

Dr. Ambedkar Institute of Technology, Bengaluru-56
Scheme and Syllabus

Course Title	BIOLOGY FOR ENGINEERS						
Course Code	BIT407B						
Branch	EEE, ECE, EIE, ETE, CSE, ISE, CSBS, AIML, ECE(VLSI), CSE (Data Science)						
Category	Basic Science Course (BSC)						
Scheme and Credits	No of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	25	2
CIE Marks:50	SEE Marks:50		Total Max. marks=100		Duration of SEE:02 Hours		

COURSE OBJECTIVES:

1. To convey that Biology is as important a scientific discipline as Physics, Chemistry and Mathematics.
2. To familiarize the students with the basic biological concepts and their engineering applications.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students develop the interdisciplinary vision of biological engineering.
5. To learn industrial and bioengineering applications.

UNIT No	Syllabus Content	No of Hours
1	<p>BIOMOLECULES AND THEIR APPLICATIONS(QUALITATIVE): Bio-molecules: Carbohydrates, Amino acids and Proteins, Lipids- classification, functions. Carbohydrates(cellulose-based water filters, PHA and PLA as bioplastics), Nucleicacids(DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics–DNA fingerprinting),Proteins(Proteins as food–whey protein and meat analogs, Plant based proteins), Lipids (biodiesel, cleaning agents/detergents) Enzymes: Enzymes, properties and classification. Mechanism of enzyme action.Enzymes and their application in Industry. Enzymes (glucose-oxidase in biosensors,lignolytic enzyme in bio-bleaching).</p>	5
2	<p>HUMAN ORGAN SYSTEMS AND BIODESIGNS-1(QUALITATIVE): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission,EEG,Robotic arms for prosthetics. Engineering solutions for Parkinson’s disease).Eye as a Camera system (architecture of rod and cone cells,optical corrections, cataract, lens materials, bionic eye).Heart as a pump system(architecture,electrical signaling-ECG monitoring and heart related issues,reasons for blockages of blood vessels, design of stents, pacemakers,defibrillators).</p>	5

3	HUMAN ORGAN SYSTEMS AND BIO-DESIGNS-2(QUALITATIVE): Lungs as purification system(architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as afiltration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).	5
4	NATURE-BIOINSPIRED MATERIALS AND MECHANISMS(QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train). Human Blood substitutes-hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	5
5	TRENDS IN BIOENGINEERING(QUALITATIVE): Bio-printing techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio-imaging and Artificial Intelligence for disease diagnosis. Self- healing Bio-concrete (based on bacillus spores, calcium lactate nutrients and bio-mineralization processes) and Bio-remediation and Bio-mining via microbial surface adsorption(removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).	5

COURSE OUTCOMES: On successful completion of this course,the students will be able to:
CO1: Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2: Evaluate the principles of design and development,for exploring novel bioengineering projects.
CO3: Corroborate the concepts of biomimetic for specific requirements.
CO4: Think critically towards exploring innovative bio-based solutions for socially relevant problems.

Mapping of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1			1									1
CO2	1		1			1							1	1	1
CO3	1		1			1							2	3	2
CO4	1		1			1							1	2	1

Strength of Correlation :Low-1, Medium-2, High-3

TEXTBOOK:

- Biology for Engineers**, Dr.Rajendra Singh C.,Dr.N Shankar Rao, IBOP Physics Facilitators, JIRS, Bangalore,2023.
- Biology for Engineers**,Wiley Precise Textbook series,1st Edition

REFERENCEBOOKS:

- Biology for Engineers**, Molecular Biology andBiotechnology2nd Edition. J.M.Walker and E.B.Gingold.T Johnson, CRC press, 2011.
- Biology: A global approach**,N.A.Campbell,J.B. Reece,L.Urry,M.L.Cain and S. A.Wasserman,Wiley Precise Textbook series,1st edition, Pearson Education Ltd,2018.