

## National Institute of Technology , Raipur (C.G.)

Course of Study & Scheme of Examination													B. Tech. VI Semester		Branch:	Biotechnology
S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week			TA	Examination Scheme				Total Marks	Credits L+(T+P)/2			
				L	T	P		FE	SE	T.C.A.	ESE					
1	Biotechnology	BT 20611 BT	Bioinformatics	3	1	-	20	15	15	50	70	120	4			
2	Biotechnology	BT 20612 BT	Analytical Techniques in Biotechnology	3	1	-	20	15	15	50	70	120	4			
3	Biotechnology	BT 20613 BT	Management Science	3	1	-	20	15	15	50	70	120	4			
4	Information Technology	IT 20614 BT	Database Management System	3	1	-	20	15	15	50	70	120	4			
5	Mathematics	MA 20615 BT	Biostatistics & Probability	3	1	-	20	15	15	50	70	120	4			
6	Biotechnology	BT 20616 BT	Heat & Mass Transfer	4	1	-	20	15	15	50	70	120	5			
7	Biotechnology	BT 20621 BT	Bioinformatics Lab	-	-	3	30	-	-	30	20	50	2			
8	Biotechnology	BT 20622 BT	Analytical Techniques in Biotechnology Lab	-	-	3	30	-	-	30	20	50	2			
9	Biotechnology	BT 20623 BT	Heat & Mass Transfer Lab	-	-	3	30	-	-	30	20	50	2			
10	Humanities	EN 20624 BT	I. & E Skill	-	-	2	25	-	-	25	-	25	1			
11			Discipline	-	-	-	25	-	-	25	-	25	1			
<b>Total</b>				<b>19</b>	<b>6</b>	<b>11</b>	<b>260</b>	<b>90</b>	<b>90</b>	<b>440</b>	<b>480</b>	<b>920</b>	<b>33</b>			

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ultimately in the following format which will be included in the semester mark-sheets.

Format for attendance			
Attendance			Category
> 85		----->	High "H"
> 70 & < 85		----->	Medium "M"
> 60 & < 70		----->	Low "L"
< 60		----->	Detained " D "

Chairman (BOS)

Member (BOS)

Member (BOS)

**DEPARTMENT OF BIOTECHNOLOGY SYLLABUS**

<b>Name of the Subject</b>	<b>Analytical Techniques in Biotechnology</b>	<b>Subject Code</b>	<b>BT20612BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Biotechnology</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits L+P</b>
<b>03</b>	<b>01</b>	<b>03</b>	<b>4+2</b>

**Unit 1: Microscopy**

Introduction, principle and various mechanical parts, various types of microscopes (Light microscopy, Phase contrast, DIC, florescent microscope, Confocal microscopy, electron microscopy and AFM )

**Unit 2: Colorimetry and Spectrophotometry**

Basic principles, nature of electromagnetic radiations, Lamberts – Beer Law, single and double beam spectrophotometers, methods of biochemical analysis- carbohydrates, protein and lipid

**Unit 3: Centrifugation & Chromatography**

Centrifugation – principle and types, chromatography- Principle, methodology and applications (Paper, Thin Layer, Column, Gas chromatography), HPLC.

**Unit 4: Electrophoresis Techniques**

Principles, methodology and types, 1D & 2D Gels; Pulse- Field Gel Electrophoresis (PFGE); Capillary electrophoresis; Gradient gel electrophoresis; Western blotting; Southern blotting; Northern blotting.

**Unit 5: Genome Maps**

Molecular markers, Chromosome jumping, chromosome walking, FISH (Flourescence In Situ Hybridization), Microsatellite mapping, genetic mapping, restriction mapping, DNA fingerprinting and DNA sequencing methods.

