



ADHIYAMAAN COLLEGE OF ENGINEERING

(An Autonomous Institution)

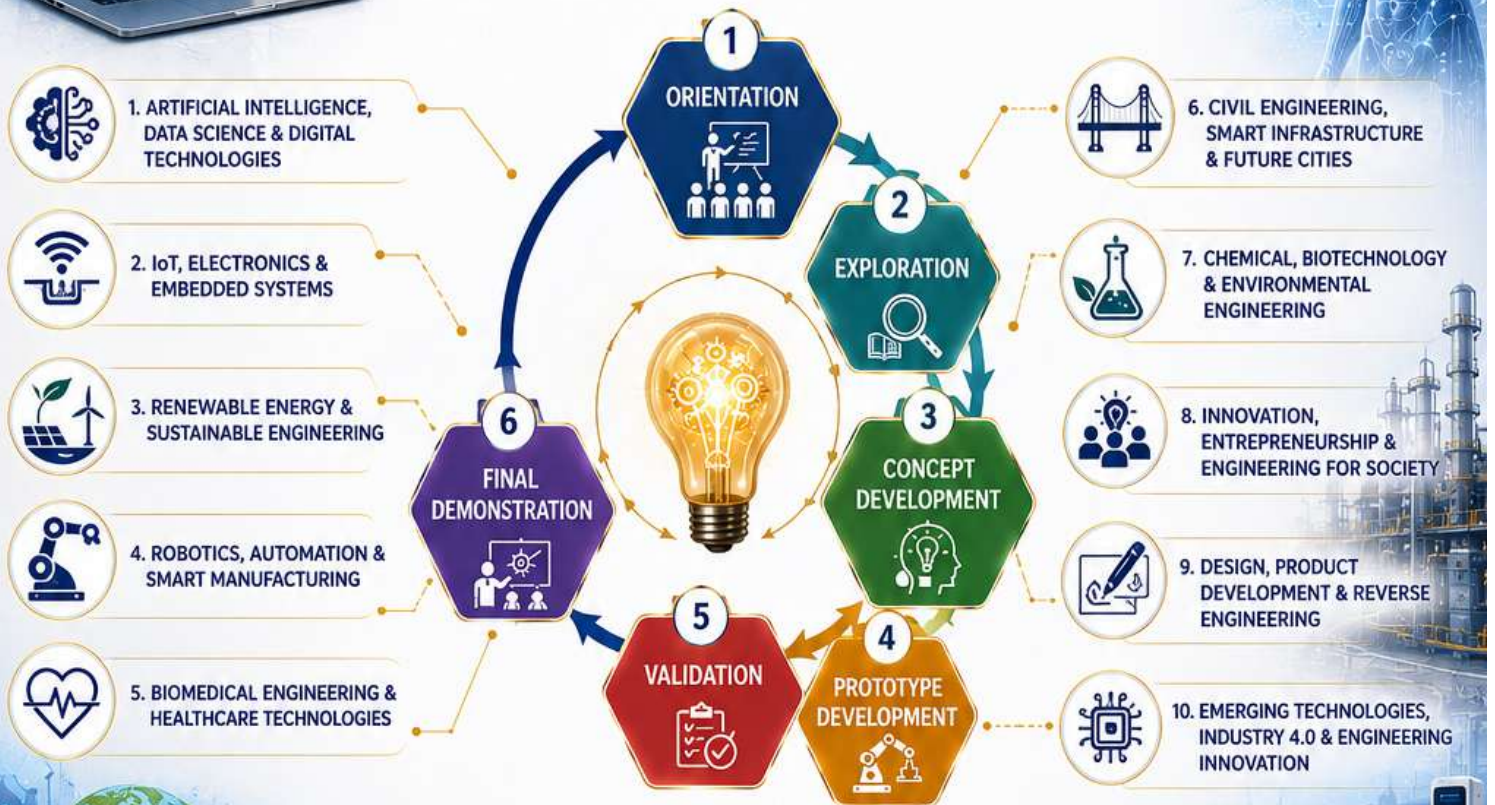
HOSUR - TAMIL NADU

ENGINEERING EXPLORATION

STANDARD OPERATING PROCEDURE (SOP)

