

<b>BIOLOGY FOR ENGINEERS</b>			
Subject Code	18CMBIT5010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
<b>Credits – 03</b>			
<b>Unit -1: Introduction</b>	<b>Hours</b>		
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayer.	08		
<b>Unit -2:Classification</b>	08		
Plant Hierarchy of life forms at phenomenological level- classification based on (a) cellularity - Unicellular or multicellular (b) ultra-structure- prokaryotes or eukaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophy, lithotrophs (d) Ammonia excretion – ammonotelic, uricotelic, ureotelic (e) Habitats- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E. coli, S.cerevisiae, D. Melanogaster, C. elegans, A. Thaliana, M. Musculus	08		
<b>Unit – 3:Genetics &amp; Biomolecules</b>	12		
Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be given not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	12		
<b>Molecules of life:</b> Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	12		
<b>Unit – 4:Enzymes &amp; Proteins</b>	12		
<b>Enzymology:</b> How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme action. -examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	12		
<b>Proteins-</b> structure and function. Hierarchy in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	12		
<b>Information Transfer:</b> The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double	12		

helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	
<b>Unit – 5:Microbiology &amp; Metabolism</b>	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoic reactions. Concept of $K_{eq}$ and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from $CO_2$ and $H_2O$ (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge <b>Concept of single celled organisms.</b> Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	10

<b>Text(T) / Reference(R) Books:</b>	
T1	Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
T2	Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
T3	Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
R1	Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
R2	Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
W1	<a href="https://ocw.mit.edu/courses/biological-engineering/">https://ocw.mit.edu/courses/biological-engineering/</a>
W2	<a href="https://onlinecourses.nptel.ac.in/noc16_ge03/preview">https://onlinecourses.nptel.ac.in/noc16_ge03/preview</a>

<b>Course Outcomes:</b> On completion of this course, students can	
CO1	Describe how biological observations of 18th Century that lead to major discoveries.
CO2	Convey that classification is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
CO3	Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
CO4	Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
CO5	Classify enzymes and distinguish between different mechanisms of enzyme action, To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”