory - Shuttle pathways – Glycerol phosphate Shuttle, Malate aspartate Shuttle –Shunt pathways.	08
Text books: 1. Jain, J L, Jain, Nitin, Sunjay Jain, S. Chand Group “Fundamentals of Biochemistry” (M. E.), ISBN: 8121924537. 2. Satyanarayana& U. Chakrapani, “Biochemistry” Books And Allied (p)Ltd., UISBN: 8187134801. 3. David L. Nelson, Albert Lester Lehninger, Michael M. Cox “Lehninger Principles of Biochemistry”, Edition 5, illustrated, W. H. Freeman, 2008. 4. Jeremy M. Berg, John L. Tymoczko, LubertStryer, “Biochemistry” Edition 7, W. H. Freeman, 2012		

BBI302 APPLIED MICROBIOLOGY AND IMMUNOLOGY		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Understand fundamental basics of microbiology, growth kinetics of bacteria and bacterial genetics	K2
CO 2	Understand the microbial ecology , application of microbes in Domestic, industry set up and and acquire knowledge of food microbiology and prevention of food spoilage	K2
CO 3	Distinguish the major cells and tissue parts of innate and adoptive immune response along with study of immunological reaction in response to different types of antigenic reactions.	K2
CO 4	Acquire basic understanding of fundamental immunological processes, Antigen antibody interaction, and MHC along with the principle and applications of immune-techniques.	K3
CO 5	Apply concepts of immunology and microbiology in disease diagnosis, and immunotherapy.	K4
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	MICROBIAL CHARACTERISTICS AND GROWTH: Introduction to microbiology and microbes, morphology, structure, growth and nutrition of bacteria. Bacterial growth curve, bacterial culture methods; bacterial genetics: mutation and recombination in bacteria, plasmids, transformation, transduction and conjugation. Gram positive and Gram negative organisms, biosynthesis of bacterial cell wall.	08
II	MICROBIAL ECOLOGY AND INDUSTRIAL APPLICATIONS: Role of microorganisms in nitrogen, biological nitrogen fixation; carbon; sulfur; and phosphorus cycles, Microbes of industrial use, Domestic and industrial sewage treatment. Food microbiology: Microbial spoilage of food products (fresh and canned), food borne infection, food preservation methods	08
III	THE IMMUNE SYSTEM: Introduction to immune system: Innate and Adaptive immunity, Humoral and Cell mediated immune response, Cells and Molecules of the immune system, Primary and Secondary lymphoid organs, T & B cell maturation and its activation, Characteristics and types of Antigens, Haptens, adjuvants and Epitopes, Antibodies: Structure, functions and characteristics of different classes of antibodies. Monoclonal antibodies.	08
IV	ANTIGEN ANTIBODY INTERACTIONS: Antigen and antibody interactions, precipitation reactions, Serological techniques: ELISA, RIA and western blotting, Structure and Function of MHC molecules, Exogenous and Endogenous pathways of antigen processing and presentation, Overview of Complement system and cytokines, immune tolerance.	08
V	IMMUNITY AND INFECTIOUS DISEASES: Immunity against: Bacterial disease- tuberculosis, typhoid, Protozoan disease- Malaria, Amoebiasis and Viral diseases. AIDS, Dengue, Chikungunya, Vaccine's, Hypersensitivity and Immunotherapy related threats, firewalls	08
Text books: 1. Microbiology by Pelczar (W C Brown publication) 2. Genral Microbiology by stainer (Mac Millan Publication) 3. Microbiology by Pawar and Dagniwala (Himalaya publishing House). 4. . Immunology and immunotechnology by Ashim K, Chakravarty (Oxford university Press) 5. Immunology by C. Fatima 3. Immunology by Kuby (Free man publication)		

BBI 303
COMPUTATIONAL BIOLOGY

Course Outcome (CO)	Bloom's Knowledge Level (KL)
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At the end of course, the student will be able to

