

Department: Biological Science & Engineering

Course Title: Biology for Engineers

Credits: 02

Pre- requisite: NIL

Course Objectives:

1. Investigate the core principles of biology, encompassing the cell as the foundational unit of life and the systematic classification of living entities.
2. Comprehend the structural intricacies, functions, and industrial relevance of biomolecules within cellular structures.
3. Attain a foundational understanding of human physiology, essential for pursuing studies in the bioengineering domain.
4. Analyze the mechanisms governing genes, DNA, and RNA, elucidating their processes of replication and information transmission in living organisms.
5. Explore the pragmatic applications of biology in daily life through technological advancements, such as the production of pharmaceuticals, development of transgenic organisms, and the creation of innovative biotechnological products.

Unit I: Basic Biology : Cell as foundations of life, cell theory, shapes, structures (plant and animal cells), protoplasm, and prokaryotic/eukaryotic cells, cell division, meiosis, mitosis., cell types, plant and animal tissues.

Unit II: Bio-Molecules: carbohydrates, proteins, amino acids, and nucleic acids (DNA/RNA), Lipids, enzymes and their industrial applications, Biomolecules for health and medicine.

Unit III: Physiology: Nutrition, digestive systems, Energy production in living cells, aerobic/anaerobic respiration, Bioenergetics, thermodynamics, respiratory organs, excretory systems, skeletal systems and muscular movement, the nervous system, Engineering aspect in Physiology.

Unit IV: Genetic engineering: Introduction to recombinant DNA technology and cloning, Genetic engineering, Gene therapy, cell therapy, Biochips, DNA chips, cell and tissue culture.

Unit V: Applications of Principles of Biology in industries: Epidemiology of infectious diseases, Vaccines, antibodies, biofuels, tissue engineering, transgenic plants and animals, and bioengineering (artificial limbs, joints, And body parts), Biomining, Bioprinting, Bioremediation, Pollution, emerging technologies in the field of Biotechnology/Bioengineering.

Course outcomes:

Students will be able to:

1. Understand the fundamental principles of cells, including their structures, cell division processes, and classification, laying the foundation for advanced studies in cell biology.
2. Acquire knowledge of essential biomolecules and their applications, particularly in health and medicine, providing a comprehensive understanding of their significance in various industries.
3. Develop an understanding of human physiology facilitating insights into the complexities of the human body.
4. Explore genetic engineering intricacies enabling proficiency in DNA-based technologies and their applications.
5. Apply biological principles to industrial settings.
6. Establish connections between biomolecules and their applications in health and medicine industry.
7. Explore the interdisciplinary field of bioengineering for technological innovations in various industries.

Text Books:

1. Cell and Molecular Biology-P.K.Gupta
2. Cell Biology-Verma and Agarwal
3. Cell Biology-Rastogi
4. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A global approach”, Pearson Education Ltd, 2018.
5. T Johnson, Biology for Engineers, CRC press, 2011 Molecular Biology and Biotechnology 2nd ed. J.M. Walker and E.B. Gingold. Panima Publications. PP 434.

Reference Books:

1. Alberts Et.Al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. De Robertis EDP & EMF De Robertis. 2001. Cell and Molecular biology. Lippincott Williams &Wilkins. Bombay.
3. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wiley and Sons, 2009.
4. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012 Principles of Biochemistry. 2nd ed. 1993. A.L. Lehninger, D.L.Nelson.M.Cox. Panama Publications. PP. 1090.
5. Harper’s biochemistry. 1988. R.K. Murray. D.K. Granner, P.A. Mayes. Printice Hall International.
6. Molecular Biology by G. Padmanabhan, K. SivaramSastry, C. Subramanyam, 1995, Mac Millan.
7. Biochemistry of Nucleic Acids.1992.11thed.R.L.P.Adams.J.T.Knowler.D.PLeader.Chapman and Hall.
8. Molecular Biology and Biotechnology by Meyers, RA, A comprehensive Desk reference (VCH Publishers). Course Title NUMERICAL METHODS, PROBABILITY AND STATISTICS B. Tech. III Sem (Common to CE & ME Branch
9. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
10. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
11. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
12. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
13. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.

14. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
15. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
16. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
17. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016 01062022
18. Blood Substitutes, Robert Winslow, Elsevier, 2005