Scheme

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
SCHEME OF STUDIES & EXAMINATIONS
M. Tech. 1st YEAR (SEMESTER – II) (BIOTECHNOLOGY)
Credit Based Scheme w.e.f. 2012-13

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	P	Total		Theory	Practical			
1	BT502B	ENZYMOLOGY AND ENZYME TECHNOLOGY-II	4	-	4	25	75	-	100	4	3
2	BT504B	GENOMICS AND PROTEOMICS-II	4	-	4	25	75	-	100	4	3
3	BT506B	BIOTECHNOLOGY IN HEALTHCARE	4	-	4	25	75	-	100	4	3
4	BT508B	BIOINFORMATICS- II	3	-	3	25	75	-	100	3	3
5	BT	ELECTIVE-II, BT522B: BIONANOTECHNOLOGY	3	-	3	25	75	-	100	3	3
6	BT510B	ENZYMOLOGY AND ENZYME TECHNOLOGY- II LAB	-	4	4	20	-	30	50	2	3
7	BT512B	BIOTECHNOLOGY IN HEALTHCARE LAB	-	4	4	20	-	30	50	2	3
8	BT514B	BIOINFORMATICS- II LAB	-	2	2	20	-	30	50	1	3
TOTAL			**18**	**10**	**28**	**185**	**375**	**90**	**650**	**23**	

ELECTIVE - II:

1. **BT522B: BIONANOTECHNOLOGY**
2. BT524B: FOOD MICROBIOLOGY
3. BT526B: BIODIVERSITY AND BIORESOURCE TECHNOLOGY

NOTE:

1. **The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.**
2. **Electronic gadgets including cellular phones are not allowed in the examination.**
3. **The choice of students for any elective shall not be a binding on the department.**

BT502B: ENZYMOLOGY AND ENZYME TECHNOLOGY- II

L	T	P	Credits	Sessional Marks: 25
4	-	-	04	Theory Marks: 75
				Duration of Exams: 3 Hours

OBJECTIVES:
The objectives of the course are to:

1. Provide a deeper insight into the fundamentals of enzyme structure and function.
2. Study Isoenzyme and its importance.
3. Describe various methods for Measurement of enzyme activity
4. Discuss Mechanisms of enzyme-catalyzed reaction.
5. Develop deep understanding of enzyme immobilization and enzyme reactors.
6. Understand the different methods of isolation, production and purification of enzyme.
7. Study Kinetics of enzyme catalyzed reactions.
8. Estimate kinetic parameters i.e. km, Vmax, K cat etc
9. Provide a deeper insight into the enzyme inhibition, its type and estimation of Ki and bisubstrate reactions.
10. Deals with current applications and future potential of enzymes.

OUTCOME: Upon successful completion of this course, the students will have sufficient scientific understanding of the enzymology and enzyme technology and they will be able to:

1. learn about the structure of enzymes, apoenzymes, prosthetic group, cofactors and the mechanisms of action of enzymes.
2. Understand the concept of isoenzyme and its importance.
3. Know the various methods for Measurement of enzyme activity and factors affecting enzyme activity.
4. Utilize the concepts of immobilization to improve the stability, specificity of the core enzymes.
5. Study about the production methods of enzymes and its purification techniques.
6. Study about the kinetics of single and multiple substrate reactions and analyze simple kinetic data, estimate important parameters K m, Vmax, K cat etc. and also understand the significant of kinetic constant.
7. Apply appropriate methods for determination of catalytic parameters and activity of enzymes.
8. Understand the different inhibition types and their effect on enzyme reaction rate.
9. Analyze options for applying enzymes in medicine and various industries for the production of sustainable and high value added products utilizing enzymes as biocatalysts and microbes as efficient producers, in order to meet various human needs.

