- Designing basic amplifier circuit using transistors
- Simulation of phase shift oscillator circuit
- Designing of oscillator circuit for frequencies in audio range
- Simulation of digital clock circuit
- Innovation Project: Deconstructing mobile phone circuit

Recommended/ Suggested Readings:

- Electronic Principles. Albert Paul Malvino, McGraw-Hill, 1998
- Electronic Devices & Circuit Theory. Robert L. Boylestad, and Louis Nashelsky, Pearson Education, 2009
- Digital Logic and Computer Design. M. Morris Mano, Pearson Education, 2008
- Signals and Systems. Alan V. Oppenheim, Alan S. willsky, and Nawab S. Hamid, Prentice Hall, 1997
- Art of Electronics. Paul Horowitz, and Winfield Hill, Cambridge University Press, 2008
- Practical Electronics for Inventors, Fourth Edition – by Paul Scherz and Simon Monk, Mc Graw Hill Education, 2022

GENERIC ELECTIVES (GE-IV.4.3): *In Silico* Biology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical / Practice			
***In Silico* Biology, GE IV.4.3.**	**4**	**2**	**0**	**2**	**Class XII pass**	**NIL**	**Chemistry/ Biology Faculty of CIC**

Learning Objectives

This module is designed to:

- Develop an understanding of the advancement of computational models and simulations in studies applied to complex biological phenomena.
- Aware students of different types of bioinformatics analysis software and their related applications so that they can solve biological problems

Learning Outcomes

Upon completion of the course the students will be able to:

- Do computational simulations using protein and DNA sequences
- Be able to build computational models of biological data and systems

- Will be aware of the software and databases related to computational biology
- Will do homology modelling, docking, building cladograms etc.

SYLLABUS

Unit I: Handling protein and DNA sequences [12 hours]

Sequence patterns and profiles; Sequence file formats; Basic concept and definition of sequence patterns, motifs and profiles; sequence representations types; Sequence similarity based search engines (BLAST and FASTA); Pattern based and Motif-based searches; Profile-based database searches; Basic concepts of sequence similarity, identity and homology; homologues, orthologues, paralogues and xenologues sequences; Scoring matrices; Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, matrix derivation methods and principles; Basic concepts of sequence alignment, pair wise alignment; application of sequences alignments. Multiple sequence alignments; concept of dendrogram and its interpretation, phylogeny and cladistics.

Unit II: Handling biological data and data models [10 Hours]

Types of Biological data- Genomic DNA, cDNA, transcriptomics and RNA sequence analysis; Primary Databases: Nucleotide and protein sequence databases, Metagenomic and Environmental Sequences, Literature Databases, Secondary or Derived Databases; Sequence motifs Databases; Composite Databases; Genome organization databases; Organism specific database; Database search engines.

Unit III: Programming languages and software [08 hours]

Algorithm and programming languages, Stochastic models; Introduction to biopython; Introduction to new software and bio packages

Practicals - [60 hours]

- Sequence analysis (BLAST, FASTA).
- Database (NCBI, DDBJ, EMBL).
- Motif and Promoter searches (e.g. CD-Search, SMART, SignalP)
    - Phylogenetic analysis (PHYLIP, MEGA)
    - Protein interaction (STRING, BioGRID)
    - Protein structure, Function (PROSITE programs, Chimera
    - Gene expression, function (GEA, Gene card, OMIM)
    - Introduction to molecular docking

Essential/Suggested Readings

- Bioinformatics: Sequence and genome analysis, David mount, Cold Spring Harbor Laboratory Press; 2nd edition, 2013.

- Introduction to Bioinformatics, Arthur M. Lesk, OUP Oxford, 4th edition, 2014.
- Bioinformatics and Functional Genomics, Jonathan Pevsner, Wiley-Blackwell, 3rd Edition, 2015.

GENERIC ELECTIVES (GE-IV.4.4): The Living world: Systems Approach

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
***GE IV.4.4 The Living world: Systems Approach**	**4**	**2**	**0**	**2**	**Class XII pass**	**NIL**	**Chemistry/ Biology Faculty of CIC**

***This paper can be opted by students in either 3rd or 4th semester.**

Learning Objectives

This module is designed to:

- Introduce students to the living system in terms of their hierarchal organization and their distinction from the nonliving.
- The specific objective of the module is to introduce biology even to students with no biology background and enable them to understand living systems.
- To enthuse students with tools and techniques for studying biology.
- Introduce students to the origin and evolution of living systems
- Introduce students to the essence of model organisms for studying biology

Learning outcomes

After studying this course, the students will be able to:

- Understand the diversity and complexity of living systems
- To comprehend different fields within Bio-Sciences
- To understand experimental processes undertaken in Biology
- Will develop a philosophical understanding of the origin and evolution of living systems, the nature of genetic materials etc.

SYLLABUS

Unit I: Introduction and organization of living systems **[6 hours]**