

**Appendix II**  
**M.Tech (Biotechnology)**  
**Jawaharlal Nehru Technological University, Kakinada**  
**Scheme of Instruction & Examination**

1 Semester	L	P	Total Hours	Sessional	Exam	Total Marks	Credits
<del>MBIO-101: Environmental Biotechnology</del>	4	-	4	30	70	100	4
<del>MBIO -102: Advanced Biochemistry</del>	4	100	44	30	70	100	4
MBIO -103: Biochemical Engineering	4	-	4	30	70	100	4
MBIO-104: Advanced Downstream Processing	4	-	4	30	70	100	4
MBIO -105: Elective-I (Any one)	4		4	30	70	100	4
MBIO 106: Biotechnology Lab-I	-	6	6	50	50*	100	3
MBIO -107: Seminar		6	6	100	-	100	3
<b>Total</b>	<b>20</b>	<b>12</b>	<b>32</b>	<b>300</b>	<b>400</b>	<b>700</b>	<b>26</b>

\* Note only internal valuation

2 <sup>nd</sup> Semester	Marks Evaluation						
	L	P	Total Hours	Sessional	Exam	Total Marks	Credits
MBIO 201: Genetic Engineering	4	-	4	30	70	100	4
MBIO -202: Enzyme Engineering	4	-	4	30	70	100	4

**M.TECH (BIOTECHNOLOGY)**  
**I SEMESTER**  
**MBIO-101: ADVANCED MICROBIOLOGY**

**UNIT-I**

**Introduction to Microbiology:** Origin and evolution of microorganisms, history of Microbiology, nature and scope of microbiology, major characteristics of prokaryotes and Eukaryotes, structure and functioning of bacterial cell, staining reactions.

**UNIT-II**

**Classification of microorganisms:** Major characteristics of microorganisms, concepts of Classification, classification methods, principles of nomenclature and identification, Modern trends in classification.

General features and classification of some groups of microorganisms - Algae, Fungi, Chlamydiae, Rickettsiae, Mycoplasmas, Viruses and Protozoa, economic importance of Micro-organisms

**UNIT-III**

**Methods in microbiology:** Nutritional requirements, nutritional types of bacteria, Characteristics of culture medium, type of culture media and preparation of culture media, isolation of microorganisms - general and selective methods, isolation of bacteria in pure culture, enrichment - enrichment methods, staining techniques, culture characteristics, maintenance and preservation of cultures, culture collections.

**UNIT-IV**

**Reproduction and growth:** Reproduction in bacteria, genetic transfer in bacteria, Bacterial growth, bacterial growth curve, growth measurement techniques, factors affecting growth, control of microorganisms by physical and chemical methods.

**UNIT-V**

**Metabolism and energy production:** Respiratory chain, energy production by aerobic and anaerobic process, energy production by photosynthesis. Microbiology of air, water, soil, milk and food.

**UNIT-VI**

**Epidemiology and infectious diseases:** Epidemiological markers, role of host in infectious diseases - Air borne, water borne and food borne diseases.

**UNIT-VII**

**Immunology:** Natural resistance, internal defense mechanisms, non-specific defense mechanisms, immunity, types of immunity, immune systems, Hypersensitivity, transplantation, autoimmunity, AIDS and other immune deficiencies, vaccines, types of vaccines, production of vaccines and synthetic vaccines, monoclonal anti bodies and their use.

**UNIT-VIII**

**Antibiotics:** history of antibiotics, antibody and its diversity, classification and production of antibiotics, microbial toxins, types of microbial toxins, effects of microbial toxins and their control

**TEXT BOOKS:**

1. Microbiology by M. J. Pelczer, E. C. S. Chan, N. R. Kries. Tata McGraw Hill publications
2. Microbiology fundamentals and applications by S. S. Purohit. Agro botanical. Publications.