CO 1	Recall the historical contributions, scope, and basic tools (NCBI, file formats) used in bioinformatics.	K1
CO 2	Understand the structure and purpose of various biological databases and describe their applications in biological research.	K2
CO 3	Apply methods of sequence alignment using scoring matrices and interpret results from multiple sequence alignment tools.	K3
CO 4	Analyze predictive methods like gene/protein prediction, molecular visualization, and phylogenetic analysis.	K4
CO5	Explain and analyze the stages of the drug discovery pipeline including target identification, lead optimization, and chemical libraries.	K4

DETAILED SYLLABUS

2-1-0

Unit	Topic	Proposed Lecture
I	HISTORY, SCOPE AND IMPORTANCE -aims and tasks of Bioinformatics-applications of Bioinformatics - challenges and opportunities - introduction to NCBI data model- Various file formats for biological sequences	08
II	DATABASES - TOOLS AND THEIR USES: Importance of databases - Biological databases-primary sequence databases- Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases - bibliographic databases	08
III	SEQUENCE ALIGNMENT METHODS: Sequence analysis of biological data-Significance of sequence alignment- pairwise sequence alignment methods-Use of scoring matrices and gap penalties in sequence alignments- multiple sequence alignment methods - Tools and application of multiple sequence alignment.	08
IV	PREDICTIVE METHODS USING DNA AND PROTEIN SEQUENCES: Gene predictions strategies - protein prediction strategies - molecular visualization tools phylogenetic analysis: Concept of trees- phylogenetic trees and multiple alignments	08
V	DRUG DISCOVERY PROCESS: Discovering a drug-target identification and validation-identifying the lead compound- optimization of lead compound-chemical libraries.	08

Text Book (s)

1. S.C. Rastogi & others, "Bioinformatics- Concepts, Skills, and Applications", CBS Publishing, 2003.
2. Andreas D Baxevanis & BF Francis, "Bioinformatics- A practical guide to analysis of Genes & Proteins", John Wiley, 2000.
3. TK Attwood, DJ Parry-Smith, "Introduction to Bioinformatics", Pearson Education, 1st Edition, 11th Reprint 2005.
4. CSV Murthy, "Bioinformatics", Himalaya Publishing House, 1st Edition 2003
5. David W. Mount "Bioinformatics sequence and genome analysis, Cold spring harbor laboratory press, 2004.
6. S. Ignacimuthu, S.J., "Basic Bioinformatics", Narosa Publishing House, 1995.

BBI 351
BASIC BIOCHEMISTRY LAB

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Recall different carbohydrate tests and their principle.	K1
CO 2	Apply Lowry/Biuret method to determine protein concentration.	K3
CO 3	Analyze separation of amino acids/sugars based on Rf values, estimate concentration of biomolecules	K4
CO 4	Understand principle of Benedict's/Fehling's test and interpret results.	K2
CO 5	Explain the iodine-starch complex formation and interpret the observed color change.	K4

DETAILED SYLLABUS

LIST OF EXPERIMENTS

1. Qualitative test of Carbohydrates
2. Qualitative test of protein and amino-acids
3. Quantitative Estimation of proteins
4. Quantitative Estimation of glucose
5. Paper chromatography
6. To distinguish reducing sugar from non-reducing sugar
7. To distinguish pentose from hexose
8. To distinguish ketose from aldose
9. To determine the presence of starch by iodine test
10. To determine the presence of sucrose by acid base hydrolysis

Note: The instructor may add/delete/modify/tune experiments; (*2 can be demonstration)

BBI 352**APPLIED MICROBIOLOGY AND IMMUNOLOGY LAB**

Course Outcome (CO)	Bloom's Knowledge Level (KL)
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At the end of course, the student will be able to

CO 1	Understand the concept of Sterilization techniques,	K3
CO 2	Understand the concept and learn to do Media preparation, Staining Techniques (Simple, Gram staining), Blood grouping	K3
CO 3	Apply knowledge and technique for isolation of pure microbial cultures,	K4
CO 4	Apply knowledge and technique to perform Immunodiffusion, Immuno electrophoresis,	K4
CO 5	Learn the principal of antigen antibody interaction and ELISA,	K3

DETAILED SYLLABUS**LIST OF EXPERIMENTS**

1. Sterilization techniques
2. Media preparation
3. Microscopy and Micrometry
4. Serial dilution, Isolation of microbes, Pure culture techniques: streaking and spreading methods
5. Staining Techniques (Simple, Gram staining)
6. Inoculation of agar slants, agar plate and nutrient broth
7. Immunodiffusion
8. Immuno electrophoresis
9. Plate ELISA
10. Blood grouping

