Semester IV

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Strategies and Concept for Innovation Management GE IV.4.1.	**4**	**3**	**1**	**0**	**12th pass**	**NIL**	**Management Faculty of CIC**

Learning Objectives

The course presents an integrated view of the skills, tools and techniques in innovation management. Innovation relies on different disciplines that ranges from creativity to organizational behaviour. Rather than focusing on just one aspect of innovation management – Idea generation, the course delves into other aspects such as consumer behaviour, teamwork, leadership and thought processes that would foster creativity and a better understanding of managing innovation.

Learning outcomes

After completing this course, student should be able to:

- Understand the basic need to innovate for growth, profit and survival
- Comprehend that the ability to innovate and innovation management as vital core competency.
- Identify innovation opportunities
- Distinguish between incremental, standard and radical innovations
- Optimize a portfolio of high risk and low risk innovation
- Understand how the in box thinking lead to out of the box creativity

SYLLABUS

Unit-I. The innovation imperative: Why innovate?; Innovation to energize; Innovate for growth and profit; innovate for survival; Discussion of relevant case study. **[11 hours]**

Unit-II. The innovation portfolio: What to innovate?; Vision, portfolios and feelings; Identifying the right question, feelings and needs; Innovating Experiences, Battling Commoditization; Technology and Psychology; Creating Emotional Appeal; Searching for Innovation Opportunities; Innovation Portfolios for Established Organizations **[10 hours]**

Unit-III. The innovation voices: How to innovate?; Thinking 'Inside and outside The Box'; Profiling Product for Profit and Growth; Understanding the voice of the product, customer and organization; Fostering creativity in organizations**.** **[12 hours]**

Unit-IV. The innovative mind: Who Innovates?; Three Levels of Innovation; The Individual Innovator; Creativity Muscles; Innovative Teams; Building a Global Team; The Innovative Organization
[12 hours]

Essential/recommended readings

- Innovation Management: Strategies, concept and tools for growth and profit, S. Maital D.V.R. Sheshadri, Response Books, 2007.
- Innovation Management and New Product Development, P. Trott, Pearson Education, 7th Edition, 2021.
- Innovation and Entrepreneurship, M. Kennard, Routledge, 2021.

GENERIC ELECTIVES (GE-IV4.2): Electronics at work & circuit simulation

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			
Electronics at work and Circuit simulation, GE IV.4.2.	**4**	**2**	**0**	**2**	**Class XII pass**	**Basic knowledge of science**	**Physics/ Electronics Faculty of CIC**

Learning Objectives

This is a basic introductory module to provide an insight of the field of electronics to the students. In this paper students learn about basics of analog and digital electronics. The emphasis is on basic electronics components and devices and their application in real world.

Learning Outcomes

After the completion of the course, the students will be familarized with

- concepts of Electronics.
- following analog electronic components and their identification: resistor, capacitor, inductor, power source, transducer, sensor, detector, switch, Potentiometer - Integrated Circuit – Transformer;
- following digital electronic components, circuits, devices and their identification: logic families, logic gates, Boolean algebra - Combinational circuits: adders, encoders, decoders, multiplexer and de- multiplexer - Sequential circuits: like flip flops, counters, shift registers, memories
- following semiconductor devices, circuits and their identification: PN Junctions characteristics, Zener and Avalanche breakdown, diode applications, transistor & applications. Operational Amplifier (Op Amp): inverting and noninverting amplifier, integrator, differentiator, summing amplifier.
- practical and circuit simulations to understand basic electronics circuits used in everyday life.

SYLLABUS

Unit I: Analog World: resistor, capacitor, inductor, power source, transducer, sensor, detector, switch – Potentiometer - Integrated Circuit – Transformer. **[10 hours]**

Unit II: Digital World: logic families, logic gates, boolean algebra - Combinational circuits: adders, encoders, decoders, multiplexer and de-multiplexer - Sequential circuits: like flip flops, counters, shift registers, memories. **[10 hours]**

Unit III: Semiconductor Devices: PN Junctions characteristics, Zener and Avalanche breakdown, diode applications, transistor & applications. Operational Amplifier (Op Amp): inverting and non-inverting amplifier, integrator, differentiator, summing amplifier.

[10 hours]

Practicals - **[60 Hours]**

- Design basic electric switch board used in home
- Simulation of rectifier circuit
- Designing device charging circuit
- Deconstructing mobile charger circuit
- Simulation of CE amplifier circuit

- 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]**

Introduction to living state: (living versus non-living), Hierarchy of organization of living systems and classification (cellular, multicellular and organismic and population levels), Cell as the unit of life.

Unit II: Origin and diversification of the living systems [6 hours]

Nature of the genetic material (DNA versus RNA), Introduction to molecular evolution, Origin of life, Evidence of evolution, Theories of evolution, Creating living systems (synthetic cell).

Unit III: Designing living systems [6 hours]

Nature of biological processes - Approaches to study Biology: Observational and Experimental, Physiology and Behaviour

Unit IV: Tools and materials for studying living systems [12 hours]

Observational, synthetic and reductionist approaches for studying living organisms, Microscopy, Centrifugation and separation techniques as basic tools for studying components of living systems, Model organisms.

Practicals - [60 hours]

Basic equipment and techniques

a. Observation or permanent slides of pollens, microbes, hydra, Daphnia and bacteria under a microscope
b. Separation techniques:
    - Fraction of cell organelles through centrifugation
    - Separation of chlorophyll pigments by paper chromatography

Exploring different levels of organization (using model organisms)

a. Tissue organization and diversity in cell shapes: studying through plant and animal tissues sections
b. Inflorescence as a model of organization
c. Understanding parts of the flower

Studying cells:

a. Bacterial growth curve analysis
b. Genomic DNA isolation
c. Preparation of metaphase chromosome
d. Preparation of karyotypes using photographs of metaphase spreads
e. Demonstration of osmosis and plasmolysis

Essential/recommended readings

- Biology, Raven et al., Tata McGraw-Hill, 2016.
- Biology: Global Approach. Reece et al., Pearson Educations, Global edition, 2020.