## **MBIO -102: ADVANCED BIOCHEMISTRY**

### **UNIT-I**

#### **Introduction to Advanced Biochemistry:**

Scope and importance of biochemistry, molecular logic of living matter, origin of biomolecules. Molecular structure of Water, macromolecular structure of water, hydrogen bonds, dissociation of water.

### **UNIT-II**

**Carbohydrates:** classification of carbohydrates, structure and properties of monosaccharides (ribose, glucose, fructose), disaccharides (maltose, lactose, sucrose) and polysaccharides (Starch, glycogen and cellulose).

### **UNIT-III**

**Amino acids and proteins:** Classification and properties of amino acids and proteins, peptide bond, structural organization of proteins: primary, secondary, tertiary and quaternary structure of proteins. Biochemical function of proteins, denaturation of proteins.

### **UNIT-IV**

**Lipids:** classification, structure and physiological functions of triglycerides, fatty acids, phospholipids, cerebrosides, gangliosides and cholesterol.

### **UNIT-V**

**Nucleic Acids:** Structure and properties of purines and pyrimidine bases, nucleosides, nucleotides. Structure of nucleic acids-DNA and RNA.

### **UNIT-VI**

**Enzymes:** Classification of Enzymes, Mechanism of Enzyme action, factors affecting enzyme action, co-enzymes and regulatory enzymes.

Enzyme inhibition-competitive, non-competitive and uncompetitive inhibitions.

Structure and functions of vitamins. Membrane assembly and transport across the membranes. Bioenergetic principles and ATP cycle.

### **UNIT-VII**

Mechanism of photosynthesis, Embden-Meyerhof pathway of glucose metabolism (glycolysis), citric acid cycle (Krebs cycle), electron transport and oxidative phosphorylation.

### **UNIT-VIII**

Biosynthesis of fatty acids- palmitic acid biosynthesis,  $\beta$ -oxidation of fatty acids.

Biosynthesis of DNA (replication).

Biosynthesis of RNA (transcription).

Biosynthesis of proteins (translation).

**Text Books:**

1. Textbook of Biochemistry by Albert-Lehninger, Kalyani Publishers,Ludhiana,New Delhi.
2. Principles of Biochemistry- Lehninger,Nelson and Cox-CBS Publishers and distributors,Delhi.
3. A text book of Biochemistry by A.V.S.S.Rama Rao,UBS Publishers and Distributors Ltd,New Delhi,Chennai.
4. Fundamentals of Biochemistry-J.L.Jain,S.Chand and company Ltd. New Delhi.

## **MBIO-103- ADVANCED BIOCHEMICAL ENGINEERING**

### **UNIT-I**

**Enzyme Kinetics:** introduction, mechanistic models for simple enzyme kinetics, experimentally determining rate parameters for Michaelis-Menten type kinetics, effects of pH and temperature, insoluble substrate , immobilized enzyme system.

### **UNIT-II**

**Microbial growth kinetics:** Batch growth, unstructured models, growth in continuous culture, structured models, product formation kinetics, cell immobilization.

### **UNIT-III**

**Stoichiometry of microbial growth and product formation:** introduction, Stoichiometry calculations, theoretical predictions of yeild coefficients, problems.

### **UNIT-IV**

**Bioreactors:** Review of various types of bioreactors used in the fermentation industry.  
Multiphase bioreactors: packed bed, bubble-column, fluidized bed and trickle-bed reactors.

### **UNIT-V**

**Sterilization:** Sterilization methods, thermal death kinetics, design criterion, batch and continuous sterilization, air sterilization

### **UNIT-VI**

**Fermentation:** general requirements of fermentation process, range of fermentation process, design and construction of fermenter

Alternate fermenters: new bioreactor configurations used in the fermentation technology.

### **UNIT-VII**

**Media design for fermentation:** medium requirements, medium formulation, simple and complex media.

## UNIT-VIII

**Transport Phenomena:** Gas-liquid Mass transfer; Theoretical models for  $K_{La}$ , interfacial area and bubble oxygen transfer, gas-liquid mass transfer of components other than oxygen.