(REGULATION 2025)

EXPLORE • INNOVATE • DESIGN • BUILD • IMPACT



INTEGRATING SUSTAINABILITY & SDGs



Prepared by
INTERNAL QUALITY ASSURANCE CELL (IQAC)
ACADEMIC YEAR 2025-2026

STANDARD OPERATING PROCEDURE (SOP)
Engineering Explorations
(Regulation 2025)

1. Purpose

The Engineering Explorations course is designed to expose undergraduate engineering student to multidisciplinary engineering concepts, contemporary technologies, innovation practices and societal problem-solving. The course enables students to understand engineering beyond their core discipline and cultivate innovation, critical thinking, teamwork, design knowledge etc..

By the end of the IV Semester, every student shall have explored engineering from multiple perspectives and completed a multidisciplinary engineering exploration project.

2. Objectives

The Engineering Explorations course aims to:

- Introduce students to emerging technologies and Industry 4.0.
- Encourage innovation, sustainability, and entrepreneurship.
- Provide broad exposure to multiple engineering disciplines.
- Prepare students for interdisciplinary projects, internships, and capstone projects.

3. Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Explain the role of various engineering disciplines in solving real-world problems.
2. Identify engineering challenges in industry, society, healthcare, agriculture, and the environment.
3. Develop prototypes, simulations, or proof-of-concept models.
4. Communicate technical ideas through reports, posters, and presentations.
5. Demonstrate professional ethics, sustainability, and societal responsibility.

4. Course Structure

1. The course shall span the entire III and IV Semesters.
2. **Duration:** One Academic Year (III & IV Semesters)
3. **Credits:** 1
4. **Student Group Size:** Maximum 6 Students

5. **Faculty Mentor:** Mentor for 1/2/3 Team(s)
6. **Evaluation:** Continuous Assessment and Final Dissertation

4.1. Team Formation

- Students shall form multidisciplinary teams wherever feasible.
- Each team shall consist of six students.
- Every team shall be allotted a unique Engineering Exploration topic as listed.
- No two teams shall undertake identical projects without approval from the Course Coordinator.

4.2. Best Practices

Students are encouraged to:

- Visit industries and research laboratories.
- Attend technical workshops and webinars.
- Use open-source tools and simulation software.
- Integrate sustainability and SDGs into project design.
- Explore patent databases before implementation.
- Publish innovative outcomes in student conferences where appropriate.

4.3. Faculty Mentoring

Each student team shall be assigned one faculty mentor.

The mentor shall:

- Guide topic selection.
- Conduct weekly mentoring sessions.
- Review documentation.
- Recommend improvements.
- Evaluate progress at each milestone.

Faculty mentors and Domain coordinators may be assigned from any department based on expertise.

5. Engineering Exploration Domains

Students may select topics from, but not limited to:

Domain 1: Artificial Intelligence, Data Science & Digital Technologies

1. AI for Smart Campus Management
2. AI-based Attendance System
3. AI Chatbot for Student Services
4. Predictive Maintenance using Machine Learning
5. AI for Crop Disease Detection
6. AI-based Water Quality Analysis
7. Intelligent Traffic Prediction
8. AI-assisted Healthcare Monitoring
9. Computer Vision for Defect Detection
10. Fake News Detection using NLP
11. AI-based Energy Consumption Prediction
12. Smart Waste Segregation using AI
13. Digital Twin of a Smart Building
14. AI-based Air Quality Monitoring
15. Recommendation System for Learning
16. AI-enabled Disaster Prediction
17. Smart Examination Analytics
18. AI-assisted Engineering Design
19. Machine Learning for Weather Forecasting
20. Generative AI for Engineering Applications

Domain 2: IoT, Electronics & Embedded Systems

1. Smart Irrigation System
2. Smart Street Lighting
3. Smart Parking System
4. IoT-based Weather Station
5. Smart Water Tank Monitoring
6. Smart Home Automation
7. Smart Electricity Meter
8. Smart Energy Meter
9. IoT-based Healthcare Monitoring
10. Embedded Fire Detection System
11. RFID-based Smart Library
12. Smart Hostel Monitoring
13. GPS Vehicle Tracking
14. Wireless Sensor Network

