KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT)
(Deemed to be University)

SCHOOL OF APPLIED SCIENCES (BIOLOGICAL SCIENCES)

AUTUMN SEMESTER 2022-23

Course Handout

1. **Course Code:** **LS-10001**
2. **Course title:** **Science of Living System**
3. **L-T-P Structure:** **2-0-0**
4. **Course Coordinator:** Dr. Sarbari Acharya
5. **Course faculty:** Dr. Chandana Mohanty (Coordinator)
   Dr Sarbari Acharya
   Dr. Nikita Mahapatra
   Dr. Vinod Ch.
   Mr. Sutanu Sathpathy
6. **Course Objective(s):**

- Enriching basic knowledge of Biology to support the Engineering and Research programs
- Learning methodology to establish models for various biological phenomena.
- Applying the aforementioned models to predict/analyse the disorders or diseases
- Establish the gate-way to design and develop the aforementioned things

7. **Course outcomes:**

CO1	learn the typical characteristics those distinguish life forms and analyse life process at cellular level.
CO2	apply concepts on structure and function of simple biomolecules in life processes.
CO3	understand different process involved in life and to analyse their effect
CO4	analyse different biological phenomenon and then relate it with engineering application domains
CO5	comprehend different physiological functions and then relate it to computer-based techniques
CO6	implement Biology and its relevance to engineering and technology

8. Course Contents

The Cellular Organization of a Living Organism: Biology in engineering, The Living World: Biodiversity of Living world, Microorganisms, Cell as the Basic unit of Life, Cell Theory, Structure and function of Prokaryotic and Eukaryotic Cells, Cell growth and reproduction, Homeostasis, Concept of Gene, Basic Structure and function of chromosomes. (6 hours)

The Molecular and Biochemical Basis of an Organism: Chemical Context of Life: Water, Carbon, Structure and Function, Types of Bonding, Bio- macromolecules (Carbohydrates, Proteins, Amino acids, Lipids and Nucleic Acids), Protein Synthesis, Cell differentiation -Stem Cells and their applications. (6 hours)

Enzymes, Photosynthesis, Metabolism and Bioenergetics: Enzymes: Introduction, structure, properties, Classification, Mechanism of Enzyme actions, Factors affecting enzyme action, Strategies Utilized by enzymes to affect catalysis. Photosynthesis: Introduction, pigments, Process of Photosynthesis, Mechanism of Photosynthesis (light reaction and dark reaction). Metabolism and Bioenergetics: Anabolism and Catabolism, Thermodynamics. (5 hours)

Nervous system, Immune system and Cell Signaling: Nervous system: Introduction, History of Neuroscience, Types of Glial cells, Nerve cells- Neurons, Organization of the Nervous system, Action potential, Diseases of the nervous system, Computer Based Neural-Networks. Immune System: Introduction, Innate Immunity, Adaptive or acquired Immunity, Diseases of the Immune system, Immune Engineering. Cell Signaling: General principles of cell signaling. (6 hours)

Molecular Machines, Biosensor and Bioremediation: Molecular Machines: Introduction, Molecular motors and Machines, F0F1-ATP synthase motors, Cytoskeleton associated motors. Biosensors: Concept of Biosensor, Working Principle, Types of Biosensors, Glucose Biosensors, Bio-detectors: DNA detection biosensor, Detection of pollutants, Biosensor in Food Industry. Bioremediation: Introduction, Role of microorganisms, Factors determining Bioremediation, Types – *in situ/ex situ,* Advantages and Disadvantages, Biofuel. (5 hours)

9. Text books

1. Biology for Engineers. S. Thyagarajan, N. Selvamurugan, M.P Rajesh, R.A Nazeer, Richard W. Thilagarajan, S. Bharathi, M.K. Jaganathan. McGraw Hill Education (India) Ed., 2012

10. Reference books

1. Biology (Indian Edition), P.H. Raven and G.B. Johnson. McGraw Hill Education (India) Private Limited.
2. Concepts of Biology, Eldon D. Enger, Feederick C, Ross and David B. Bailey. TMH Publications.
3. Biology. Neil A. Campbell and Jane B. Recee, Pearson Education.
4. Biology Concepts and Application, Cecie Starr, Thomson Books.

11. Lesson plan and active learning activities

Lecture No.	Learning Objective	Learning Topics to be covered
The Cellular Organization of a Living Organism		
1	**Comprehend the typical characteristics those distinguish life forms and analyse in life process at cellular level**	➢ Biodiversity of Living world, Micro-organisms
2		➢ Cell as the Basic unit of Life, Cell Theory, Structure and functions of Prokaryotic and Eukaryotic Cells
3		➢ Concept of Gene, Basic Structure and function of chromosomes.
4		➢ Cell growth and reproduction
5		➢ Cell differentiation,
6		➢ Homeostasis.
	Practice & discussion in class	
7	**Assessment 1[40 minutes assessment and 20 minutes discussion]**	
The Molecular and Biochemical Basis of an Organism		
8	**Apply concepts on structure and function of simple biomolecules in life processes.**	➢ Chemical Context of Life -Water, Carbon, Types of Bonding
9		➢ Structure and Function of Bio-macromolecules (Carbohydrates, Proteins, Amino acids, Lipids)
10		➢ Bio-macromolecules (Nucleic acids, Minerals)
11,12		➢ Protein Synthesis
13		➢ Stem Cells
13		➢ Stem Cells Applications.
	Practice & discussion in class	
14	**Assessment 2 [40 minutes assessment and 20 minutes discussion]**	
Enzymes, Photosynthesis, Metabolism and Bioenergetics		
15	**To comprehend the**	➢ **Enzymes**: Introduction, structure,

