

## 401. EMERGING TRENDS IN BIOTECHNOLOGY

## UNIT I

1. Stem cell Technology: Types of Stem cells.
2. Manipulation of stem cells and applications in medicine.
3. *In vitro* fertilization: Principle, Methods, applications and ethics.
4. Cloning of animals: Methods and applications.

## UNIT II

1. Genome & Genomics: Concept and methods of genome analysis, genome projects.
2. Transcriptome & Transcriptomics: Concept and methods.
3. Proteome and Proteomics: Concept and methods of Proteome analysis.
4. Metabolome and Metabolomics.

## UNIT III

1. Nano biotechnology: Introduction and biological materials-example and uses.
2. DNA nanotechnology:-Structural DNA assembly-Nanopores and
3. Nanoparticles-biological arrays-nanoprobes for analytical applications.
4. Nano biosensors-nano scale organization-characterization-quantum size effects-sensors of the future.
5. Tools for measuring nanostructures. Microscopies-SEM, TEM, AFM modern advances-microanalysis-optical detection of single molecule.

## UNIT IV

1. Biochemical diagnostics: Biochemical markers of disease diagnosis and their applications.
2. Introduction and Concept of Molecular Diagnostics: DNA diagnostics: PCR based diagnostics, RAPD and RFLP etc. in diagnostics.
3. Microarray Technology, Array-based diagnostics, SNP's (Single Nucleotide Polymorphism) and GMS (Genome Mismatch Signals) and diagnostic significance.
4. Western blot diagnostics, Immunoarrays, Phage display concept and applications of phage display.

## UNIT V

1. Biosensors: Concept, principle, Organization of biosensor and types.
2. Biosensors: Health and medicine.
3. Biosensors: Food technology, Environmental monitoring.
4. Bacterial biosensors; Array Biosensors.

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## 402: BIOINFORMATICS

## [Optional II]

Overview of Bioinformatics: Merger of life sciences with computers.

Search engines: Google, Pub Med, NCBI, EMBL,

Protein and DNA databases: Swiss port, PIR, OMIM, Embark, ENTREZ, DDJB, MIPS, Hovered, ECDC, Cambridge small molecular crystal structure data bank.

Analysis packages: Commercial databases and packages, GPL software for bioinformatics, web based analysis protocol.

## II

Sequence Databases: Contents, Structure, and annotation for Human Genome Databases, Plant Genome Databases, Retrieving and Installing a program (Tree Tool), Multiple sequence alignment program- Clustal W, X.

Genome analysis programs: BLAST, FASTA, CGC, Motif and Profile, Sequence search.

Phylogenetic analysis: Phylogenetic reconstruction, distance matrices, Parsimony, Philip.

Data models: Instances and schemes; E-R model, E-R diagrams, reducing E-R diagrams to tables, network data model.

## T III

Methods of predication of Proteins, DNA, RNA, fold recognition, Ab initio methods for structure predication.

Computer aided drug designing: Basic principles, docking, ADME/ TOX

Genome mapping applications: EST and Functional genomics, EST clustering gene discovery, ORF prediction.

Use of genome analysis programs, primer designing tools.

## UNIT IV

1. Cluster analysis: Phylogenetic clustering by simple matching coefficients; Sequence comparison; Sequence pattern; Regular expression based pattern; Theory of profiles and their use in sequence analysis.
3. Markov models; Concept of HMMS; Baum-Welch algorithm; Use of profile HMM for protein family classification; Pattern recognition methods.
4. Structure determination: X-ray crystallography; NMR spectroscopy; PDB (Protein data bank) and NDB (Nucleic acid data bank); File formats for the storage and dissemination of molecular structure.

## UNIT V

1. Modeling and conformational analysis: Homology modeling; Threading and protein structure prediction.
2. Force fields; Molecular energy minimization, Monte Carlo and molecular dynamics simulation.
3. Tagging of genes and molecular modeling.
4. Modeling and Drug Design.

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