# AAVARTAN'25-26

# VIGYAAN

## DEPARTMENT OF BIOTECHNOLOGY ENGINEERING

## PROBLEM STATEMENTS

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### BT01: Drug Discovery using AI and Machine Learning

Drug discovery is slow, costly, and data-heavy, demanding smarter approaches. The challenge is to build an AI/ML-powered model that predicts drug targets, designs molecules, repurposes compounds, and reduces false positives. Teams must deliver an efficient end-to-end workflow for rapid, data-driven drug development.

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### BT02: CRISPR-Cas9 in Genetic Disorder

Genetic disorders persist due to inefficient and error-prone editing methods. The task is to design a CRISPR-Cas9 model that enables precise gene correction with lower off-target effects and safer delivery. Teams must provide a demonstrable gene-editing framework with improved efficiency and therapeutic potential.

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### BT03: Development of Cost-Effective Vaccines

High vaccine costs and cold-chain dependence limit global accessibility. The challenge is to model low-cost, thermostable vaccine platforms—recombinant, mRNA, or controlled-release systems—that allow rapid scaling. Teams must deliver a design enabling faster production, biocompatibility, and affordability.

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### BT04: Nanobiotechnology in Targeted Drug Delivery

Conventional drugs struggle with poor targeting and systemic side effects. The task is to build a nanobiotechnology-based delivery model

that uses nanosystems and receptor-mediated mechanisms for precision therapy. Teams must present a targeted, efficient, and clinically relevant nano-delivery strategy.

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## BT05: Stem Cell Therapy for Degenerative Diseases

Degenerative diseases lack curative options due to irreversible tissue loss. The challenge is to model a stem-cell-based therapeutic system using iPSCs/MSCs for regeneration, safe delivery, and controlled differentiation. Teams must propose a translational pathway supported by promising preclinical evidence.

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## BT06: Genetically Modified Crops for Drought Resistance

Drought severely reduces crop yield and threatens food security. The task is to design a model using GM and CRISPR-engineered crops that enhance survival, reduce fertilizer needs, and improve nutrient uptake. Teams must deliver a sustainable drought-resilience strategy with viable GM and non-GM options.

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## BT07: Biopesticides as Alternatives to Chemical Pesticides

Chemical pesticides harm ecosystems and lose effectiveness over time. The challenge is to model biopesticides using microbial blends, Bt, or Trichoderma with improved stability and region-specific performance. Teams must deliver an eco-friendly pest-control framework that boosts soil synergy and adoption.

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## BT08: Biofortification of Crops to Combat Malnutrition

Micronutrient deficiencies persist despite supplementation programs. The task is to design a biofortification model using GM or conventionally bred crops enriched with essential vitamins and minerals. Teams must deliver a scalable, rural-friendly solution improving nutrient intake and long-term health.

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## BT09: Plant Tissue Culture for High-Yield Production

Traditional breeding is slow and vulnerable to disease. The challenge is to model tissue-culture workflows that mass-produce clean, high-yield plants through micropropagation and callus culture. Teams must optimize media, reduce contamination, and demonstrate applications for food, fuel, and biomass crops.

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## BT10: Microbial Inoculants for Soil Fertility Enhancement

Soil fertility declines due to chemical misuse and nutrient depletion. The task is to design a model of microbial inoculants that enhance nutrient cycling, root interaction, and soil health. Teams must propose effective microbial formulations and application strategies for sustainable agriculture.

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## BT11: Biofuels from Algae and Lignocellulosic Biomass

Fossil-fuel dependence and food-crop competition limit earlier biofuel approaches. The challenge is to model biofuel production using algae or lignocellulosic waste for sustainable, high-yield energy generation. Teams must deliver a viable conversion pathway with improved efficiency and scalability.