

<b>BIOLOGY FOR ENGINEERS</b>			
Course Code	21BE45	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0:0 /2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	02
<b>Course objectives:</b> <ul style="list-style-type: none"> <li>➤ To familiarize the students with the basic biological concepts and their engineering applications.</li> <li>➤ To enable the students with an understanding of biodesign principles to create novel devices and structures.</li> <li>➤ To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.</li> <li>➤ To motivate the students develop the interdisciplinary vision of biological engineering.</li> </ul>			
<b>Teaching-Learning Process (General Instructions)</b> These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. <ul style="list-style-type: none"> <li>✓ Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.</li> <li>✓ Instructions with interactions in classroom lectures (physical/hybrid).</li> <li>✓ Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.</li> <li>✓ Flipped classroom sessions (~10% of the classes).</li> <li>✓ Industrial visits, Guests talks and competitions for learning beyond the syllabus.</li> <li>✓ Students' participation through audio-video based content creation for the syllabus (as assignments).</li> <li>✓ Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.</li> <li>✓ Students' seminars (in solo or group) /oral presentations.</li> </ul>			
<b>Module-1 (5 Hours)</b>			
<b>BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):</b> Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (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 (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).			
<b>Module-2 (5 Hours)</b>			
<b>HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):</b> 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 signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).			
<b>Module-3 (5 Hours)</b>			
<b>HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):</b> Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).			
<b>Module-4 (5 Hours)</b>			
<b>NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):</b> Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).			
<b>Module-5 (5 Hours)</b>			
<b>TRENDS IN BIOENGINEERING (QUALITATIVE):</b> Bioprinting 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, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).			

Department Of Biotechnology,

Sir M Visvesvaraya Institute of Technology



# **A Two Day FDP on “Biology for Engineers”**

**Date: 15th and 16th December 2022**

## **Course material**

**Organized By**



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