BOOKS:

1. Nature of Enzymology By RL Foster (1979)
2. A textbook of enzyme biotechnology By Alan Wiseman (1995)
3. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry By Trevor Palmer (2008)
4. Enzymes: By M Dixon and EC Webb. EC Longmans, London (1979)
5. Lehninger Principles of Biochemistry 6th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company (2012)
6. Biochemistry: Biomolecules, Mechanisms of Enzyme Action and Metabolism Vol 1 3rd Ed By D Voet. John Wiley and Sons (2004)
7. Advances in Enzymology: V. 75 By Alton Meister. John Wiley and Sons Inc (2010)

LECTUREWISE PROGRAMME: (from 08.01.2018 to 27.04.2018)

Introduction of subject	1
Unit-I (09.01.18 to 25.01.18)	2
Introduction to Enzymes: History, nomenclature and classification of enzymes	
Isoenzymes	1
Enzyme specificity	2
Monomeric and oligomeric enzymes, multienzyme complex	1
Holoenzyme, apoenzyme, units of enzyme activity, specific activity of enzyme	1
Measurement of enzyme activity, enzyme turnover	1
Ribozymes and abzymes- a brief account	2
Unit-II (26.01.18 to 13.02.18)	1
Enzyme catalysis: Role of enzymes in energy of activation, factors affecting action of enzymes-proximity and orientation, strain and distortion Acid base catalysis and covalent catalysis, determination of active site, mechanism of action of chymotrypsin, ribonuclease, carboxypeptidase and lysozyme.	2
Strategies for Enzyme Production, Isolation and Purification: method of calculating the purification fold, estimation of enzyme activity, characterization of an enzyme, criteria of enzyme purity,	2
Determination of molecular weight and number of sub units of enzyme	1
Enzyme immobilization, protein engineering	2
Enzyme reactors	1
Unit-III (14.02.18 to 21.03.18))	5
Enzyme Kinetics: Enzyme kinetics and its importance, methods used for investigating the kinetics of enzyme catalyzed reactions, factors affecting the velocity of enzyme catalysed reaction, Michaelis-Menten equation, Vmax, Km and its significance, Lineweaver Burk plot- its advantages and limitations, Eadie-Hofstee and Hanes plots,Enzyme inhibition, types of enzyme inhibitions- competitive, uncompetitive	1
Noncompetitive, mixed type inhibition	2
Determination of Ki, feedback inhibition,	2
Bisubstrate reactions- brief introduction to sequential and ping -pong mechanism with examples.	2
Unit-IV (22.03.18 to 27.04.18)	
Applications of Enzymes and Immobilized Enzymes in: medicine, textile, leather,	3
detergent,paper,	2
bakery	1
Dairy industry, beverage and fruit processing,	1
Food processing and preservation	1
Clinical applications of enzyme estimation	1
Enzymes as biosensors.	1

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Home Assignments: 4 –5 assignments are given during the semester.

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

BT504B GENOMICS AND PROTEOMICS- II

M. Tech. Semester - II (Biotechnology)

L	P	Credits			
4	--	4	**Class Work**	**:**	**25 Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives:

1. To review the basic organization and arrangement of prokaryotic and eukaryotic genomes.
2. To study the significance of genome mapping using genetic and physical techniques.
3. To study the basic principle and different techniques for whole-genome sequencing.
4. To understand the various *in-silico* and experimental techniques used for structural and functional annotation of genomes.
5. To develop an understanding of transcriptome analysis.
6. To study protein profiling techniques.
7. To develop an understanding of the protein identification and characterization studies.
8. To understand metabolomics and systems biology by studying protein-protein interactions.
9. To study pharmacogenomics, and to analyze the applications of genomics and proteomics in human healthcare.
10. To study comparative genomics and to analyze the applications of genomics & proteomics in the field of agriculture.

Course Outcomes:

1. Students will get an overall concept of prokaryotic and eukaryotic genomes.
2. Students will get a clear-cut understanding of how complete genomes are mapped & sequenced.
3. Students will understand the significance and means of structural and functional annotation of genomes.
4. Students will develop an in-depth understanding of transcriptomics and proteomics.
5. Students will understand how the study of genomics and proteomics help us in designing a better healthcare and agriculture system.