	chemical reaction involved	properties
15,16	**in life process and to analyse the effects of governing reactions**	➢ **Enzymes**: Classification, Mechanism of Enzyme actions, Factors affecting enzyme action
16		➢ **Enzymes**: Strategies Utilized by enzymes to effect catalysis.
17		➢ **Photosynthesis:** Introduction, pigments
17		➢ **Photosynthesis:** Process of Photosynthesis, Mechanism of Photosynthesis - light reaction
17		➢ **Photosynthesis:** Mechanism of Photosynthesis - Dark reaction Factors affecting photosynthesis.
18		➢ **Metabolism and Bioenergetics:** Anabolism and Catabolism
18		➢ **Thermodynamics**
	Practice & discussion in class	
19	**Assessment 3 [40 minutes assessment and 20 minutes discussion]**	
Nervous system, Immune system and Cell Signaling		
20	**To comprehend the functions at neural level and relate to computer based techniques dependent on these**	➢ **Nervous system:** Introduction, History of Neuroscience, Types of Glial cells, Nerve cells- Neurons
21		➢ **Nervous system:** Organization of the Nervous system, Action potential.
21		➢ **Nervous system:** Diseases of the nervous system, Computer Based Neural-Networks.
22		➢ **Immune System:** Introduction, Innate Immunity
23		➢ **Immune System:** Adaptive or acquired Immunity, Diseases of the Immune system.
23		➢ **Immune System:** Diseases of the Immune system, Immune Engineering.
24		➢ **Cell Signaling:** General principles of Cell signaling.
	Practice & discussion in class	
25	**Assessment 4 [40 minutes assessment and 20 minutes discussion]**	
Molecular Machines, Biosensor and Bioremediation		
26	**To realize and relate biological phenomenon with engineering application domains. To understand Biology and its relevance to engineering and technology**	➢ **Molecular Machines**: Introduction, Molecular motors and Machines, F0F1-ATP synthase motors, Cytoskeleton associated motors
27		➢ **Biosensors:** Concept of Biosensor, Working Principle, Types of Biosensors
28		➢ Glucose Biosensors, Bio-detectors: DNA detection biosensor, Detection of pollutants, Biosensor in Food Industry.
29		➢ **Bioremediation:** Introduction, Role of microorganisms, Factors determining Bioremediation, Types –

		in situ/ex situ, Advantages and Disadvantages, Biofuel.
	Practice & discussion in class	
30	**Assessment 5**	

12. Assessment components:

Sl No.	Assessment Component	Weightage / Marks	Time	Nature of the Component
1	Mid Semester Examination	20	90 Minutes	Closed Book
2	End Semester Examination	50	3 Hours	Closed Book
3	**Active learning activities:** (a) Quiz (b)Assignment/ Presentation (c) Critical thinking	15 10 05		Closed book Open book Open/Closed book

13. Assessment plan for active learning activities:

Sl No	Active learning Assessment Component	Weight age	Date and Time	Nature of the Component
1	Quiz	50%	Preferably after each unit (minimum 3)	Test in class
2	Assignment/Presentation	35%	1 assignment before mid-semester	Take home written assignment or slide presentation in class
3	Critical thinking	15%	To be submitted within 2 weeks after mid-semester	Two page write up on a particular topic (Home Assignment)

14. Attendance:

Every student must be to be regular (in attendance) in all lecture classes, tests, quizzes, etc. and in fulfilling all tasks assigned to him / her. The recorded attendance should be compulsorily 75%.

15. Make up:

No make-up examination will be scheduled for the mid semester examination. However, under exceptional circumstances (such as admission in a hospital due to illness / injury, calamity in the family at the time of examination) official permission to take a make-up examination will be given. The student has to write an application

form (within five working days after the missed examination) with supporting document(s) and medical certificate to the Dean of the School for a make-up examination.

16. Discussion of Mid Semester performance: Performance of the mid semester examination will be discussed in the classroom.

17. **Pre-end semester total marks**: Will be communicated to the students.

18. Course Management System:

SAP Portal is a software system designed to facilitate teachers in the management (instructional content, assessment and documentation) of the courses for their students, both teachers and students can monitor the system. Though usually considered as a tool and often used to complement the face-to-face classroom.

19. Notices: All notices regarding the course shall be displayed only on the School of Applied sciences notice board.

Dr. Sarbari Acharya
Course Coordinator
(Science of Living systems)