Annexure I: Course Curriculum

MODULE WISE COURSE CONTENT AND OUTCOME				
Sl. No	**Module Name**	**Module Content**	**Module Learning Outcome**	**Duration (Hrs)**
1	INTRODUCTION TO ECU SIMULATION	Introduction to Automotive, Vehicle E&E Architecture, Partner ECU Simulation, Vehicle sub-system, and Network communication.	• Gain knowledge of the automotive industry's structure and key players. • Understand basic automotive components and their purposes. • Understand the structure and operation of various ECUs (Electronic Control Units) and wiring harnesses. • Learn how	9

			partner ECUs interact within a networked vehicle system. • Explore how sub-systems contribute to overall vehicle performance and safety. • Understand key automotive communication protocols, including CAN, LIN, MOST, and Ethernet.	

2	AUTOMOTIVE COMMUNICATION PROTOCOLS	Introduction about different types of communication protocols, Importance of CAN Protocol, Frame format, and different types. Applications of communications protocols.	• Gain a foundational understanding of various types of communication protocols used in technology and their significance in enabling data exchange across systems. • Learn about the importance of the Controller Area Network (CAN) protocol in embedded systems, particularly in automotive and industrial applications. • Comprehe	9

			nd the structure of data frames in communication protocols, including the role of each field in ensuring successful data transfer. • Differentiate between key protocols, such as serial, parallel, and wireless protocols, with real-world examples. • Identify and describe real-world applications of various communication protocols across	

			industries, such as automotive, IoT, industrial automation, and healthcare.	
3	VECTOR CANOE TOOL INTRODUCTION	Install & Configuration of CANoe, Tool Overview, creating a sample Configuration about CANoe, how to send the messages and Interactive generator block, Introduction about CAPL Browser.	• Gain foundational knowledge of the CANoe tool and its purpose in vehicle network simulation, testing, and diagnostics. • Understand the workflow to customize CANoe setups for network communication and message analysis. • Explore the	9

			functionality of the Interactive Generator block for creating and sending CAN frames in real-time. • Gain an introductory understanding of the CAPL (CAN Access Programming Language) Browser. • Apply theoretical knowledge to practical tasks like setting up configurations, interacting with the CAN bus, and analyzing communication. • Enhance troubleshooting abilities by	

			working with CANoe tools to diagnose and address network communication issues.	
4	REAL-TIME USE CASES WITH VECTOR CANOE	How to understand the OEM requirements, practice with the use cases how to use the CANoe tool and CAPL Scripting part, and how to write the test cases.	• Gain the ability to analyze and interpret Original Equipment Manufacturer (OEM) specifications to ensure alignment with industry standards and project objectives. • Develop hands-on experience in utilizing the CANoe tool for simulation, testing, and	9

			analysis in automotive communication networks. • Learn the fundamentals and advanced techniques of CAPL (CAN Access Programming Language) scripting for automating and customizing test cases. • Writing, debugging, and executing CAPL scripts to simulate and validate automotive communication protocols. • Understand the	

			process of designing comprehensive test cases based on system requirements and use case scenarios.	
5	INTRODUCTION UDS PROTOCOL	Understand the Diagnostics concepts, OBD Tool, Onboard and Off-board diagnostics, UDS with CANOE	• Gain foundational knowledge of automotive diagnostic systems and their role in fault detection and repair processes. • Learn the purpose and functionality of On-Board Diagnostics (OBD) systems in monitoring vehicle health and emissions. •	9

			Distinguish between onboard diagnostics (vehicle-embedded systems) and offboard diagnostics (external tools and equipment). • Develop a working knowledge of the Unified Diagnostic Services (UDS) protocol and its significance in automotive diagnostics. • Understand how to use the CANoe tool for simulating and testing diagnostic	

			protocols.	

Annexure II: Use Cases and Test Projects

USE CASES:

1.Implementation of LED Blinking Control via Switch Press using CANoe Simulation Tool.

2. Design and Simulation of Autonomous Emergency Braking System Using CANoe.

3. Simulation of Automatic Door Locking System in CANoe.

4. Development of Pre-Crash Seat Belt Control System.

5. Development and Simulation of Tire Pressure Monitoring System in CANoe.

TABLE 2: LIST OF TEST PROJECTS (20 PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOMES)	
S.NO	**Final Projects**
1	Implementation of LED Blinking Control via Switch Press using CANoe Simulation Tool
2	Design and Simulation of Autonomous Emergency Braking System Using CANoe
3	Simulation of Automatic Door Locking System in CANoe
4	Development of Pre-Crash Seat Belt Control System
5	Development and Simulation of Tire Pressure Monitoring System in CANoe
6	Development and Simulation of Headlight Control System in CANoe Using Ambient Light Sensors
7	Implementation of Wiper Control System Based on Rain Sensors in CANoe
8	Simulation of Vehicle Speed Monitoring and Overspeed Warning System in CANoe
9	Design and Simulation of Electronic Parking Brake System Using CANoe

10	Implementation of Anti-lock Braking System (ABS) Control Logic Using CANoe
11	Simulation of Cruise Control with Adaptive Speed Adjustment Using CANoe
12	Development of Centralized Door Locking System with Remote Key Access in CANoe
13	Design and Simulation of Lane Keeping Assist System Using CANoe
14	Implementation of Battery Management System (BMS) Simulation Using CANoe
15	Development and Simulation of Rearview Mirror Adjustment System Based on Driver Preference
16	Simulate a communication error on the CAN bus and verify fault detection by the ECU.
17	Validate CAN communication between multiple ADAS ECUs in a simulated network.
18	Test the effect of introducing bus load on CAN message delivery.
19	Verify object detection functionality using LiDAR or radar input simulations.
20	Perform a real-time simulation of traffic scenarios (e.g., city traffic, highway).

Annexure III: Assessment Rubrics

TABLE 3: COURSE ASSESSMENT RUBRICS (TOTAL MARKS: 70)				
ASSESSMENT CRITERIA	**FAIR (50%-64%)**	**GOOD (65%-79%)**	**EXCELLENT (80%-100%)**	**WEIGHTAGE (MARKS)**
Practical Skills Proficiency	Basic understanding with gaps.	Solid understanding of key concepts.	Comprehensive understanding	20
Technical Knowledge Application	Limited practical application.	Competent application with minor errors.	Innovative solutions	20
Project Execution	Basic project with minimal innovation.	Meets project objectives effectively.	Exceeds expectations with innovative implementation	20
Communication and Reporting	Needs improvement in communication.	Clear presentation with minor gaps.	Professional and comprehensive presentation.	10