Semester III

GENERIC ELECTIVES (GE-3.1): Economic Behaviour

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 3.1; Economic Behaviour	4	3	1	0	Class XII pass	NIL	Management Faculty of CIC

Learning Objectives

The purpose of this course is to familiarize the student with the present day modern economics that is both intuitive and relevant to the students. The course introduces the generally accepted concepts of economics both at the micro and macro level. In addition to this, the purpose of this course is to analyse how individual decision-makers, both consumers and producers and the government policies, behave in a variety of economic environments.

Learning outcomes

After completing this course, student will be able to:

- understand the basic structure of the economic ecosystem.
- Conceptualize how individuals and firms allocate resources and how market prices are determined.
- understand shifts in supply and demand and their implications for price and quantity sold.
- analyse firms' decisions mathematically using a production function and calculate their optimal level of production, costs, and profits.
- Learn to model the decisions made by firm in a monopoly and an oligopoly, and the implications of these alternate structures for consumer welfare.
- Learn to perceive the nation’s economy as a whole and compare the views of Keynes and the classical economists.
- Learn various techniques measuring and tracking macroeconomics using GDP and CPI.

- Analyse the model of full employment and use it to examine important macroeconomic issues, such as the extent to which taxes may depress economic activity and lower the level of GDP.

SYLLABUS

Unit I: The Economic Problem
Scarcity and Choice; Market economies and the price system; Variables, correlation and causation; Recommending appropriate policies [8 hours]
Unit II: The supply and demand model
Elasticity of supply and demand; Market equilibrium; Demand curve and behaviour of consumers; Supply curve and behaviour of firms [11 hours]
Unit III: Efficiency of markets
Rise and fall of industries; Monopoly; Antitrust policy; Taxes, transfers and income distributions [11 hours]
Unit IV: Macroeconomics
Unemployment, inflation and interest rates; Macroeconomic theory and policies; Measuring theoretical and actual GDP [15 hours]

Essential/recommended readings
- Principles of Economics, J.B. Taylor and A. Weerapana, Flatworld, 9th Edition, 2021.
- Principles of Economics, K. E. Case, R. C. Fair and S. C. Oster, Pearson Education, 13th Edition, 2019.
- Principles of Economics, N. G. Mankiw, Cengage, 9th Edition, 2021.

GENERIC ELECTIVES (GE-3.2.): Electronic Circuit elements and innovation lab

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 3.2.; Electronic Circuit Elements and Innovation Lab	4	2	0	2	Class XII pass	Mathematics till XII	Physics/ Electronics Faculty of CIC

Learning Objectives

This module involves interactive learning of A.C. fundamentals. It helps to understand the basic network analysis of electronic circuits. It also provides the interface to understand the working of

various electronic devices and its characteristics. Working of electronic instruments will also be understood.

Learning Outcomes

After completing this course, student will be able to;

- understand the concepts of AC fundamentals
- gain good knowledge of Network Analysis
- understand the basics of Diodes and Transistor based devices
- knowledge about instruments like CRO, Function Generator, Multimeter, etc.

SYLLABUS

Unit I: AC Fundamentals
Concept of voltage and current sources - KVL and KCL - Node voltage analysis and method of mesh currents - Network theorems [8 hours]
Unit II: Transistors
PN Junction: variants and applications - Bipolar Junction Transistor (BJT) biasing and amplifier design - Field Effect Transistor (FET) variants – FET biasing and amplifier design [6 hours]
Unit III: Structure and working of SCR. Structure and operation of LDR, Photo voltaic cell, Photo diode, Photo transitors & LED [8 hours]
Unit IV: Operational Amplifiers basics and practical circuits - Feedback and oscillator circuits - Voltmeters-Multimeters-Function generator- Cathode ray oscilloscope - Cathode Ray Tube [8 hours]

Practical component – [60 hours]

- Characteristics of PN junction and Zener diode filters
- Half wave rectifier.
- Full wave rectifier with 2 diodes.
- LC and Pi filters
- Full wave rectifier with 4 diodes (Bridge rectifier). Input, Output and Transfer characteristics of CE and CC Amplifier.
- Amplifiers and Oscillator characteristics.
- Characteristics of LDR, Photo-diode and Phototransistor.
- Transfer characteristics of JFET.
- Transfer characteristics of MOSFET (with depletion and enhancement mode)
- Characteristics of LED with three different wavelengths.
- Series voltage Regulator.
- Shunt voltage Regulator.
- Characteristics of Thermistor.

Essential/recommended readings

- Circuits and Networks - A. Sudhakar & Shyammohan S. Palli ,TMH, 2017
- Principles of Electronics- V.K. Mehta and Rohit Mehta, S Chand &Co, 2014

- Electronic Devices and Circuit Theory-R.L. Boylestad and L.Nashelsky, Pearson Education, 2009.

GENERIC ELECTIVES (GE-III.4.3.): Flow of information in Living Systems

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 3.3.; Flow of Information in Living Systems	4	2	0	2	Class XII pass	NIL	Chemistry / Biology Faculty of CIC

Learning Objectives

This module is designed to:

- Introduce students to nuclear events such as replication, transcription, translation, condensation, repair and recombination etc.
- Introduce gene regulation in prokaryotes and eukaryotes
- Introduce various biophysical and biochemical techniques related to these nuclear events

Learning Outcomes

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

- Understand the structure and function of DNA and RNA
- Build concepts about the processes of the Central Dogma of the living systems (replication, transcription, translation, recombination etc.)
- Develop an understanding of prokaryotic and eukaryotic gene regulation

SYLLABUS

Unit I: Structure and properties of the nucleic acids

Structure and biophysical properties of the DNA and RNA, forms of DNA and RNA, DNA binding domains [8 hours]

Unit II: Replication, Transcription and Translation

DNA replication models, Enzymes of DNA replication, DNA replication in prokaryotes and eukaryotes, regulation of DNA replication; [8 hours]

RNA polymerases, Transcription in prokaryotes and eukaryotes, Regulation of transcription in Prokaryotes and Eukaryotes, Eukaryotic chromatin; Ribosomes; translation in prokaryotes and eukaryotes

Unit III: DNA repair and recombination

DNA damage and repair, Molecular recombination [8 hours]

Unit IV: DNA packaging and chromatin structure, regulation of gene expression in eukaryotes [6 hours]

Practical Component [60 hours]

- Agarose gel electrophoresis of DNA/ Proteins
- SDS-PAGE Electrophoresis
- Polymerase Chain Reaction (PCR)
- Primer design
- Spectrometry (Experiments based on DNA/ protein interactions with ligands)
- Modelling of DNA and RNA forms and motifs through computational tools
- Innovation Projects

Essential/recommended readings

- Nucleic acids in Chemistry and Biology; G. Michael Blackburn, Martin Egli, Michael J. Gait; RSC Publisher, 2022
- Molecular Biology of the Cell; Bruce Alberts, Rebecca Heald, Alexander Johnson, David Morgan, Martin Raff, Keith Robert, Peter Walter 2022
- Biology, Raven et al. Tata Mc Graw –Hill, 2016
- Biology: Global Approach. Reece et al., Pearson Educations, Global edition, 2020
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GENERIC ELECTIVES (GE-3.4.): 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 3.4.; 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
- comprehend different fields within Bio-Sciences
- gain knowledge about experimental processes undertaken in Biology
- 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 [8 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 [8 hours]

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

Unit IV: Tools and materials for studying living systems [8 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.

Practical components [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.