TEXT / REFERENCE BOOKS:

1. Brown TA, Genomes, 3rd Edition. Garland Science Pub (2006).
2. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Pearson Education (2007).
3. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell (2006).
4. Sensen CW, Handbook of Genome Research, Vol. I and II. Wiley CVH. (2005).
5. Daniel C. Liebler, Introduction to Proteomics. *Humana Press*.
6. Twyman RM, Principle of Proteomics. *BIOS Scientific Publishers.* (2004).
7. Kamp RM, Methods in Proteome and Proteome Analysis. Springer. (2004).
8. Jolles P and Jornvall H, Proteomics in Functional Genomics: Protein Structure Analysis. Birkhauser (2000).

Lecture-wise Schedule (08.01.2018 to 27.01.2018):

Introduction of the subject (08.01.18)	1
UNIT- I (09.01.18 to 02.02.18)	
Genome Organization and Mapping	
Structural organization of prokaryotic, eukaryotic and organellar genomes	2
Gene distribution and arrangement in prokaryotes and eukaryotes	2
Genetic mapping: molecular markers for construction of maps	3
Physical mapping: restriction mapping, FISH, STS mapping	3
UNIT- II (05.02.2018 to 28.02.2018)	
Genome Sequencing, Analysis and Annotation	

Sequencing principles and techniques	3
Whole genome sequencing: shotgun sequencing, clone-contig assembly	3
Structural annotation of genomes	3
Determination of functions of individual genes	3
Transcriptome Analysis	2
UNIT – III (01.03.18 to 30.03.18)	
Protein Expression Analysis	
Protein profiling techniques	2
Protein Identification studies	2
Protein characterization techniques	3
Protein-protein interaction studies	2
Analysis of protein complexes	2
Introduction to metabolomics and systems biology	2
UNIT – IV (02.04.18 to 27.04.18)	
Applications of Genomics and Proteomics	
In research	1
In human healthcare	2
In agriculture	2
Pharmacogenomics	2
High throughput screening for gene target and drug discovery	2
Comparative genomics	1

Home Assignments: 2-3 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

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Attendance Record – Candidate should attend at least75% of the total classes held in the subject

Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

BT506B BIOTECHNOLOGY IN HEALTHCARE

M. Tech. Semester - II (Biotechnology)

L	P	Credits			
4	--	4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Objectives

1. To study the disease burden of infectious microbial agents
2. To review the mechanism of microbial disease causation
3. To perform a detailed theoretical survey of medically important diseases caused by bacteria , viruses , fungi and parasites
4. To study clinically important microbial diseases like AIDs, tuberculosis, cancer etc
5. To study the basic immune response against microbial infections
6. To examine the immunology of cancer, transplantation
7. To study the therapeutic measures like antisense therapy, vaccine, Gene therapy etc
8. To survey the recent developments in genomics and pharmaceutical sciences

Outcomes

1. Students will develop an overall insight into the biology of infectious diseases
2. The students will be able identify the clinical significance of diseases like cancer and AIDs
3. They will be able to analyse the various immune mechanisms involved in disease prevention
4. able to design and execute specific therapeutic measures against various infectious agents
5. Educate the students regarding latest developments in genomics and pharmaceutical sciences and use it for benefit of mankind

Lecture wise schedule: (8.01.18-27.04.18)

Unit I (8.01.18-16.01.18) Total no. of lectures: 6

Biology of Infectious diseases: Disease Burden- medically important diseases caused by bacteria, viruses, fungi and parasites

Unit I (17.01.18-31.01.18) Total no. of lectures: 6

studies of some representative diseases like AIDS, typhoid, tuberculosis,cancer, hepatitis, influenza and dermatophytic diseases.