Mass transfer into solid particles: External transfer, intraparticle diffusion.

Heat transfer correlations.

### TEXT BOOK:

Shuler, M. L and F. Kargi, Bioprocess Engineering: Basic concepts, 2<sup>nd</sup> ed., Prentice Hall India, New Delhi, 2003.

### REFERNCES:

1. Lee, J. M., Biochemical Engineering (e Book), Prentice Hall, Englewood Cliffs, 2001.
2. Bailey, J. E., and D. F. Ollis, Biochemical Engineering Fundamentals, 2<sup>nd</sup> edition, Mcgraw-Hill, New York, 1986.
3. Blanch, H. W., and D. S. Clark, Biochemical Engineering, Marcel Dekker, New York, 1996.
4. Swamy,A.V.N.,' Fundamentals of Biochemical Engineering' , BS publications, 2007

## **MBIO-104-ADVANCED DOWN STREAM PROCESSING**

**UNIT-I: Introduction** - An Overview of Bioseparations: Bioprocesses, Range and characteristics of bioproducts, Need for down stream processing, Characteristics of Fermentation broths, An overview of bioseparations; A few case studies.

### **UNIT-II**

**Cell Disruption:** cell disruption methods for intracellular products, removal of insoluble, biomass separation techniques, flocculation and sedimentation

### **UNIT-III**

Filtration: theory of filtration and filtration equipment

centrifugation: theory of centrifugation, centrifugation methods, centrifugation equipment

### **UNIT-IV**

**Liquid- Liquid Extraction with Ternary Systems-**Instructional objectives: industrial example; Equipment: mixer- settlers, spray columns, packed columns, plate columns, columns with mechanically agitated agitation; General design considerations; Hunter- Nash graphical equilibrium- stage method: number of equilibrium stages, minimum and maximum solvent- to- feed flow rate- ratios, use of right- triangle diagrams, use of an auxiliary distribution curve with McCabe- Thiele diagram, extract and raffinate reflux.

### **UNIT-V**

**Membrane Separations:** Instructional objectives: industrial example; Membrane materials, Dialysis and electro dialysis; Reverse osmosis; Gas permeation; Pervaporation; Ultra filtration: process configurations; Micro filtration: constant- flux operation, constant- pressure operation, combined operation. Introduction to liquid membranes, principle, its advantages and its applications.

### **UNIT-VI**

**Crystallization:** Instructional objectives: industrial example; Crystal geometry: crystal- size distributions, differential screen analysis, cumulative screen analysis, surface mean diameter, mass- mean diameter, arithmetic- mean diameter, volume- mean diameter; Thermodynamic considerations: solubility and material balances, enthalpy balances; Kinetic and transport considerations: super saturation, nucleation, crystal growth; Equipment for solution crystallization: circulating, batch crystallizers, continuous, cooling crystallizers, continuous, vacuum, evaporating crystallizers.

## **UNIT-VII**

**Drying of Solids:** Instructional objectives: industrial example; Drying equipment: batch operation, continuous operation; Psychrometry: wet- bulb temperature, adiabatic-saturation temperature, moisture- evaporation temperature; Equilibrium- moisture content of solids; Drying periods: constant- rate drying period, falling- rate period.

## **UNIT-VIII**

### **Enrichment operations**

Precipitation methods(with salt, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), integrated bioprocessing.

### **Text Books:**

**Units 2 to 5:** 'Separation Process Principles', Seader, J.D. and Henley, EJ, 2Ed.Wiley India.

**Unit 1:** 'Bioseparations: Principles and Techniques' by B.Sivasankar, Prentice-Hall India.

## **MBIO-105-ELECTIVE – I**

### **MBIO-105A - BIO-ANALYTICAL TECHNIQUES**

#### **UNIT-I**

Chromatographic Techniques - Affinity - Adsorption - paper - Thin layer Chromatography

#### **UNIT-II**

Column - Ion Exchange - Gel Chromatography - Applications.

