ELECTRIC VEHICLES & TELEMATICS SOFTWARE DEVELOPMENT

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SUMMARY

This 100-hour online certificate course is designed for Diploma & Bachelor's students and professionals who want to build a strong foundation in Electric Vehicle (EV) Technology and Telematics Software Development.

COURSE DETAILS

Course Name	Certificate program on Electric Vehicles & Telematics Software Development
Course Structure	**Parts: 3** | **Modules**: 10 each | **Duration**: 30 Hours each | **Level**: Intermediate to advanced
Assessment	Final assessment and certification (2 hours each) will be conducted separately to validate learning and award certificates.
Target Audience	Diploma & Bachelor's Students and Professionals
Prerequisites	Basic knowledge on Electrical, Electronics, Physics, Mechanics, Computer Programming, Interest in Automotive Technology & Sustainability
Outcome	Certified candidates can secure EV industry jobs or start their own EV startup

COURSE MODULES - PART 1 (ELECTRIC VEHICLE & SOFTWARE DEVELOPMENT) — 30 hours

Module 1: Introduction to Electric Vehicles — 3 hours

- History & Evolution of Electric Vehicles
- Types of Electric Vehicles (BEV, HEV, PHEV, FCEV)
- EV Market Trends & Future Scope
- Basic Working Principle of an EV
- Key Components of an EV (Motor, Battery, Controller, Charger, etc.)
- Comparison: EV vs ICE (Internal Combustion Engine) Vehicles
- Assignment & Quiz

Module 2 : EV Powertrain & Motor Technology — 3 hours

- EV Powertrain Architecture
- Types of Motors Used in EVs (BLDC, PMSM, Induction Motors, etc.)
- Motor Efficiency & Performance Analysis
- Motor Controllers & Inverters in EVs
- Regenerative Braking System
- Case Study: Tesla's Powertrain vs Indian EVs
- Assignment & Quiz

Module 3: Battery Technology & Battery Management System (BMS) 3 hours

- Battery Chemistry (Li-ion, LFP, NMC, Solid State, etc.)
- Battery Design & Manufacturing Process
- Battery Charging & Discharging Cycles
- State of Charge (SOC) & State of Health (SOH) Calculation
- Thermal Management of Batteries
- Safety and Protection Mechanisms in BMS
- Case Study: Tesla vs Ather Battery Technology
- Assignment & Quiz

Module 4: Charging Infrastructure & Charging Management 3 hours

- Types of EV Chargers (AC, DC, Fast Charging, Wireless Charging)
- Charging Station Infrastructure & Standards (CCS, CHAdeMO, GB/T, Bharat EV Charger)
- Grid Integration & Load Management for EV Charging
- Smart Charging & V2G (Vehicle to Grid) Technology
- Solar-powered Charging for EVs
- Case Study: Tesla Supercharger vs Indian Charging Networks
- Assignment & Quiz

Module 5: Battery Swapping Technology 3 hours

- Concept of Battery Swapping
- Advantages & Challenges of Swapping
- Global vs Indian Battery Swapping Policies & Market
- Battery Standardisation for Swapping
- Case Study: Ola Battery Swapping & Gogoro Swapping Model
- Assignment & Quiz

Module 6: EV Maintenance, Repair & Safety 3 hours

- Common EV Issues & Troubleshooting
- Motor & Controller Issues
- Battery Fault Detection & Repair
- Software Issues & Diagnostics
- Safety & Emergency Handling in EVs
- Hands-on Virtual Training & DIY EV Repair
- Assignment & Quiz

Module 7: EV Software Development & IoT 3 hours

- Introduction to EV Software Development (CAN, IoT, BMS Software, etc.)
- Motor Control & Powertrain Software Basics
- Battery Simulation & Software Testing
- IoT & AI in Electric Vehicles
- Cloud-based Vehicle Diagnostics
- Case Study: Smart Features in Tesla & Ather 450X
- Assignment & Quiz