UNIT II (1.02.18-13.02.2018) Total no. of lectures: 7

Immune system and Immune Response: Immune system- overview, humoral and cell mediated immune responses, antigen & antibodies structure & function transplantation, hypersensitivity, cancer, & autoimmunity.

UNIT II (14.02.18-2.03.18) Total no. of lectures:

transplantation, hypersensitivity, cancer, & autoimmunity.

UNIT-III: (5.03.18-16.03.18) Total no. of lectures: 8

Therapeutics: Oligonucleotides- gene therapy, antisense therapy, ribozyme, oligosaccharides- glycoproteins, polysaccharides, bacterial vaccines, carbohydrate- based cancer vaccines.

UNIT-III: (19.03.18-30.03.18) Total no. of lectures: 5

Oligopeptides- endogeneous peptides and proteins with modifications. radiological agents- radiosensitizers and radioprotective agents, Drug targeting- basic concepts & novel advances

UNIT-IV: (2.04.18-13.04.18) Total no. of lectures: 5

Recent developments in genomics and pharmaceutical sciences: Sequencing of human genome, brief account of repetitive sequences present in human genome, human genome project, latest developments in human genetics.

UNIT-IV: (16.04.18-27.04.18) Total no. of lectures: 5

Chemotherapeutic agents- synthetic antibacterial agents, antifungal, anti- protozoal, antiviral agents, endocrine drugs- sex hormones and analogs, agents affecting the immune response, cardiovascular drugs- hematopoietic agents, anticoagulants, antithrombotics etc.,

TEXT / REFERENCE BOOKS:

1. Christine M. and Bladon John Pharmaceutical Chemistry. Wiley & Sons, Ltd. (2002).
2. Manfred E.,Wolff. Burger's Medicinal Chemistry and Drug Discovery (5^{th} edition). A Wiley Sons, Inc. (2000).
3. Gritje Molema and Dirk K. F. Meijer. Drug Targeting Organ-Specific Strategies. Wiley (2002).
4. Ananthanarayanan R. and Jayaram C.K. Panuker Textbook of Microbiology R, Drient Longman.
5. Immunology by kuby JWH Freeman and company, New York.
6. Jawetz. Review of Medical Microbiology.
7. Specific Journals and published references.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

EVALUATION PROCEDURE

1.	Surprise quiz/ tutorial test	5 marks
2.	Assignment/ class presentation	5 marks
3.	Minor test I Minor test II	15 marks (Total)
4.	Major Test (University examination)	75 marks

Award of grades will be according to university rules and regulations.

M. TECH. SEMESTER – II (BIOTECHNOLOGY) 2017-18 Even Semester

BT508B: Bioinformatics-II

L	T	P	Credits
4	-	-	4

Class Work Marks : 25 **Exam Marks : 75**

Total Marks : 100 **Duration of Exam : 3 Hrs.**

COURSE OBJECTIVES:

1. To understand the Bioinformatics in sequence analysis.

2. Awareness of bioinformatics in Biotechnology Research.

3. Awareness about the Bioinformatics in Taxonomy.

4. Tools related to Bionformatics analysis.

5. Computational methods.

OUTCOME:

1. Able to understand the concept and utility of Bioinformatics in Biotechnology.

2. Able to understand the basics and use of softtware use of bioinformatics.

3. Able to comprehend and develop the scientific temper related to the biotechnology in bioinformatics.

4. Discussion of the phylogenetic analysis and taxonomy of organisms. Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

BOOKS:

1. Pennington SR, Dunn MJ, Proteomics from Protein Sequence to Function , Viva Books Ltd, 2002
2. David W Mount, Bioinformatics: Sequen
3. Leach A.R. , Molecular Modelling - Principles and Applications , 2nd Edition, Prentice Hall, 2001.
4. Prasad R.K., Quantum Chemistry , Halsted Press, 1992.
5. Ramachandran K. I., Deepa G., Namboori K., Computational Chemistry and Molecular Modeling: Principles and Applications , Springer, 2008.
6. Young, D.C., Computational Chemistry: A Practical Guide for Applying Techniques to Real-World Problems , Wiley-Interscience, 2001.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction to bioinformatics (08.01.18) 1

