

SVKM's Narsee Monjee Institute of Management Studies
Mukesh Patel School of Technology Management and Engineering

Program: B Tech All Program (except B Tech CSBS, CSE (DS) 311 (VT)), MBA Tech (All Program)				Semester: I / II	
Course: Elements of Biology				Code: 702BS0C049	
Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks - 100)
3	0	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Fundamental knowledge of physics, chemistry, and mathematics.

Course Objective:

To introduce students to modern biology with an emphasis on evolution of biology as a multi-disciplinary field, to make them aware of application of engineering principles in biology. This will encourage engineering students to think about solving biological problems with engineering tools. They will also be exposed to the application of engineering principles in biology and engineering robust solutions, inspired by biological examples.

Course Outcomes:

After completion of the course, students will be able to –

1. Identify key principles of biomimicry and develop engineering solutions for different fields
2. Classify microorganisms and their molecular properties and analyze the role of DNA as genetic material in transferring information among living organisms
3. Describe the fundamental building blocks of life, including carbohydrates, amino acids, proteins, and lipids, and illustrate their functions in cellular processes and metabolism

Detailed Syllabus

Unit	Description	Duration
1.	Introduction to Biomimicry Applications of biology in engineering, Biology as an independent scientific discipline, Importance of studying biology, Exploring biological discoveries of the 19 th century: Brownian motion and beyond. Applications of biology: Biotechnology, Bioremediation, Bioinformatics, etc., Biologically inspired engineering. Biomimicry in engineering using designs, processes, and ecosystems. Sustainable engineering. Case study: The Kingfisher's beak inspired high-speed Bullet trains.	09
2.	The fundamental building blocks of life Unity in diversity of life, Molecules of life. Structure and functions of carbohydrates, amino acids, proteins, and lipids. Hierarchy in protein structure. Primary secondary, tertiary, and quaternary structure. Proteins as enzymes, transporters, receptors, and structural elements. Nucleotides and DNA/RNA.	06




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3.	<p>Genetics and Information Transfer Genetics as the foundation of biology, Mendel's laws, Segregation and independent assortment, Gene mapping, Single gene disorders, Molecular basis of genetic information transfer, DNA as genetic material, Genetic code, Universality of genetic code, DNA replication, Protein synthesis, Central dogma of life: transcription and translation. Case study: Breaking the storage barrier by storing massive amounts of data on DNA.</p>	09
4.	<p>Enzymes Catalysis as a crucial element for life, Enzymology, Enzyme-catalyzed reactions, Enzyme-substrate complex, Mechanism of action, Enzyme classification, Enzyme kinetics, Enzyme inhibition, Industrial applications of enzymes.</p>	06
5.	<p>Metabolism Metabolism: catabolism and anabolism, Principles of energy transactions, ATP as energy currency, ATP cycle, Cellular respiration, Anaerobic respiration, Aerobic respiration, Metabolic regulation, Bioenergetics.</p>	06
6.	<p>Microbiology and Drug Discovery Introduction to biological classification: criteria of organization and hierarchy of life. Ecological aspects of single-celled organisms, Identification, and classification of microorganisms, Microbial growth kinetics, Microbial biotechnology. Drug discovery, Model organisms for biological studies <i>E. coli</i>, <i>S. cerevisiae</i>, <i>D. melanogaster</i>, <i>C. elegance</i>, <i>A. thaliana</i>, <i>M. musculus</i>. Vaccines, Targeted drug delivery Case study: Development of a nanoparticle-based vaccine delivery system for cancer immunotherapy.</p>	09
	Total	45

Textbooks:

1. Arthur T. Johnson, *Biology for Engineers*, 2nd Edition, CRC Press Taylor & Francis group, 2018.
2. Prescott, L.M J.P. Harley and C.A. Klein, *Microbiology*, 12th edition, McGraw-Hill Higher Education, 2022.

Reference Books

1. Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B., *Biology: A global approach*, 12th edition, Pearson Education Ltd.,2020.
2. Nelson, D. L.; Lehninger, A. L.; and Cox, M. M., *Principles of Biochemistry*, 8th edition, W.H. Freeman, 2020.

Laboratory/Tutorial details

- Not applicable.