Module 8: EV Companies & Job Opportunities 3 hours

- Top EV Companies in India & Globally (Tesla, Tata, Ola, Ather, Rivian, BYD, etc.)
- Skills Required to Enter the EV Industry
- Job Roles & Salary Expectations in EV Industry
- EV Startups – How to Build Your Own EV Company?
- Government Policies & Subsidies for EV Startups
- Assignment & Quiz

Module 9: Case Studies of 5 Vehicles 3 hours

- Tesla Model 3 – Battery, Charging & Performance Analysis
- Ola Electric Scooter – Battery Swapping & Software
- Tata Nexon EV – Battery & BMS Case Study
- Ather 450X – Performance, Motor & Charging System
- Mercedes EQS – Advanced EV Features & Market Trends
- Assignment & Quiz

Module 10: Advanced Topics – Solar-Powered EVs & Future Technologies 3 hours

- Solar-Powered EV Design & Integration
- Fuel Cell Electric Vehicles (FCEV) – Hydrogen Fuel Cell Technology
- Wireless Charging & Dynamic Charging Roads
- Autonomous & AI-Driven EVs
- Solid-State Batteries & Future of Battery Tech
- Case Study: Aptera Solar Car & Toyota Mirai FCEV
- Assignment & Quiz

Final Assessment & Certification 2 hours

- Final Test Covering All Modules (Objective + Case Study Based)
- Project Submission: EV System Design | TO BE DONE
- Live Q&A and Expert Panel Discussion
- Certificate Distribution to Qualified Participants

COURSE MODULES - PART 2 (SOFTWARE DEFINED VEHICLES & EMBEDDED SYSTEMS) **30 hours**

Module 1: Vehicle Platform 3 hours

- Introduction to vehicle platforms
- Key components
- Platform types/ generations
- Scalability and Customisation
- Future evolution, Wiring harness

Module 2: In-Vehicle Software Engineering 3 hours

- Control Units
- E/E architecture
- SDLC and Design Thinking
- In-Vehicle networking
- Model-Based Design
- AUTOSAR
- SBOM

Module 3: **Cloud & OTA Deployments** 3 hours

- Architecture of OTA systems
- Automotive OTA updates
- Coud infrastructure
- Edge computing

Module 4: **Automotive Cybersecurity** 3 hours

- Cybersecurity basics
- Secure boot
- Secure gateway
- Infrastructure protection
- Cybersecurity in OTA

Module 5: **SDV Architecture & Flashing** 3 hours

- Functional domains
- HPCs
- Zonal ECUs
- Flash bootloader
- Virtualisation & Hypervisor
- Vehicle OS

Module 6: **SW Verification & Validation** 3 hours

- SIL / MIL / HIL / VIL
- Verification methodologies
- XIL, Virtual ECUs
- Software and system verification
- Test automation

Module 7: **Autonomous Driving** 3 hours

- Levels of autonomous driving
- AI in AD/ADAS
- Hardware / software requirements
- V&V in ADAS

Module 8: **Future Trends** 3 hours

- Future evolution in automotive

- V2X, Digital Twin
- Mobility as a service
- Shared mobility

Module 9: **Case Studies & Industry Applications** 3 hours

- Real-world case studies
- SDV and automation use-cases from leading companies like Tesla, Waymo, etc

Module 10: **Software Defined Vehicles** 3 hours

- Embedded software for SDV
- Control systems
- CAN
- AUTOSAR
- Virtualisation
- Vehicle Platforms

COURSE MODULES - PART 3 (TELEMATICS SOFTWARE DEVELOPMENT) 40 hours

Module 1: Automotive Telematics Software 10 hours

- Telematics Technologies & Platform
- Telematics Software Engineering
- Ethical CAR Hacking
- Automotive Security and Privacy
- CAN Bus - Secure Programming

Module 2: Connected Vehicle Software 10 hours

- Telematics Communication Technologies
- In-Vehicle & Vehicle to Vehicle Communication
- Vehicular ad hoc networks
- Connected Vehicle Security
- Telematics Communication Protocols

Module 3: Autonomous Vehicles (AV) 10 hours

- Driverless CAR Technologies
- Intelligent Transportation Systems
- Real-time operating systems for AV
- Autonomous Vehicle Security

Module 4: Automotive Cyber Security 10 hours

- Telematics Software Security
- Automotive Security and Privacy
- Ethical CAR Hacking
- Connected Vehicle Security
- Automotive Cyber Security

AUTOMOTIVE CYBERSECURITY

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SUMMARY

This online course is designed for professionals who want to build a strong foundation in Automotive Cybersecurity.