#### **UNIT-III**

Gas liquid chromatography- equipment- applications.

#### **UNIT-IV**

High pressure liquid chromatography- equipment- applications.

#### **UNIT-V**

Spectrophotometric techniques- IR- UV-Visible

#### **UNIT-VI**

Spectrophotometric techniques- NMR- ESR- optical density

#### **UNIT-VII**

pH- pH titrations- Determination of pKa values- Buffers preparation- Buffer Action- physiological buffers- potentiometric titration

#### **UNIT-VIII**

Centrifugal dialysis- lyophilization- electrophoresis- ultra filtration.

**Text Books:**

1. “ Instrumental methods of Chemical Analysis - Chatwal, G & Anand, S. Himalaya Publishing House, Bombay.
2. “Instrumental methods of Chemical Analysis - Sharma, B.K. Goel Publishing House, Meerut.
3. “Instrumental Methods Analysis - Willard, Merritt, Dean & Settle, CBS Publishers & Distributors, Delhi.

**ELECTIVE – I**  
**MBIO-105B-Bioinformatics**

**UNIT-I**

Introduction, Molecular Biology and Bioinformatics, Biological database:  
Primary, Secondary and Structural data bases, tools for web search, data retrieval tools

**UNIT-II**

Genome analysis and gene mapping: sequence assembly problem, genetic mapping and linkage analysis, genome sequencing, sequence assembly tools, Human genome project.

**UNIT-III**

Alignment of pairs of sequences, scoring matrices, multiple sequences, phylogenetic analysis, Tree evaluation, automated tools for phylogenetic analysis, working with FASTA and BLAST.

**UNIT-IV**

Gene identification and prediction: Basis for gene prediction, pattern recognition, gene prediction methods, working with DNA, Micro arrays, Micro array analysis.

**UNIT-V**

Protein classification and structure visualization: structure – based protein classification, protein structure databases, visualization databases and tools, protein structure alignment, tools for plotting protein-ligand interaction.

**UNIT-VI**

Protein structure prediction: Analysis and prediction of primary structure and secondary structure, motifs, profiles, patterns and fingerprints search, Ab Initio approach, 2-D structure prediction, protein function prediction from DNA sequence.

**UNIT-VII**

Proteomics: Tools and techniques in proteomics, protein – protein interactions, gene family identification methods.

## **UNIT-VIII**

Computational Methods for pathways and systems Biology: Analysis of pathways, metabolic network properties, metabolic control analysis, simulation of cellular activities.

### **Text-book:**

S.C..Rastogi, N.Mendiratta and P.Rastogic, **Bioinformatics**, Prentice- Hall of India Pvt.Ltd, New Delhi, 2004

### **Reference books:**

1. T.K.Attwood and D.J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, Delhi, 2002
2. A.M. Lesk, Introduction to Bioinformatics, Oxford University press, New Delhi, 2004.

**v.rajesh**

## **II SEMESTER**

### **MBIO 201: GENETIC ENGINEERING**

#### **UNIT-I**

Introduction to Gene manipulation, Enzymology of gene cloning, modification methylases, restriction endonucleases, Reverse transcriptase and D N A cloning in E. Coli.

#### **UNIT-II**

##### **Cloning vectors and host**

- 1.Choice and its properties
- 2.baterial vectors .
- 3.Eukaryotic vectors.
- 4.cloning host- prokaryotes and eukaryotes

#### **UNIT-III**

##### **Recombinant DNA technology**

selection and screening of recombinant clones.Direct and indiect method.Probe preparation (radio labelling and non radiolabelling).Methods based on Nucleic acid homology(southern,Northen,WesternSouthern-western)

#### **UNIT- IV**

##### **Tools and techniques**

polymerase chain reaction:pcr methodology,RT-PCR,multiplex PCR,identification and application of pcr,restiction enzyme,DNA sequencing, DNA fingerprinting