UNIT- I Sequence Analysis

09.01.18 to 20.01.18

Sequence Analysis: File formats for bio-molecular sequences- GenBank, FASTA, GCG, MSF etc., 1

sequence similarity, identity and homology, homologues, orthologues, paralogues and xenologues 2

Scoring Matrices and Database searches: Matrices for nucleic acid and protein sequences, PAM and BLOSUM series; 2

23.01.18 to 31.01.18

Keyword-based Entrez and SRS, sequence-based- BLAST & FASTA, their use in sequence analysis,	2
on-line use of these tools and interpretation of results from various sequences.	2

UNIT- II, Taxonomy and Phylogeny

02.02.18 to 23.02.18

Introduction, Basic concepts in systematic,	1
taxonomy and phylogeny, molecular evolution, nature of data used in taxonomy and phylogeny,	2
phylogenetic trees- various types and their construction, mathematical basis for phylogenetics, genetic algorithms, multiple alignment.	2
Pairwise and Multiple Sequence Alignments: Needleman and Wunsch, Smith and Waterman algorithms, gap penalties	2
use of pairwise alignments for analysis of nucleic acid and protein sequences; various approaches for MSA (progressive, hierarchical etc.), CLUSTALW and PileUp algorithm, their application in sequence analysis,	2
dendrograms. Sequence Patterns and Profiles: Sequence patterns, motifs and profiles, pattern representations viz. consensus, regular expression (Prosite-type) and sequence profiles	2
profile-based database searches using PSI-BLAST, analysis and interpretation of profile-based searches.	1

UNIT – III Taxonomy and Phylogeny:

26.02.18 to 14.03.18

Introduction	1
Phylogenetic Analysis building the data model,	2
Extraction of a phylogenetic data set, tree building methods	2

16.03.18 to 26.03.18

Distance methods, character based method, phylogenetic software- gene prediction methods,	2
Genome analysis and annotation,	1
large scale genome analysis and computational tools.	2

UNIT – IV, Protein and nucleic acid properties: Drug Designing

27.03.18 to 17.04.18 (Protein and nucleic acid properties)

Protein and nucleic acid properties: Computation of parameters using proteomic tools at the ExPASy server,	2

GCG utilities and EMBOSS; secondary structure prediction- algorithms viz. Chou Fasman, GOR methods,	2
Mathew s correlation coefficient; tertiary structure prediction- methods for 3D structure prediction (sequence similarity/ identity of target proteins, protein folding etc.),	2
homology modeling, fold recognition, threading approaches, ab-initio structure prediction methods.	2
Drug designing (18.04.18 to 27.04.18)	
Fundamentals of docking small and macromolecules to proteins and nucleic acids,	1
Bioinformatics in drug designing- drug discovery cycle, physicochemical principles of drug action,	2
lead discovery, lead modification, optimization, docking, docking algorithms,	2
structure based drug design- rational design, pharmacophores, QSAR, ADME/T, drug delivery.	2

Home Assignments : **2-** 4 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
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4.	Major test (University Examination)	75 Marks

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For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: In vacant period.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks. All questions will carry equal marks.