Note: The instructor may add/delete/modify/tune experiments; (*2 can be demonstration)

BBI 353
COMPUTATIONAL BIOLOGY LAB

Course Outcome (CO)	Bloom's Knowledge Level (KL)
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At the end of course, the student will be able to

CO 1	Identify and describe different types of biological databases and their purposes.	K1
CO 2	Retrieve sequences from databases and perform similarity searches for nucleotide and protein data, study GenBank flat file	K3
CO 3	Analyze protein properties and identify homologous sequences to infer functional/evolutionary relationships.	K4
CO 4	Perform multiple sequence alignment and apply dynamic programming methods for sequence comparison.	K4
CO 5	Evaluate and implement gene prediction methods to identify coding regions in genomic sequences.	K5

DETAILED SYLLABUS

LIST OF EXPERIMENTS

1. Knowledge of different biological database
 - Protein and gene sequence databases (NCBI, DDBJ, EMBL, SWISS PROT, PIR)
 - Structured at a bases (MMDB, PDB, CATH, SCOP)
 - Pathway Databases (KEGG, BRENDA, METACYC)
 - Bibliographic database (PUBMED, MEDLINE)
2. Sequence retrieval from biological database
3. To retrieve nucleotide sequences from GenBank in flat file format.
4. To identify and analyze various fields (LOCUS, DEFINITION, ACCESSION, FEATURES, ORIGIN) in a GenBank flat file.
5. Retrieve a protein structure (PDB file) from the Protein Data Bank (PDB) and visualize it using PyMOL, Chimera, or Jmol.
6. Identify alpha-helices, beta-sheets, and active sites.
7. Sequence similarity searching of nucleotide and protein sequences
8. Finding homologous sequences
9. Multiples Sequence alignment
10. Dynamic programming method-local and global alignment
11. Gene prediction methods

Note: The instructor may add/delete/modify/tune experiments

B. TECH (BIOINFORMATICS)
FOURTH SEMESTER (DETAILED SYLLABUS)

BBI 401		
PRINCIPLES OF MOLECULAR GENETICS		
Course outcome		Bloom's Knowledge Level (KL)
At the end of this course student will be able to		
CO1	Understand the fundamental Structure of DNA	K2
CO2	Discuss the process of DNA replication & different repair mechanisms.	K2
CO3	Discuss the process of Gene expression and its regulation, DNA repair and Comprehend mutation and its causes	K3
CO4	Understand the basis of inheritance and chromosome organization	K2
CO5	Discuss linkage and crossing over mechanism of chromosome	K3
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	STRUCTURE OF NUCLEIC ACID :Structure of DNA - Different forms of DNA and RNA – Identification of DNA as genetic material by Griffith–Avery, McLeod and McCarty-Frankel and Singer- Hershey and ChaseMesselson and Stahl experiment.	08
II	DNA REPLICATION AND MUTATION : Semi-Conservative replication - replication of DNA in Eukaryotes - molecular basis of Mutation- classification of mutation, DNA Repair mechanism	08
III	GENE EXPRESSION AND REGULATION : Genetic code – transcription- prokaryotes and Eukaryotes- Post transcriptional modification - Translation in prokaryotes and Eukaryotes - Post translational modification-Gene Regulation- Lac operon model	08
IV	MENDELIAN GENETICS – monohybrid – dihybrid inheritance- multiple alleles- structure and organization of chromosome in prokaryote and Eukaryotes.	08
V	CROSSING OVER AND LINKAGE : Linkage –types of linkage-crossing over and their types Recombination mapping by two point and three point text cross mapping in bacteria.	08
Text books:		
1. Genetics a conceptual approach, 2nd Edition Benjamin A. Pierc WH freeman and, company, New York		
2. Advance Genetics by G.S. Miglani, Narosa Publishing House.		
3. Albert B, Bray Denis et al.: Molecular Biology of The Cell, latest ed.		
4. Watson, Hopkins, Roberts et al. Molecular Biology of the Gene, 4 th ed.		
5. Genetics-Strickberger, 2nd.		
6. Baltimore-Molecular Biology of the Cell		