#### **UNIT- V**

##### **Application of recombinant DNA technology**

Transgenic animals,transgenic plants,gene therapy ,pharmaceutical product , reverse genetics, application and ethics of genetics technology, genomics bio informatics and proteomics

#### **UNIT-VI**

##### **mutations**

Modification of cloned DNA:site directed mutagenesis,secretion of cloned product, reverse genetics

## **UNIT-VII**

### **Gene regulation**

Gene regulation in prokaryotes: operon model of regulation (with example of lac, trp, and ara): lytic and lysogenic switch in lambda. Gene regulation in eukaryotes: overview of gene regulation in animals and plants using example of galactose –utilization in yeast, heat shock gene expression

## **UNIT- VIII**

### **molecular marker**

molecular marker, RFLP, RAPD, AFLP, 16S r-RNA typing, gene chip and microarray ; application in disease profile

## **TEXT BOOK**

1. T.A. Brown, Gene Cloning
2. Old RW, Primrose SB, Principles of Gene manipulation, An introduction to genetic engineering, Blackwell Scientific Publication, 1993
3. Hood, Hartwell, Leland-Genetics from genes to genome

## **REFERENCE**

1. Concept of Genetics-V11 edition –William S. Klug, Michael R. Cummings.
2. Ansel F.M, Brent a, Kingston AE, Moore DO, current protocol in molecular biology, Greene Publishing associates, NY, 1988
3. J.F. Griffith, Richard, Gelbart, Genetic Analysis

## **MBIO -202: ENZYME ENGINEERING**

### **UNIT- I**

**Applications of enzymes:** classification of enzymes, purification and characterization of enzymes from natural sources comparison of chemical and enzyme catalysis.

### **UNIT-II**

**Enzyme inhibition:** types of inhibition- kinetic models; substrate and product inhibition; Allosteric regulation of enzymes; Deactivation kinetics

### **UNIT-III**

Enzymes from plant & animal sources & Enzymes from microbial sources.

### **UNIT-IV**

Techniques of enzyme extraction from plant, animal and microbial sources & b) Techniques of enzyme purification.

### **UNIT- V**

Techniques used for immobilization of enzymes & Techniques used for immobilization of whole cells.

### **UNIT-VI**

Characterisation of enzymes & Effect of chelating agents and molecular weight determination

### **UNIT- VII**

Production of industrially important enzymes & Application of enzymes in Chemical and Pharmaceutical industries.

### **UNIT-VIII**

**Enzyme Biosensors:** Applications of enzymes in analysis, design of enzyme electrodes and their applications as biosensors in industry, health care and environment.

**Book :**

Enzyme Engineering, edited by L.B. Wingard, J. Inter Science, New York, 1972.

**Reference :**

Biotechnology edited by H.J. Rehm and G. Reed, Vol. 7a, ( Enzyme Technology).

## **MBIO-203: ENVIRONMENTAL BIOTECHNOLOGY.**

### **UNIT-I**

Environment, types of Environment, Environment and Development, Environmental management, environmental education, principles of ecology, ecosystems, types of ecosystems, ecosystem structure and functioning, food chains, food webs, Ecological pyramids, nutrient cycling, microbial associations.

### **UNIT-II**

Source, effects and control aspects of various pollutants: Air (Particulate matter, SO<sub>x</sub>, NO<sub>x</sub>, CO<sub>x</sub>, CH<sub>x</sub>, noise), water (primary, secondary and advanced treatment techniques), solids (recycling, incineration and bioconversion) Global environmental problems: global warming, ozone depletion and acid rain. Industrial effluent treatment: case studies of paper and pulp, tannery, pharmaceutical, fertilizer and petroleum industries.

### **UNIT-III**

Biodegradation of xenobiotics: Xenobiotic compounds in the environment, persistent compounds, degradation mechanisms.

### **UNIT-IV**

Bioremediation: Bioremediation by microorganisms, bioremediation process and technologies, measuring bioremediation in the field, monitoring and efficacy of bioremediation.

