Biology

1.1. Course Number: BY101

1.2. Contact Hours: 2-1-0 Credits: 08

1.3. Semester-offered: 1st Year-Odd

1.4. Prerequisite: Class 12th level Biology

1.5. Syllabus Committee Member: Dr. Praveen Kumar Srivastava

2. Objectives:

Biology for engineering students is a discipline that focuses on teaching biological principles and concepts to engineering students. It aims to provide engineering students with a solid foundation in biological sciences, helping them understand and apply biological concepts in engineering design, research, and development. In this course, students will typically study various aspects of biology, including cell biology, genetics, microbiology, physiology, and bioenergy. They will learn about the structure and function of biological systems, such as cells, tissues, and organs, as well as the mechanisms underlying biological processes. The course may also cover topics related to biotechnology, bioengineering, and biomedical engineering, which involve applying engineering principles to solve biological problems or develop new technologies and products. Students may learn about techniques and tools used in biological research and engineering students can gain a better understanding of how living organisms function, which can be applied to various engineering fields. Overall, biology for engineering students helps bridge the gap between biology and engineering, equipping students with the necessary knowledge and skills to apply biological concepts in their engineering careers. It enhances their ability to address real-world challenges by integrating principles from both disciplines, ultimately leading to innovative solutions and advancements in engineering fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topic	Sub-topics	Lectures
1	Introduction to Biology	Basic principles of biology, classification of plant and animal kingdom, difference between plant cell and animal cell, biological classification, biological macromolecules, cell and genes, definition, and scope of bioengineering: biology for engineers.	5

2	Biomolecules, Cell, and Molecular biology	Carbohydrates: definition and classification of carbohydrates, importance of carbohydrates in biological systems, structure and examples of monosaccharides, disaccharides and polysaccharides, carbohydrate metabolism Proteins: definition and importance of proteins, hierarchical structure of proteins (primary, secondary, tertiary, and quaternary structure), protein functions and their significance, structure and properties of amino acids, protein purification methods Lipids: definition and classification of lipids, importance of lipids in biological systems, structure and properties of lipids, fatty acids: structure, nomenclature, and classification. Cell: prokaryotic and eukaryotic cell, cell organelles.	9
3	Basic Human Anatomy and Physiology	Organization levels of the body, anatomical terminology: directional term, planes of the body, body cavities, introduction to human body, blood: components, their function, and disorders, basic anatomy, and physiology: cardiovascular, digestive, and respiratory system.	6
4	Industrial Microbiology and Environmental Biotechnology	Introduction and scope of industrial microbiology, importance of microorganisms in industrial processes, microbial growth and control, factors affecting microbial growth, microbial growth in batch, continuous, and fed-batch cultures, sterilization methods, fermentation process: batch, fed-batch, and continuous, industrial production of microbial products, industrial biotechnology applications, bioremediation of pollutants and waste treatment, production of biofuels and renewable chemicals, biotechnological approaches in food and beverage industries.	8
		Total	28

4. Readings:

4.1. *Textbooks:*

1. Campbell Biology by Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece.
2. Biology by Neil A. Campbell, Jane B. Reece: Another popular choice for college-level biology courses.
3. Essential Cell Biology by Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter.
4. Biology: A Global Approach by Neil A. Campbell, Jane B. Reece, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky.

4.2. *Reference books:*

1. Campbell Biology by Jane B. Reece, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Robert B. Jackson.

2. Essential Cell Biology by Bruce Alberts, Dennis Bray, Alexander Johnson, Julian Lewis, Keith Roberts, Peter Walter.
3. Biology: A Global Approach by Neil A. Campbell, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Robert B. Jackson.
4. Brock Biology of Microorganisms by Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, David A. Stahl, Christopher L. Hemme.
5. B.D. Singh. Biotechnology Expanding Horizons.

5. Outcome of the Course:

- Engineering students gain a deep understanding of biological systems, including the structure, function, and behavior of living organisms. This knowledge is valuable for designing and operating engineering systems that interact with or are influenced by biological processes.
- Studying biology helps engineering students develop a biomimetic approach to design. By observing and learning from biological systems, engineers can create technologies inspired by nature, resulting in more efficient and sustainable engineering solutions.
- Interdisciplinary knowledge and skills: Biology courses can expose engineering students to interdisciplinary approaches and methodologies, which can be valuable in an increasingly interconnected world.