BT522B BIONANOTECHNOLOGY

M. Tech. Semester - II (Biotechnology)

L	P	Credits
3	--	3

Class Work : 25 Marks
Examination : 50 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

OBJECTIVES:

1. To study the history and concept of nanoscience and nanotechnology.
2. To identify the differences between nanomaterials and their bulk counterparts with respect to their mechanical, optical and electrical behaviour.
3. To learn different approaches for nanomaterial synthesis, including conventional mechanical and chemical synthesis procedures and new age biological synthesis processes.
4. To understand different classes of nanomaterials based on structure and composition.
5. To study the modifications possible with nanomaterials for their application in the field of electronics and biological sciences.
6. To analyze several techniques aims at characterization of nanomaterials.
7. To analyze surface properties of nanomaterials along with their visualization, size calculations and state of the material.
8. To study possible implementation of nanotechnological approaches to aid and improve biological applications
9. To analyze the role of nanomaterials in detection systems and biosensors.
10. To evaluate advantages of using nanomaterials in combination with biological systems in the field of medicine.
11. To correlate biotechnology and nanotechnology with environment protection strategies for better and quick results.
12. To analyze the use of nanomaterials for routine biotechnological processes of transfection and cloning for betterment of the society.

OUTCOME:

5. Able to clearly differentiate between nano-sized materials and their bulk counterparts
6. Know relevance of using materials of nano-scale with concept clarity for differences posed by the two classes in terms of their behaviour.
7. Able to predict properties of nanomaterials based on their parent material, shape and size.
8. Able to know various concepts of nanomaterial synthesis, with pros and cones of every method.
9. Able to analyze data obtained by several techniques employed for characterization and how to handle nanomaterials safely.
10. Able to co-relate interesting properties of nanomaterials with biological entities to devise systems for better and easy detection of molecules or pathogen, control of microorganisms, as future drug delivery agents, and bioremediation of the environment.

BOOKS:

1. Goodsell, David S. Bionanotechnology- Lessons from Nature. John Wiley & Sons, INC., Publication. (2004).
2. Niemeyer C.M. and Mirkin, C.A. Nanobiotechnology- Concepts, Applications and Prespectives, Wiley-VCH Verlag. (2004).
3. Avouris, P., Klitzing, K. Von, Sakaki, H. and Wiesendanger, R. NanoScience and Technology Series. Springer. (2003).
4. Bauerlein, E. Biomineralization- From Biology to Biotechnology and Medical Applications. Wiley-VCH Verlag. (2000).
5. Cao, G. Nanostructures and Nanomaterials. Imperial College Press. (2004).
6. Bhushan, Bharat. Handbook of Nanotechnology. Springer. (2004).
7. Kohler, M., Fritzsche, W. Nanotechnology-An Introduction to nanostructuring Techniques. Wiley-VCH Verlag. (2005).
8. Scherge, M. and Gorb, S.N. Biological Micro- and Nanotribology- Natures solution, Springer. (2003).
9. Schmid, G., Nanoparticles- From Theory to Applications. Wiley-VCH Verlag. (2004).
10. Lyshevski, Sergey Edward. Nano- and Microscience, Engineering, Technology, and Medicine Series. CRC press. (2001).

LECTUREWISE PROGRAMM : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT- I	
Introduction to Nanoscience and Nanotechnology (09.01.18 to 19.01.18)	
History of nanoscience and technology	1
Nanomaterials- structural, chemical and physical properties	2
Mechanical, optical and electrical behaviour of nano structures	2
Nanofabrication and Nanosynthesis (22.01.18 to 02.02.18)	
Introduction to various approaches of synthesis	1
Types of synthesis: Gas phase synthesis, controlled flame synthesis, liquid phase synthesis	2
Mechanical synthesis, nanolithography; nanocoating	1
Biological production of nanoparticles- fungi, bacteria, yeast and actinomycetes	2
UNIT- II	
Nanostructures and Nanomaterials (05.02.2018 to 23.02.2018)	
Introduction to different types of nanostructures: fullerenes; carbon nanotubes; quantum nanodots; nanorods; nanocomposites; polymeric nanomaterials	3
Bionanostructures: Basic concept, necessity, advantages and problems associated	1
Protein-based nanostructures, DNA-based nanostructures, DNA-protein nanostructures	3
DNA gold nanoparticle conjugates, DNA templated electronics	2
UNIT – III	
Instrumentation techniques for Nanotechnology (26.02.18 to 30.03.18)	
Introduction, need for characterization, various properties to be characterized after synthesis	1
Low energy electron diffraction (LEED), scanning probe microscopy,	1
SEM, TEM	2
XRD (Powder/ Single/ Crystal),	2
Atomic force microscopy (AFM), scanning tunneling microscopy (STM)	2
Various forms of spectroscopy for the analysis of biological systems, nuclear magnetic resonance (NMR)	3+1
UNIT – IV	
Applications of Bionanotechnology (02.04.18 to 27.04.18)	
Introduction to concept of applied bionanotechnology and current status	1
Nanoparticles for disease diagnosis	2
Nanoparticles for drug solubilization and delivery	2
Nanoparticles as biosensors, biochips	2
Use of nanoparticles- as molecular imaging probes, as non-viral transfection agents	2
Nanoparticles for cleaning environment, particularly heavy metal bioremediation and for enhanced oil-recovery	2
Latest advances and research paper discussion	1