BBI 402 DATABASE SYSTEMS AND BIOINFORMATICS		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Explain the basic concepts of database systems, architecture, and applications in computing.	K2
CO 2	Design conceptual models using the Entity-Relationship model and apply E-R to relational schema mapping.	K3
CO 3	Analyze relational model concepts, functional dependencies, and normalization techniques in database design.	K4
CO 4	Develop and execute SQL queries using various operations and constraints.	K2
CP 5	Understand the challenges and strategies of biological data integration in bioinformatics.	K3
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION: Database -System Applications- Purpose of Database Systems, View of Data, Database Languages, introduction to Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators, History of Database Systems.	08
II	DATABASE DESIGN AND THE E-R MODEL : Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity- Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data, Other Aspects of Database Design.	08
III	RELATIONAL MODEL AND ITS DESIGN TECHNIQUE: Introduction to the Relational model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations. Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database- Design Process, Modeling Temporal Data.	08
IV	STRUCTURED QUERY LANGUAGE: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.	08
V	BIOLOGICAL DATA BASE MANAGEMENT: Introduction to Biological Data Integration - specifications. - Challenges Faced in the Integration of Biological Information: - Nature of Biological data,- Data sources in Life Sciences, - Challenges in information integration-. Data management in Bioinformatics, Dimensions -Describing the Space of Integration Solutions.	08
Text books: 1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management System", McGrawHill, 3rd Edition, 2003 2. Elmasri & Navathe, "Fundamentals of Database System", Addison-Wesley Publishing, 3rd Edition, 2000 3. Date C.J., "An Introduction to Database", Addison-Wesley Pub Co, 7th Edition, 2001 4. Jeffrey D. Ullman, Jennifer Widom, "A First Course in Database System", Prentice Hall, AWL 1st Edition, 2001 5. Peter Rob, Carlos Coronel, "Database Systems- Design, Implementation, and Management", 4th Edition, Thomson Learning, 2001. 6. Zoe Lacroix, Terence Critchlow, "Bioinformatics: Managing Scientific Data", Morgan Kaufmann Publishers (Elsevier Science), 2003		

BBI 403
PROGRAMMING IN C&C++

Course Outcome (CO)	Bloom's Knowledge Level (KL)
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At the end of course, the student will be able to understand

CO 1	Students recall syntax and basic concepts, understand flow control, and apply them to construct simple C programs.	K1, K2 , K3
CO 2	Students understand memory and array handling, apply function calls, and analyze program structure and modularity.	K2, K3, K4,
CO 3	Students apply object-oriented principles, analyze class hierarchies, and evaluate the design for encapsulation and inheritance.	K2, K3, K4, K5
CO 4	Students apply advanced C++ constructs, analyze execution flow, and evaluate performance and reusability	K3, K4, K5
CO 5	Students apply programming to biological data, analyze sequence patterns, and create tools for computational biology.	K3, K4, K5

DETAILED SYLLABUS

2-1-0

Unit	Topic	Proposed Lecture
I	INTRODUCTION TO C PROGRAMMING–I: Program structure, Algorithm/Pseudocode, Flowcharts, data types, variables, operators, keywords, data modifiers types, storage classes; Input/Output functions. Decision making statements: if/else, switch/case statements; Loop control statements -for, while, do/while.	08
II	INTRODUCTION TO C PROGRAMMING–II: Single and multi-dimensional Array operations –matrix operation, push, pop etc. Function handling- scope of variables, call by value and call by reference, function over writing and overloading. Data Structures	08
III	OOP CONCEPTS AND C++-I: classes and objects, data hiding, constructor and destructor, Inheritance: single, multiple, multilevel. Overloading-Function, overloading, Operator over loading. Polymorphism, Abstraction, Encapsulation, interfaces and multi threading	08
IV	C++-II : Files and streams, Data structures. Exception handling, Dynamic memory, Namespaces, Templates, Preprocessor, signal handling, multithreading and web programming.	08
V	APPLICATION IN BIOINFORMATICS : Program development for DNA/Protein sequence analysis. Dynamic programming. Sequence retrieval from databases, Motif finding in sequences. Phylogentic Tree traversal and other tool development applications.	08