### **UNIT-V**

Biosorption of metals: Microorganisms and metal absorption, factors affecting bioabsorption, bioreactors and bioabsorption, phytoremediation.

### **UNIT-VI**

Bioleaching: Types of bioleaching, advantages and disadvantages of bioleaching, methods for bioleaching.

### **UNIT-VII**

Biodiversity: Levels of biodiversity, value of biodiversity, global biodiversity, hotspots of biodiversity, threats to biodiversity, conservation of biodiversity.

## **UNIT-VIII**

Environment and energy: Biomass sources, biomass production and utilization for energy, biomass conversion routes, energy crops, biofuels, biodiesel, hydrogen Production, conservation of energy. Biofertilizers, biopesticides, biofilters, biosensors, biopolymers and bioplastics.

### **TEXT BOOKS:**

1. Environmental Pollution Control Engineering by C. S. Rao. Wiley Eastern Limited
2. Waste Water Treatment: Rational Methods of design and industrial practices by M. Narayana Rao and Amal K. Datta. Oxford & IBH publishing Co. Pvt. Ltd.
3. Environmental Biotechnology: Basic concepts and applications by Indu Shekhar Thakur. I. K. International Pvt. Ltd.

### **REFERENCE BOOKS:**

1. Microbial Ecology: A conceptual approach by Lunz, I. M. Oxford Black N.S.D.
2. Environmental Biotechnology by Geetha Bali. APH publishing corporation.

## **MB10-204: Industrial Biotech Products**

### **UNIT-I**

Fundamentals involved in the' production of industrial Microbial products such as details of the Fermentors, Synthetic and natural medium, precursors, Sterilization methods, and inoculum preparation.

### **UNIT-II**

A detailed study of 'Ethanol' production by fermentation, using black strap molasses, starchy substances and cellulose substrates like waste sulphate liquor and purification methods of the fermented broth and production, of absolute ethyl alcohol.

### **UNIT-III**

Materials for fermentative production of Vinegar, Lactic Acid, Citric Acid, and Amino acids. The method Involves selection of the particular strain of the micro-organism for Industrial Fermentation, process details and purification.

### **UNIT-IV**

Production of Alcoholic beverages like Beer, Brandy, Whisky and Wine.

### **UNIT-V**

Baked goods, cheese and other dairy products.

### **UNIT-VI**

Production of Antibiotics, Tetracyclines, Alkaloids

### **UNIT-VII**

Bakers yeast and Microbial Enzymes and Co-enzymes.

### **UNIT-VIII**

Fermentative materials for producing vitamins, Products from plant cell Cultures, Non - alcoholic beverages (Coco, Coffee, Tea fermentation).

***Textbook:***

"Industrial Microbiology" by Samuel C. Prescott and Cecil, G. Dunn; A McGraw - Hill Publication.

***References:***

- 1." Industrial Microbiology" by L.E. Casida. Jr. Wiley Eastern Limited.
- 2."Microbial Technology Vol. 1 and Vol. 2 by H.J. Peppler and D. Pulman (Academic Press).

## **MBIO -205 A:Elective-I NANOTECHNOLOGY**

### **UNIT-I**

Introduction to nanotechnology, molecular and atomic size, surface and dimensional spaces. Molecular nanotechnology: atoms by inference, electron microscopes, nanomanipulator, nanotweezers, atom manipulation, nanodots, nanolithography.

### **UNIT-II**

Nanopowders and nanomaterials: preparation, plasma arcing, chemical vapor deposition, sol-gels, electrodeposition, Ball milling, applications. Carbon nanotubes: types, formation, assemblies, purification, properties and uses.

### **UNIT-III**

Molecular mimics: Catenanes and rotaxanes, various molecular switches, synthesis of rotaxanes and catenanes, molecular computers, chemical rotors, prodders, flippers, atom shuttles, actuators, contacts.