**Name of Text books:**

1. Practical Biochemistry by Wilson and Walker
2. Genomes 3 by T. A. Brown
3. Biochemical calculation by Irwin H. Segal

**DEPARTMENT OF BIOTECHNOLOGY SYLLABUS**

<b>Name of the Subject</b>	<b>Bioinformatics</b>	<b>Subject Code</b>	<b>BT20611BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Biotechnology</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits L+P</b>
<b>03</b>	<b>01</b>	<b>03</b>	<b>4+2</b>

**Unit 1: Introduction and History**

Introduction to Bioinformatics: - History of Bioinformatics, Aim and Tasks of Bioinformatics, Applications of Bioinformatics, Sequences and nomenclature- DNA sequences, Amino acid sequences of proteins, Types of sequences of proteins, Types of sequences in nucleotide sequences database.

**Unit 2: Databases**

Databases and Search tool- Nucleic acid Database. Protein sequence Databases. Structural Databases. Importance and uses of Databases. Databanks. Applications of Databanks- FASTA, BLAST, PDB, Microbial and cellular Databanks. Hybridoma databanks. Genbank, cDNA bank.

**Unit 3: Sequence alignment**

Sequence Alignment- Local and Global alignment. Pair wise alignment of sequences- Dot matrix, Needleman Winch method, Smith Waterman method. Multiple sequence alignment- methods of multiple sequence alignment.

**Unit 4: Gene Identification**

Analysis using Bioinformatics tools- Detection of genes, identification of function of new genes, identification of function domains, detection of non coating RNA, genome annotation and molecular phylogenetics.

**Unit 5: Genome Mapping and Human Genome project**

Genome Mapping, Different type of maps, Human Genome project, Application of genome mapping, Chromosome maps.

**Text Books:**

1. S.Misener and S.A. Krawetz, “ Bioinformatics methods and protocols, Human press 2000.
2. H.Rauehler and L.K.Buehler, “ Bioinformatics Basics”, CRC Press, 2000.
3. Basic Bioinformatics S. Ignacimuthu, S.J, Narora publishing House, New Delhi.

**Reference Books:**

1. Bioinformatics computing by Bergeron and Bryan.

**National Institute of Technology, Raipur (C.G.)**

2. Bioinformatics: Sequence and genome analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.

**DEPARTMENT OF BIOTECHNOLOGY SYLLABUS**

<b>Name of the Subject</b>	<b>Biostatistics &amp; Probability</b>	<b>Subject Code</b>	<b>MA20615BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Mathematics</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits</b>
<b>03</b>	<b>01</b>	<b>00</b>	<b>04</b>

**Unit 1:-** Presentation of data frequency distribution, graphical presentation by histogram, frequency curve and cumulative frequency curves. Measure of location and dispersion—mean, median, mode and their simple properties (without derivation) and calculation of median by graphs, (Range, mean deviation, standard deviation, coefficient of variation).

**Unit 2:-** Probability and distribution, random distribution, definition of probability (single exercise), definition of binomial, poisson and normal distribution of their interrelations.

**Unit 3 - Co-relation and Regression:** Bivariate data (Single , correlation and regression coefficient, their relations), limits of correlation coefficient, effect of change of origin and scale on correlation coefficient.

**Unit 4 - Test of Significance:** Sampling distribution of mean and standard error, Large sample test (test for an assume mean and equality of two population means with known SD), small sample test (test for an assume mean and equality of means of two populations when sample observations are independent). T-test for comparison of variants of two populations, chi-square test for independence of attributes, goodness of fit & homogeneity of sample.

**Unit 5 - Experimental design :** Principles of experimental design, completely randomized block and latin square design, analysis of variants (ANOVA), its use in analysis of RBD.

