AAVARTAN'23-24

VIGYAAN
DEPARTMENT OF BIO-TECHNOLOGY ENGINEERING

PROBLEM STATEMENTS

BIT01.   <u>Revolutionizing   Plastics: Crafting   Biodegradable   Plastics   for   a Sustainable Tomorrow</u>

Plastic pollution is a global crisis, with conventional plastics wreaking havoc on our environment. As future innovators and stewards of our planet, your challenge is to lead the charge towards a greener future by developing degradable plastics – an ingenious solution that promises to reduce plastic waste and environmental impact. Your task is to create biodegradable plastics. Pave the way for a world where plastics no longer harm our planet, but instead contribute to its well being.

BIT02.   Enzyme Kinetics and Inhibition Analysis

The problem at hand pertains to the realm of Enzyme Kinetics and Inhibition Analysis. This study aims to comprehensively investigate the catalytic behavior of enzymes and their interaction with inhibitors. The primary objective is to elucidate the underlying mechanisms governing enzyme-substrate interactions, reaction rates, and the impact of various inhibitors on enzyme activity. Develop a computational model that accurately characterizes the kinetics of enzyme-catalyzed reactions, enabling the prediction of reaction rates under varying conditions and the assessment of how different inhibitors influence enzymatic activity.

BIT03.   Cellular Agriculture/Sustainable Nutrient Solutions for Efficient Cell
              Culture in Food Production

Development of cost-effective and sustainable nutrient sources for cell cultures is a key challenge. The cultivation of cells for food products requires nutrient-rich media that support cell growth, differentiation, and product synthesis.
Develop nutrient formulations and sourcing strategies that optimize cost efficiency and sustainability. Ensuring the nutritional requirements for optimal cell growth while minimizing production costs and environmental impact.

BIT04.   Microbial Power Innovation: Designing Microbial Fuel Cells for Sustainable
              Energy Generation

Microbial Fuel Cells (MFCs) are emerging as a fascinating avenue for renewable energy production, tapping into the metabolic capabilities of microorganisms to generate electricity from organic matter. In this exciting challenge, aspiring students are invited to explore the world of bioenergy and create functional Microbial Fuel Cells. Your task is to design and construct a simple yet efficient MFC system that demonstrates the conversion of organic waste materials into electricity. Develop innovative strategies to optimize power output, enhance microbial activity, and showcase the potential of MFCs in sustainable energy solutions.

BIT05.   Optimization of Algal Biorefineries

Efficiently optimizing algal biorefineries is crucial to harness the full potential of renewable algae biomass for producing biofuels, biochemicals, and other valuable products. The challenge involves improving algal cultivation, extraction, and conversion processes to achieve higher yields, reduced energy consumption, and minimized environmental impact. Develop a computational approach to enhance the growth of algae and streamline their conversion into biofuels, valuable chemicals, and nutritional supplements. This model should consider factors like nutrient availability, light exposure, and metabolic pathways to optimize the overall process efficiency and yield of desired products.

BIT06.   Bioremediation of Oil Spills

Oil spills pose substantial threats to marine and coastal ecosystems, resulting in severe environmental degradation, ecosystem disruption and economic loss. Innovate efficient and sustainable Bioremediation techniques for oil spills, harnessing the potential of microorganisms to efficiently degrade oil pollutants.

BIT07.   Technologies to improve Virtual Reality/Augmented Reality

Design and develop innovative technologies that enhance the immersive experience, interaction, and realism in virtual reality and augmented reality environments, addressing challenges such as reducing motion sickness, enhancing spatial tracking accuracy, optimizing hardware efficiency, and creating seamless integration between virtual and physical worlds.

BIT08.   <u>Design an AI System that detects the traits of human disease and drugs insertions in humans.</u>

Design an AI-powered system that utilizes advanced machine learning algorithms to accurately detect and predict human disease traits based on a comprehensive analysis of medical data. The system should also provide personalized recommendations for appropriate drug insertions, taking into consideration individual patient profiles, genetic information,
and medical history. The goal is to enhance diagnostic accuracy, improve treatment outcomes, and optimize drug prescriptions for various
diseases.

BIT09.   <u>Antibiotic Resistance: Finding innovative solutions to combat the growing problem of antibiotic resistance.</u>

Antibiotic resistance is a global public health crisis, with the emergence of multidrug-resistant pathogens rendering existing antibiotics less effective or entirely ineffective. The scarcity of new antibiotics in the pipeline exacerbates this issue. Developing innovative solutions to address antibiotic resistance and discover new treatment approaches is crucial to ensure our ability to combat infectious diseases. Develop and optimize bacteriophage-based therapies that target specific bacterial strains, providing an alternative to traditional antibiotics. Phage therapy can exploit the natural host pathogen interactions to selectively eliminate bacteria.

BIT10.   <u>Creating Biosensors for Real-Time Disease Monitoring</u>

Engineer biosensors using synthetic biology techniques to detect disease-specific biomarkers in bodily fluids. Integrate these biosensors with wearable or implantable devices for continuous, real time monitoring of health conditions, enabling early diagnosis and intervention.

BIT11.   <u>Developing CRISPR-Based Therapies for Genetic Disorders</u>

Design and validate a CRISPR-based gene editing approach for correcting specific genetic mutations associated with hereditary disorders. Address challenges like off-target effects and delivery methods to ensure safe and precise genome modification.

BIT12.   <u>Food security</u>

A very important challenge that hopes to use biotechnology is to address food security objectives. There are many challenges in food safety, such as changes in environment leading to food contamination, changes in food production and supply, hazards such as microbiological, physical and chemical hazards. Design a food security program to overcome these challenges.