- This course provides a comprehensive understanding of cybersecurity in the automotive industry. With a focus on practical applications, hands-on exercises, and real-world case studies, participants will gain the necessary skills to identify, mitigate, and prevent cyber threats in modern vehicles. .

REQUIRED TOOLS & SIMULATORS

Wireshark	Packet sniffing & CAN Bus Analysis
ICSim (CAN Bus Simulator)	Hands-on CAN hacking & security
Scapy (Python-based tool)	Simulating automotive attacks
Kali Linux on Mac	Security testing & pen testing (via Virtual Machine)
Open-source OTA Testing Tools	Secure OTA update simulations
Hands-on Learning	**Duration**: 40 hours online course | 50% practical work using online tools
Real-World Scenarios	Industry case studies & simulations

COURSE MODULES

Module 1: Introduction to Automotive Cybersecurity 5 Hours

- Overview of Automotive Security Threats
- Attack Surfaces in Modern Vehicles
- Cybersecurity Regulations: UNECE WP.29, ISO 21434, ASPICE
- Real-World Case Studies: Jeep Cherokee Hack, Tesla Hacks
- Hands-on: Exploring Cybersecurity Attack Vectors in a Simulator

Module 2 : Cybersecurity Basics 5 Hours

- Cryptography Basics (AES, RSA, ECC, HMAC)
- Secure Communication in Vehicles (CAN, LIN, FlexRay, Ethernet)
- Secure Protocols: TLS, SSL, IPsec
- Authentication & Access Control in Vehicles
- Hands-on: Sniffing and Analysing CAN Bus Traffic using an Online Simulator

Module 3: Secure Boot & Secure Firmware Updates 5 Hours

- What is Secure Boot?
- Secure Boot Implementation in ECUs
- Firmware Update Security: Code Signing & Integrity Checks
- Practical Attacks: Firmware Tampering & Bypass Techniques
- Hands-on: Analysing Firmware Signing & Validation in a Virtual Environment

Module 4: Secure Gateway & Network Security 5 Hours

- Vehicle Gateway Security Architecture
- Firewall & Intrusion Prevention in Automotive Networks
- Attack Scenarios: Man-in-the-Middle (MITM) & Packet Injection Attacks
- Hands-on: Simulating & Detecting Intrusions in an Automotive Network

Module 5: Infrastructure Protection & Intrusion Detection 5 Hours

- Intrusion Detection & Prevention Systems (IDS/IPS) in Vehicles
- Threat Modelling & Risk Assessment for Automotive Systems
- Case Study: Tesla vs Traditional Automakers Security Approaches
- Hands-on: Detecting Cyber Threats in a Simulated Automotive IDS

Module 6: Cybersecurity in OTA Updates 5 Hours

- Over-the-Air (OTA) Update Security Challenges
- Secure OTA Deployment Best Practices
- OTA Attack Scenarios: Data Theft, Remote ECU Hijacking
- Hands-on: Simulating Secure OTA Updates in a Cloud Environment

Module 7: Real-World Attack Scenarios & Penetration Testing 5 Hours

- Threat Vectors in Modern Vehicles
- Wireless Attack Surfaces: Bluetooth, WiFi, Keyless Entry
- Practical Car Hacking Techniques
- Hands-on: Pen testing an Automotive System using Open-Source Tools

Module 8: Final Case Studies & Advanced Topics 5 Hours

- Deep Dive: Tesla, Mercedes, Toyota Security Strategies
- AI in Automotive Cybersecurity
- Future of Automotive Security: AI-Driven IDS, Blockchain for Security
- Hands-on: Simulating a Security Attack & Defence Strategy