**Name of Text Books:**

1. Statistical methods in biology by Norman T.J. Bailey (3<sup>rd</sup> edition), Combridge University Press (1995).
2. Biostatistical Analysis by Zar and H. Jerrold

## DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

<b>Name of the Subject</b>	<b>Database Management System</b>	<b>Subject Code</b>	<b>IT20614BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Information Technology</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits L+P</b>
<b>03</b>	<b>01</b>	<b>00</b>	<b>4</b>

### **Unit 1: Introduction to database**

Advantages of DBMS, Type of Data Models, Schema and instances, DBMS Architecture and Data Independence, Entity- Relationship Model, Attributes and Keys, Relationship Types, Weak Entity set, Strong Entity Set, Enhanced E-R Modeling, Specialization and Generalization.

### **Unit 2: Database Design**

Functional Dependencies and Normalization for Relational databases: Informal design guidelines for relation schemes, Functional dependencies, Normal forms based on primary keys, General Definitions of second and third normal forms, Boyce- Codd normal form, problem related with normal forms and solutions. Multivalued and Join dependencies, 4<sup>th</sup> and 5<sup>th</sup> Normalization.

### **Unit 3: The Relational Data model and SQL**

Relational data model concepts, constraints, relational algebra, relational calculus, Tuple relational calculus. SQL: DDL, DML, DCL, Types of constraints, Defining different constraints on a table, Defining and dropping integrity constraints in the alter table command, View, Index.

### **Unit 4: Query and Transaction Processing:**

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Query Processing: Query processing stages, Query interpretation, Query execution plan, Table scans, Fill Factor, Multiple index access, Methods for join tables scans, structure of a query optimizer.

### **Unit 5: Indexing Techniques and Concurrency Control**

Indexes, Multilevel indexes, Dynamics Multilevel indexes using B-trees and B+ Trees.  
Concurrency Control: Different type of concurrency control techniques and their comparative analysis, Locking techniques, Time- stamp ordering, Multi-version techniques, Optimistic techniques, Multiple granularity.

### **Name of Text books**

1. Database system concept, Korth and Sudarshan, MH
2. Principles of Database systems, Ullman, J.O., Galgotia Publications.
3. Introduction to Database Systems, C.J. Date, Pearson Education.
4. Fundamentals of Database systems, Emasri and Navathe, Pearson Education.

**DEPARTMENT OF BIOTECHNOLOGY SYLLABUS**

<b>Name of the Subject</b>	<b>Heat &amp; Mass Transfer</b>	<b>Subject Code</b>	<b>BT20616BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Biotechnology</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits L+ P</b>
<b>04</b>	<b>01</b>	<b>03</b>	<b>5+2</b>

**Unit 1: Introduction of Heat Transfer**

Introduction to various modes of heat transfer, Fourier's law of heat conduction, Effect of temperature on thermal conductivity, Steady and unsteady state conduction, Compound resistances in series, Heat flow through a cylinder, sphere, critical radius of insulation, Thermal diffusivity.

**Unit 2: Convective heat transfer**

Heat flux, Average temperature of fluid stream, Overall heat transfer coefficient, LMTD, Individual heat transfer coefficient, Relationship between individual and overall heat transfer coefficient, concept of heat transfer by convection, Natural and forced convection, Application of dimensional analysis for convection, Heat exchange equipments, Single pass, 1-1 double pipe exchanger, 1-2 parallel counter flow exchanger, Enthalpy balance in heat exchange equipments, Evaporation, Condensation.

**Unit 3: Introduction to mass transfer**

Molecular diffusion in fluids, Diffusivity, Mass transfer coefficients, Interphase mass transfer, Gas absorption, counter current multistage operation, Calculation of NTU, HTU and number of stages, HETP.

**Unit 4: Distillation**

Vapour liquid equilibrium, Rayleigh's equation, Flash distillation and differential distillation for two component mixture, McCabe-Thiele method, Bubble cap and sieve distillation column, Azeotropic and extractive distillation.

**Unit 5: Mass Transfer Processes**

Extraction, Drying and Crystallization, Liquid-liquid equilibrium, Liquid extraction, stage wise contact, liquid solid equilibria, Leaching, Batch drying, Principle and operation of a spray drier, Preliminary idea of crystallization.