Text books:

1. Balagurusamy. “*Object Oriented Programming With C Plus Plus*”, Tata McGraw-Hill Education, 2008.
2. Bjarne Stroustrup, “*The C++ Programming Language*”, Third Edition, Imprint of Addison Wesley Longman, Inc., 2003.
3. Scott Meyers, “*Effective C++*”, Third edition, Addison Wesley Longman, 2005.
4. Brian W. Kernighan, Dennis M. Ritchie, “*The C Programming Language*”, second edition, Prentice hall, 1988.

BBI 451
BASIC MOLECULAR GENETICS LAB

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Remember principles of DNA structure, sources (plasmid, plant, bacterial) and isolation basics.	K3
CO 2	Explain the principles of electrophoresis, PCR, and spectrophotometry in DNA analysis.	K3
CO 3	Perform DNA isolation, amplification, and quantification using standard protocols.	K4
CO 4	Interpret agarose gel patterns and PCR products,	K4
CO 5	Applying knowledge of absorbance to quantify DNA concentration.	K3

DETAILED SYLLABUS

LIST OF EXPERIMENTS

1. Preparation of buffers
2. Preparation of different concentration of Agarose gel
3. Horizontal Agarose gel electrophoresis
4. Isolation of Plant genome
5. Isolation of Bacterial genome
6. Isolation of Plasmid DNA
7. PCR amplification of DNA and visualization by gel electrophoresis
8. Estimation of DNA by spectrophotometric method
9. Estimation of T_m of duplex DNA strand using UV-Spectrophotometer
10. Demonstration of DNA Sequencing

Note: The instructor may add/delete/modify/tune experiments; (* two can be demonstration)

BBI 452**DATABASE SYSTEMS AND BIOINFORMATICS LAB**

Course Outcome (CO)	Bloom's Knowledge Level (KL)
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At the end of course, the student will be able to

CO 1	Understand, Analyse and solve Simple Queries; Multiple Sub-queries	K3 ,K4
CO 2	Understand and implement Built-in Functions	K2, K3
CO 3	Understand and implement Group Functions	K2, K3
CO 4	Understand and implement SQL Views & Triggers; PL/SQL (or MySQL) Procedures accessing Databases	K3, K4
CO 5	Apply the understanding of database management system in doing real life data analysis and management as miniproject	K4,K5

DETAILED SYLLABUS**LIST OF EXPERIMENTS**

1. Simple Queries
2. Built-in-functions
3. Group Functions
4. Multiple sub-queries
5. SQL Views & Triggers
6. Simple PL/SQL (or My SQL)Procedures
7. PL/SQL Procedures (or My SQL) accessing Databases
8. Mini Project

Note: The instructor may add/delete/modify/tune experiments

BBI 453**PROGRAMMING IN C & C++ LAB**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Students recall the syntax of conditional statements, understand the control flow (if, else, switch), and apply them in writing decision-based programs .	K1, K2, K3
CO 2	Learners understand DNA sequence structure , apply string manipulation and loops to count bases , and analyze input sequences to distinguish nucleotide types .	K2, K3, K4
CO 3	Students apply logic for sequence comparison and analyze similarities, mismatches, and alignment scoring for biological interpretation .	K3, K4
CO 4	Students understand the purpose and scope of functions , and apply modular programming by defining and calling user-defined functions.	K2,K3
CO 5	Students understand object-oriented programming basics like classes and objects, and apply them to write simple C++ programs, operator overloading and functional overloading	K2, K3
DETAILED SYLLABUS		
LIST OF EXPERIMENTS		
1. Programs using conditional statements 2. Programs to count total nucleotide count of DNA 3. Alignment of two sequences 4. Programs to implement functions 5. Programs to illustrate recursion 6. Program to create classes and objects using C++ 7. Programs to implement C on structor and Destructor in C++ 8. Programs to implement single inheritance in C++ 9. Programs to implement Function overloading in C++ 10. Programs to implement Operator overloading in C++		
Note: The instructor may add/delete/modify/tune experiments		