Ph.D. Entrance Examination Syllabus (Bioinformatics)(2026-27)

Fundamentals of Molecular Biology

Bio molecule s, structure and function of nucleic acids (DNA, RNA) and Amino acids (Proteins) , transcription, translation and genetic code systems around the central dogma of molecular biology.

Database Management and Programming Concepts

Relational and E-R models, database system architecture, SQL, basics of data structures, data types, operators , lists, hashes and object-oriented programming concepts.

Biological databases

Importance of databases in bioinformatics , biological and bioinformatics databases-NCBI , Pub Med, GenBank, EMBL, DDBJ, Swiss Prot-UniProt KB, PDB, KEGG, genomic databases , dbSNP, SRA, GEO.

Biological sequence analysis

Various file formats- FASTA, GenBank , EMBL, pair wise sequence alignment - methods and algorithms, Concepts of sequence similarity and homology, Scoring systems, Gap penalties and substitution matrices (PAM, BLOSUM), Dynamic programming algorithms: Needleman-Wunsch and Smith-Waterman algorithms, Heuristic methods: FASTA , BLAST, multiple sequence alignment - methods and applications., phylogenetics and molecular evolution.

Structural bioinformatics and Computer Aided Drug Design

Structural bioinformatics , Ramachandran plot, protein secondary and tertiary structure prediction methods, computer aided drug design: principles and applications, QSAR, Pharmacophore modeling , molecular docking , ADMET.

Advanced Topics and Future Trends in Bioinformatics

DNA sequencing methods and NGS technologies for biological sequences, Computational genomics , Systems and synthetic biology, Integration of bioinformatics with artificial intelligence and machine learning, Single-cell sequencing and its implications, Applications in precision medicine, healthcare and drug discovery.