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Note:

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2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

BT510B ENZYMOLOGY AND ENZYME TECHNOLOGY- II LAB

M. Tech. Semester II (Biotechnology)

L	P	Credits		
--	4	2	**Class Work**	**: 20 Marks**
			Examination	**: 30 Marks**
			Total	**: 50 Marks**
			Duration of Examination	**: 3 Hours**

TEXT /REFERENCE BOOKS:

1. Principles & Techniques of Practical Biochemistry, ed . K. Wilson & J. Walker, 1994, Cambridge University Press, Cambridge.

2. Introductory Practical Biochemistry, ed., S.K. Sawhney & Randhir Singh, 2000, Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw Hill, Book Company. U.K.

OBJECTIVES

- To study the enzyme reactions and examining the effect of concentration, temperature and pH of alkaline phosphatase.
- To determine Km and Vmax of the substrate concentration reaction and protein sample by lyophilisation
- To study the enzyme immobilization and partial purification
- To study the sub-cellular fractionation of organelles.

OUTCOMES

- Students will learn the enzyme reactions and its effects.
- They will learn to experiment enzyme immobilization, substrate concentration and how to note Km and Vmax of the reaction.
- Able to do the partial purification and sub-cellular fractionation experiments.

List of Experiments/ Exercises (from 08.01.18 to 27.04.18)

1.	Assay of enzyme catalyzed reaction.	4
2.	To study time course of the reaction catalyzed by alkaline phosphatase.	4
3.	To examine the effect of enzyme concentration on the rate of an enzyme catalyzed reaction.	4
4.	To determine temperature optima for alkaline phosphatase.	4
5.	To examine the effect of pH on activity of alkaline phosphatase.	4
6.	To stud y the effect of substrate concentration on activity of alkaline phosphatase and determine Km and Vmax of the reaction.	8
7.	Demonstration of enzyme immobilization	4
8.	Partial purification of an enzyme by ammonium sulphate fractionation	4
9.	Concentration of a protein sample by lyophilisation	4
10.	Sub -cellular fractionation of organelles from liver cells/plant tissue	4

Evaluation Procedure

1.	Assignment / Project / Performance in the Class	5 Marks
2.	Practical File Viva, Experiment/Task	5 Marks each
3.	Major test (University Examination)	30Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note: T**he students will be required to perform 08 experiments/ exercises from the above list and the other two experiments may be designed by the department based on the theory courses: BT502B (Enzymology and Enzyme Technology-II**

BT512B BIOTECHNOLOGY IN HEALTHCARE LAB

M. Tech. Semester II (Biotechnology)

L P Credits Class Work: 20 Marks

-- 4 2 **Examination : 30 Marks**

Total : 50 Marks
Duration of Examination : 3 Hours

OBJECTIVES:

1. To study the basic concept of Immunology.
2. To develop understanding of various antigen antibody interactions.
3. To understand the applications of antigen antibody interactions for diagnosis of various diseases.