15. Smart Helmet
16. Embedded Smart Classroom
17. Automatic Street Light Controller
18. Smart Retail Billing System
19. Voice-controlled Appliances
20. Smart Security Surveillance System

Domain 3: Renewable Energy & Sustainable Engineering

1. Solar-powered Water Purifier
2. Solar Tracking System
3. Solar EV Charging Station
4. Wind Energy Monitoring
5. Hydrogen Energy Applications
6. Campus Energy Audit
7. Green Building Concepts
8. Smart Rainwater Harvesting
9. Smart Composting System
10. Biofuel Production
11. Waste-to-Energy System
12. Smart Microgrid
13. Carbon Footprint Assessment
14. Plastic Recycling Technologies
15. Energy-efficient Home Design
16. Smart Water Conservation
17. Sustainable Agriculture Technologies
18. Carbon Neutral Campus
19. Smart Greenhouse
20. Circular Economy Applications

Domain 4: Robotics, Automation & Smart Manufacturing

1. Line Following Robot
2. Obstacle Avoiding Robot
3. Robotic Arm
4. Warehouse Automation
5. Industrial Robot Simulation
6. Fire Fighting Robot
7. Agricultural Robot
8. Drone-based Surveillance
9. Autonomous Delivery Robot
10. Smart Conveyor System
11. Automated Sorting Machine

12. Digital Manufacturing
13. CNC Process Optimization
14. Industry 4.0 Factory Model
15. Additive Manufacturing
16. Reverse Engineering of Consumer Products
17. Smart Inventory System
18. Predictive Machine Maintenance
19. Digital Factory Simulation
20. Autonomous Material Handling

Domain 5: Biomedical Engineering & Healthcare Technologies

1. Smart Health Monitoring Device
2. Wearable Fitness Tracker
3. ECG Monitoring System
4. Smart Wheelchair
5. AI-based Disease Prediction
6. Medical Image Analysis
7. Telemedicine Platform
8. Smart Medicine Box
9. Elderly Care Monitoring
10. Portable Health Kiosk
11. Oxygen Monitoring System
12. AI-based Skin Disease Detection
13. Biomedical Waste Management
14. Smart Prosthetic Design
15. Remote Patient Monitoring
16. Smart Hospital Dashboard
17. Health Risk Prediction
18. Smart Rehabilitation Device
19. Water Quality Monitoring for Healthcare
20. Healthcare Chatbot

Domain 6: Civil Engineering, Smart Infrastructure & Future Cities

1. Smart Traffic Signal System
2. Bridge Health Monitoring
3. Flood Monitoring System
4. Earthquake-resistant Structures
5. Smart Drainage Monitoring
6. Green Roof Technology

7. Sustainable Urban Planning
8. Digital Building Information Model (BIM)
9. Smart Construction Safety
10. Smart Village Development
11. Intelligent Road Monitoring
12. Smart Water Distribution
13. Smart Bus Stop
14. Campus Accessibility Audit
15. Urban Heat Island Analysis
16. Disaster-resilient Infrastructure
17. Smart Public Utility Monitoring
18. Sustainable Pavement Materials
19. Intelligent Parking Infrastructure
20. Smart Campus Infrastructure

Domain 7: Chemical, Biotechnology & Environmental Engineering

1. Natural Water Purification
2. Wastewater Treatment
3. Biofertilizer Production
4. Green Chemistry Applications
5. Carbon Capture Technologies
6. Plastic Upcycling
7. Natural Dye Extraction
8. Biogas Production
9. Heavy Metal Detection
10. Food Waste Management
11. Water Recycling System
12. Compost Quality Assessment
13. Biodegradable Packaging
14. Smart Pollution Monitoring
15. Environmental Risk Assessment
16. Sustainable Chemical Processes
17. Indoor Air Quality Assessment
18. Eco-friendly Cleaning Products
19. Enzyme-based Green Processes
20. Biofuel from Waste