**Name of Text Books**

1. Heat Transfer by K.A. Gavhane
2. Mass Transfer by Trebol
3. Heat and Mass transfer by McCabe Smith



DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

<b>Name of the Subject</b>	<b>Management Science</b>	<b>Subject Code</b>	<b>BT20613BT</b>
<b>Semester</b>	<b>6<sup>th</sup></b>	<b>Board of Studies</b>	<b>Biotechnology</b>
<b>Maximum Marks</b>	<b>70</b>	<b>Minimum Marks</b>	<b>25</b>
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits L+P</b>
<b>03</b>	<b>01</b>	<b>00</b>	<b>04</b>

**Unit 1- Basic Concept :** Small and large scale industries, public sector private sector and joint sector undertaking, Industrial Finance institutions.

**Unit 2 - Industrial administration:** Relationship and scientific management, nature of management, functions of managements, control, organizations and structure, out line of time and motion study and work study.

**Unit 3 – Industrial Management:** Management of production, plant locations Factory locations, production and cost control, personal management– job evaluations and wages payment plans, Factory act, minimum wages act, Trade union act, workman compensation acts.

**Unit 4 – Capital Management:** Factory involved in project cost estimation, methods employed for the estimation of the capital investments and cost estimation in chemical plants Depreciation and methods of its calculations, effects of taxes on depreciations.

**Unit 5 – Investment & Book Keeping:** Evaluation of profitability, return on investments, Studies on alternative investments, Replacement cost and asset accounting, Book keeping Factory records and Balance sheet.

**Name of Text Books:**

1. Peter & Timmerhauss-Plant Design & economics for Chemical Engineers
2. Tarachand-Engineering Economics
3. O P Kharbanda- Process Plant & Equipment Costing

**National Institute of Technology, Raipur (C.G.)**

**Subject : Analytical techniques in Biotechnology Lab**

**Subject Code : BT20622BT**

**End Semester Exam Marks : 20**

**List of Experiments :**

1. Microscopic analysis of biological specimen.
2. Chromatography techniques for biomolecule separation (TLC/column/Gas).
3. Separation of plant pigment by paper chromatography.
4. Separation of Amino acid by paper chromatography.
5. Principal of Electrophoresis.
6. Electrophoretic separation of biomolecules.
7. Working principal of Centrifuge.
8. Working principal of spectrophotometer/colorimeter.
9. Spectro-photometric analysis of carbohydrates and proteins.
10. NMR/ESR study

**List of Equipments/Machine Required:**

1. As mentioned in other labs.

**Recommended Books:**

1. Practical Biochemistry by Wilson and Walker
2. Refer books mentioned in theory syllabus Chhattisgarh Swami Vivekanand Technical University.

**National Institute of Technology, Raipur (C.G.)**

**Subject: Bio-Informatics Lab**

**Subject Code: BT20621BT**

**End Semester Exam Marks: 20**

**List of Experiments :**

1. Pairwise Alignment of nucleotide sequences using BLAST software.
2. Pairwise Alignment of nucleotide sequences using FASTA software.
3. Pairwise Alignment of protein sequences using BLAST software.
4. Pairwise Alignment of protein sequences using FASTA software.
5. Multiple sequence alignment of nucleotide sequences using CLUSTALW software.
6. Multiple sequence alignment of protein sequences using CLUSTALW software.
7. Multiple sequence alignment of nucleotide sequences using T-Coffee software.
8. Multiple sequence alignment of protein sequences using T-Coffee software.
9. Phylogenetic prediction of nucleotide sequences using WORKBENCH software.
10. Phylogenetic prediction of protein sequences using WORKBENCH software.
11. Identification of functional domains using Interproscan software.
12. Identification of gene using GENSCAN.
13. Identification of 3D-structures of proteins using Geno3D software.

**List of Equipments/Machine Required:**

1. Computers for analyzing datas using various softwares (P-4 computers with 256 MB RAM)