OUTCOME:

1. Able to know the importance of immunological tools for detections of pathogens in diseases.
2. Able to know the importance of biochemical tests.

List of Experiments/ Exercises: (08.01.18 to 27.04.18)	No. of hours
1. To perform single radial immunodiffusion test for disease diagnosis.	4
2. To perform double immunodiffusion test for immunodiagnosis.	4
3. To perform different types of ELISA.	8
4. To detect antigen or antibody by latex agglutination method.	4
5. To isolate B and T lymphocytes from blood.	8
6. To study the biochemical profile of pathogenic bacteria by IMVIC test.	8
7. To distinguish between given bacterial pathogens on the basis of catalase activity.	8
8. To study the carbohydrate fermentation patterns of the pathogenic microbes.	8
9. To perform Triple-Sugar-Iron Agar test to characterize the pathogenic microorganisms.	4
10. To determine the ability of microorganisms to produce urease.	8

TEXT /REFERENCE BOOKS:

1. Kuby s Immunology (4 th edition) R. A. Goldsby, T. J. Kindt, B. A. Osborne, J.W.H. Freeman & company, New York.

2. Talwar, G.P. Practical Immunology. Volume 1&2.

3. Cappucino. Laboratory Manual in Microbiology.

4. Specific journals and published references.

Attendance Record – Candidate should attend at least75% of the total classes held in the subject
Chamber consultation hour: Any vacant period.

BT514B BIOINFORMATICS- II LAB

M. Tech. Semester – II (BIOTECHNOLOGY)

L	P	Credits			
--	2	1	**Class Work**	**:**	**20 Marks**
			Examination	**:**	**30 Marks**
			Total	**:**	**50 Marks**
			Duration of Examination	**:**	**3 Hours**

Objectives:

1. To visualize various biological databanks and to perform sequence retrieval from these.
2. To perform pairwise and multiple sequence alignment using different tools.
3. To perform protein sequence analysis (ExPasy) and to study molecular visualization tool (Swiss-pdb viewer).
4. To perform phylogenetic tree construction.
5. To study gene structure and function prediction (using GenScan, GeneMark).
6. To learn to perform molecular docking.

Outcomes:

1. Students will gain knowledge about various biological databases and the different tools used to retrieve and analyze the available biological data.
2. Students will be able to perform gene & protein sequence analysis, and phylogenetic studies with the help of online tools.
3. Students will be able to perform genome annotation and molecular docking.

Text /Reference Books:

1. Bioinformatics: A Practical Approach by K. Mani and N. Vijayaraj, Aparna Publications, Coimbatore.
2. Bioinformatics. Higgins & Taylor (2000). OUP.
3. Leach A.R. , "Molecular Modelling - Principles and Applications", 2nd Edition, Prentice Hall, 2001.

Note: T he students will be required to perform 08 experiments/ exercises from the given list and the other two experiments may be designed by the department based on the related theory course.

Experiment Schedule (08.01.2018 to 27.01.2018):

08.01.18 to 02.02.18	
Introduction about various biological databases	1
To learn about Database file formats and Data retrieval tools	1
To perform similarity searching using NCBI, BLAST	1
Multiple sequence alignment using Clustal	1

05.02.2018 to 02.03.2018	
To learn about Molecular visualization tools: Swiss-Pdb Viewer	1
Protein sequence analysis using ExPasy	1
To perform phylogenetic tree construction	2
05.03.18 to 30.03.18	
To perform structural and functional genome annotation using different prediction tools	2
To perform homology modelling	1
02.04.18 to 26.04.18	
To study molecular dynamics and to perform molecular docking	2
To perform drug designing using INVENTUS software	2

Evaluation Procedure

1.	Test / Viva-Voce	06 marks
2.	Class performance/ Objective Test	08 marks
3.	Practical Records	06marks
4.	Major Test (University examination)	30 marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %) For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% of the total classes held in the subject

Chamber consultation hour: Any vacant period.