Domain 8: Innovation, Entrepreneurship & Engineering for Society

1. Campus Sustainability Dashboard
2. Women's Safety Device
3. Smart Tourism Guide

4. Rural Healthcare Solution
5. Digital Agriculture Marketplace
6. Smart Library Management
7. Assistive Technology for Persons with Disabilities
8. Community Innovation Challenge
9. Smart Disaster Alert System
10. Food Donation Platform
11. Skill Development Portal
12. Local Business Digitalization
13. Smart Recycling Campaign
14. Carbon Neutral Campus Initiative
15. Water Conservation Technologies
16. Green Mobility Solutions
17. Campus Navigation Application
18. Digital Volunteer Platform
19. Technology for SDGs
20. Student Start-up Prototype

Domain 9: Design, Product Development & Reverse Engineering

1. Design Thinking for Social Innovation
2. Biomimicry in Product Design
3. Reverse Engineering of Household Appliances
4. Product Redesign for Sustainability
5. Eco-friendly Consumer Product Design
6. Ergonomic Product Development
7. Modular Product Design
8. Low-cost Assistive Device Design
9. Sustainable Packaging Design
10. CAD-based Product Development
11. Rapid Prototyping using 3D Printing
12. Failure Analysis of Consumer Products
13. Design Optimization using Simulation
14. Nature-inspired Engineering Solutions
15. Product Lifecycle Analysis
16. Human-centered Design
17. Digital Product Prototyping
18. Functional Product Disassembly
19. Design for Manufacturability
20. Reverse Engineering using 3D Scanning

Domain 10: Emerging Technologies, Industry 4.0 & Engineering Innovation

1. Digital Twin Applications
2. Cyber-Physical Systems
3. Smart Factory Solutions
4. AI-assisted CAD Design
5. Edge Computing Applications
6. Blockchain for Engineering Systems
7. Augmented Reality for Engineering Education
8. Virtual Reality-based Industrial Training
9. AI-assisted Simulation
10. Smart Predictive Analytics
11. Quantum Computing Applications in Engineering
12. Cloud-based Manufacturing
13. Human-Robot Collaboration
14. Smart Supply Chain Management
15. Engineering Metaverse Concepts
16. Industry 5.0 Applications
17. AI-assisted Quality Inspection
18. Intelligent Decision Support Systems
19. Autonomous Engineering Systems
20. Future Engineering Technologies

6. Engineering Exploration Process

Phase I – Orientation (Weeks 1–2)

Students shall undergo orientation on:

- Design Thinking
- Engineering Design Process
- Sustainability
- Project Management
- Technical Documentation

Phase II – Exploration (Weeks 3–6)

Students shall:

- Literature Survey on selected engineering domain.
- Conduct literature surveys.
- Visit laboratories/Industries.
- Interact with faculty experts.
- Identify real-world problems.

Deliverable:

- Problem Identification Document

Phase III – Concept Development (Weeks 7–10)

Students shall:

- Generate multiple solution concepts.
- Perform feasibility studies.
- Select the best solution.
- Prepare system architecture.
- Plan implementation.

Deliverable:

- Concept Proposal
- Design Document

Phase IV – Prototype Development (Weeks 11–16)

Students shall:

- Develop prototype/model/simulation.
- Record observations.
- Improve the design.

Deliverable:

- Prototype

Phase V – Validation (IV Semester)

Students shall:

- Validate the proposed solution.
- Compare with existing solutions.
- Incorporate mentor feedback.
- Improve system performance.

Deliverable:

- Validation Report

Phase VI – Final Demonstration

Each team shall present:

- Working prototype/simulation with posters
- Engineering Report
- Project Presentation and Demonstration

7. Timeline

Semester-wise Timeline

Phase	Semester	Week(s)	Major Activities	Deliverables	Review
Phase I	III	Weeks 1–2	• Orientation Programme • Design Thinking • Engineering Design Process • Sustainability & SDGs • Project Management • Technical Documentation • Team Formation & Mentor Allocation	• Team Formation • Mentor Allocation • Learning Reflection	Review-I
Phase II	III	Weeks 3–6	• Literature Survey • Laboratory Visits/ Industry Visit/Interaction • Expert Lectures • Problem Identification • Benchmarking Existing Solutions	• Problem Identification Report • Literature Review • Problem Statement	Review-II