### **UNIT-IV**

Nanobiometrics: Lipids as nano-bricks and mortar, self – assembled monolayers, proteins, 3-D structures arising from amines acids, nanoscale motors, Biological Computing, ion channels as sensors, Information in DNA structure, using DNA to build nano-cubes, hinges, smart glue, wire template.

### **UNIT-V**

Optics, photomics and solar energy: Properties of light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, Imaging, New low cost energy efficient windows and solar absorbers based on nanoparticles, Photonic crystals, surface wave guides and control of light paths.

### **UNIT-VI**

Nanoelectrons: birth of electrons, semiconductors, transistor, integrated circuits, the tools of micro and nanofabrication, quantum electronic devices, quantum information and quantum computers, experimental implementations of quantum computers.

### **UNIT-VII**

Future applications: microelectomechanical systems, nano-robots , ageless materials, invisible mending of atomic dislocations inside damaged materials, nanomechanics and nanoelasticity, nanoparticle coatings, nanoelectronic and magnetic devices and new computing systems, optoelectronic devices, environmental applications.

## UNIT-VIII

Molecular Dynamics, Simulation and Optimization of Nanosystems: Integration of Newton equation of motion, simulation of systems in contact with a heat bath, simulation methods based on accuracy and computational time, use of local and global optimization methods. (Scope: Chapters 5&6, Ali Mansoori\*: Principles of Nanotechnology).

*(This last section is not open for external assessment, but students are assessed internally by means of assignments and home work problems).*

### **Text-book:**

1. M.Wilson, K.Kannangara, G. Smith, M. Simmons and B. Ragues, **Nanotechnology**, Overseas press ( India) Private Ltd; New Delhi, 2005.

### **Reference books:**

1. G. Ali Mansoori\*, **Principles of Nanotechnology**, World Scientific Publishing Company, 2005.
2. G. Timp, Nanotechnology, Springer-Verlag, Network, 1999.
3. P. Poole and F.J. Owens, Introduction to Nanotechnology, John Wiley, 2003.
4. D.Ratner and M.Ratner, Nanotechnology: A Gentle Introduction, Pearson Education,2003.
5. B. Bhusan, Handbook of Nanotechnology, Springer, 2004

**MBIO -205 A: Elective-II**  
**PROTEOMICS AND GENOMICS FOR TARGET IDENTIFICATION**

**UNIT-I**

Protein expression profiles, brief description of methods for generating protein expression profiles: 2D- electrophoresis, 2D LCMS and 2D mass spectrometry.

**UNIT-II**

Analysis data from Mass spectrometry: peptide sequencing using mass spectrometry- spectrum graphs. MS for protein identification via database search. Spectral convolution spectral alignment.

**UNIT-III**

Protein function: use of sequence patterns, motifs and profiles, pattern representation methods: consensus, regular expressions, profiles.

**UNIT-IV**

Protein protein interaction: methods( phage display, yeast two-hybrid technique, protein arrays) and Tools for analysis of protein- protein interaction.

**UNIT-V**

Gene and genome sequencing strategies.

Genome assembly and annotation: fragment assembly. Mapping. Interval graphs. DNA sequencing- overlap, layout and consensus.

**UNIT-VI**

Gene prediction- frequentist approaches, model based approaches and similarity based approaches.

Prediction methods for regulatory regions.

**UNIT-VII**

Functional genomics. Differential display of alterations in gene expression. Serial analysis of gene expression.

## **UNIT-VIII**

Comparative genomics: genome alignment and genome rearrangements. Sorting by reversals. The breakpoint graph. Interleaving graphs and hurdles. Duality theorem for genomic distance. Genome duplications. Gene networks.

Text-Book:

1. Charles R. Cantor, Cassandra L. Smith (1999) Genomics: the science and technology behind the human genome project. John Wiley and sons.
2. T.A. Brown Genomes 2 nd Edition. Bios scientific 2002.
3. S.R Pennington and M.J Dunn. Proteomics. Viva books. New Delhi, 2002.