Phase III	III	Weeks 7–10	• Brainstorming & Ideation • Concept Generation • Feasibility Analysis (Technical, Economic & Environmental) • Work Plan Preparation	• Concept Proposal • Design Document • Implementation Plan	Review-III
Phase IV	III	Weeks 11–16	• CAD/Simulation/Programming • Prototype Fabrication • Experimentation • Data Collection • Prototype Improvement	• Prototype Version-I • Progress Report	Semester End Review
Phase V	IV	Weeks 1–8	• Prototype Refinement • Performance Testing • Validation • Comparison with Existing Solutions • Mentor Feedback & Modifications	• Validation Report • Prototype Version-II	Review-IV
Phase VI	IV	Weeks 9–12	• Performance Optimization • Cost Analysis • Sustainability Assessment • Documentation • Preparation of Poster & Presentation	• Final Technical Report • Poster • Presentation Slides	Review-V

Phase VII	IV	Weeks 13–16	• Final Demonstration • Project Exhibition • Viva Voce • Evaluation by Expert Committee	• Working Prototype/Simulation • Engineering Report • Poster Presentation • Project Demonstration	Final Evaluation
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8. Assessment

Component	Weightage
Literature Review	10%
Problem Identification	10%
Design & Innovation	20%
Prototype Development	20%
Progress Reviews	20%
Documentation	5%
Poster & Presentation	5%
Final Demonstration	10%
Total	100%

9. Continuous Improvement

The Engineering Explorations course shall be reviewed annually based on:

- Student feedback
- Faculty mentor feedback
- Industry expert recommendations
- Academic audit observations
- Outcome attainment
- Prototype quality
- Innovation and patent potential
- Alignment with NBA, NAAC, AICTE, and NEP 2020 requirements

Prepared by

IQAC

Principal

ADHIYAMAAN COLLEGE OF ENGINEERING
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Office of the Principal

ACE/2026-27/EE/02

Date: 22-07-2026

CIRCULAR

Sub: Constitution of Engineering Exploration Implementation Committee – Appointment of Overall Coordinator and Domain Coordinators – Reg.

As per the provisions of Regulation 2025, the Engineering Exploration course shall be implemented for all II Year B.E./B.Tech. students from the Academic Year 2026–2027.

Overall Programme Coordinator

Dr. D. Thilagavathy-HoD/IT

Domain Coordinators

S. No.	Engineering Exploration Domain	Domain Coordinator
1	Artificial Intelligence, Data Science & Digital Technologies	Mrs. T. Vinothini/CSE
2	IoT, Electronics & Embedded Systems	Dr. Xavier Arokiyaraj/ECE
3	Renewable Energy & Sustainable Engineering	Dr. K. Senthil/EEE
4	Robotics, Automation & Smart Manufacturing	Dr. James Selvakumar/Mech
5	Biomedical Engineering & Healthcare Technologies	Mr. Kaviyarasu/BME
6	Civil Engineering, Smart Infrastructure & Future Cities	Mr. Diwakar/civil
7	Chemical, Biotechnology & Environmental Engineering	Dr. Nagarajan/Chem
8	Innovation, Entrepreneurship & Engineering for Society	Mrs. Sakthidevi/IT
9	Design, Product Development & Reverse Engineering	Mrs. Suriya/ECE
10	Emerging Technologies, Industry 4.0 & Engineering Innovation	Mrs. B. Uma/ECE

Immediate Action Points

All Domain Coordinators are requested to initiate the implementation process immediately by undertaking the following activities:

1. Convene a meeting with the faculty mentors associated with the respective domain.
2. Finalize mentor allocation in consultation with the respective Heads of Departments.
3. Prepare the domain-wise implementation schedule and review calendar.
4. Coordinate laboratory, IDEA Lab and industry resources required for project execution.
5. Plan orientation sessions for student teams.
6. Submit the Domain-wise Implementation Plan, including mentor allocation and review schedule, to the Overall Programme Coordinator on or before 30/07/2026
7. All Heads of Departments and faculty members are requested to extend their full cooperation to ensure the successful implementation of the Engineering Exploration Programme in accordance with the approved SOP.


Principal 21/7/26

Copy to:

- Deans
- Heads of Departments
- IQAC
- IDEA Lab
- All Domain Coordinators
- Office File