Electric Vehicles: Industry-Ready Training Program

A comprehensive 4-month online course designed for early professionals, graduate students, and career transitioners entering the rapidly growing EV industry. This program bridges the gap between classroom theory and real-world engineering and business practice — giving you the skills, tools, and confidence to launch your EV career.

4 MONTHS · 15–16 WEEKS · INDUSTRY-ORIENTED

Why This Course Matters

The EV Industry Is Transforming Transportation — Are You Ready?

The Market Opportunity

Global EV sales surpassed **14 million units** in 2023, with projections pointing to over 40 million annually by 2030. Governments worldwide are mandating emission reductions, and automakers are committing hundreds of billions to electrification.

The Talent Gap

The EV sector faces a critical shortage of trained professionals in battery engineering, power electronics, thermal management, and EV systems integration. This course directly addresses that gap with practical, employer-aligned content.

Early movers in the EV talent market earn premium salaries and fast-track promotions.

Program Architecture

How the 4-Month Program Is Structured

Intermediate Phase

Weeks 5–8: Systems, components, and integration.

Advanced & Application

Weeks 9–12: Real-world engineering practice.

Foundation Phase

Weeks 1–4: EV fundamentals and core concepts.

Capstone Phase

Weeks 13–16: Project delivery and career launch.

Each week combines a **recorded concept session** for self-paced learning with a **live mentoring session** for Q&A, case discussions, and personalized feedback. This blended structure mirrors modern engineering team workflows and prepares you for collaborative industry environments.

Weekly Format

What Every Week Looks Like

Weekend Recorded Session

Concept-focused video lectures covering 5–6 structured topics per week. Watch at your own pace, pause, replay, and take notes — designed for deep comprehension and retention.

Live Mentoring Session

1:1 or small-group live sessions with an industry mentor for doubt clearing, case study discussions, assignment reviews, and real-world scenario walkthroughs.

Weekly Assignment

Practical exercises, mini-projects, or industry analysis tasks that reinforce the week's learning outcomes and build your professional portfolio progressively.

Learning Outcomes

Each week has clear, measurable outcomes — so you always know exactly what you will be able to do, explain, and apply by the end of each module.

PHASE 1 · WEEKS 1–4

Foundation Phase: EV Fundamentals & System Overview

Week 1 — Introduction to Electric Vehicles

- History and evolution of EVs: from early prototypes to Tesla and beyond
- Types of EVs: BEV, HEV, PHEV, FCEV — differences and use cases
- Global EV market landscape and key players (OEMs, startups, suppliers)
- Regulatory frameworks: CAFE standards, Euro 7, ZEV mandates
- EV ecosystem overview: OEMs, Tier 1 suppliers, charging networks, grid
- Career pathways in the EV industry — roles and entry points

Week 2 — Electrochemistry & Battery Fundamentals

- Electrochemical cells: how batteries store and release energy
- Key parameters: voltage, capacity (Ah), energy density, power density
- Battery chemistries: NMC, LFP, NCA, solid-state — trade-offs explained
- State of Charge (SOC), State of Health (SOH), and cycle life
- C-rate, internal resistance, and their impact on performance
- Thermal behavior of lithium-ion cells: why heat matters

Week 3 — Electric Motors & Power Electronics

- Types of electric motors: PMSM, BLDC, induction — pros and cons
- Motor operating principles: torque, speed, and efficiency maps
- Power electronics basics: inverters, converters, rectifiers
- Pulse Width Modulation (PWM) and motor control fundamentals
- Regenerative braking: how it works and its efficiency contribution
- Industry tools: MATLAB/Simulink for motor modeling intro

Week 4 — Vehicle Architecture & Energy Management

- EV powertrain architecture: single-speed vs. multi-speed systems
- High-voltage bus architecture and safety considerations
- Vehicle dynamics and range estimation models
- Energy management strategies: rule-based vs. optimization-based
- Drive cycles: WLTP, EPA, NEDC — what they measure and why
- Mini Project: EV architecture comparison report (3 production vehicles)

PHASE 2 · WEEKS 5–8

Intermediate Phase: Systems, Components & Engineering Tools

Week 5 — Battery Pack Design & BMS

- Cell-to-module-to-pack architecture and mechanical design considerations
- Series/parallel configurations: voltage, current, and redundancy trade-offs
- Battery Management System (BMS): functions, architecture, and algorithms
- SOC and SOH estimation: Coulomb counting, Kalman filter intro
- Cell balancing: passive vs. active balancing circuits
- Tools: MATLAB BMS modeling, Battery Design Studio introduction

Week 6 — Thermal Management Systems

- Why thermal management is mission-critical for EV safety and longevity
- Battery thermal management: liquid cooling, air cooling, phase change
- Motor and power electronics cooling strategies
- HVAC systems in EVs: heat pump integration and efficiency impact
- Thermal runaway: causes, detection, and prevention mechanisms
- Simulation tools: ANSYS Fluent basics for thermal analysis

Week 7 — Charging Systems & Grid Integration

- Charging levels: Level 1, Level 2, DC Fast Charging (DCFC) explained
- On-board charger (OBC) design and efficiency requirements
- Communication protocols: CAN, ISO 15118, OCPP for smart charging
- Vehicle-to-Grid (V2G) and Vehicle-to-Home (V2H) concepts
- Grid impact of mass EV adoption: load management and demand response
- Assignment: Design a charging infrastructure plan for a 500-unit fleet

Week 8 — Functional Safety & Standards

- ISO 26262 functional safety standard: ASIL levels and safety lifecycle
- FMEA and fault tree analysis for EV systems
- High-voltage safety: isolation monitoring, interlock systems
- UN ECE R100: EV safety regulations for global markets
- Cybersecurity in connected EVs: ISO/SAE 21434 overview
- Mini Project: FMEA worksheet for a BMS subsystem

PHASE 3 · WEEKS 9–12

Advanced & Application Phase: Real-World Engineering & Integration

Week 9 — Vehicle Control Systems & Software

- Vehicle Control Unit (VCU): architecture, inputs/outputs, and logic
- CAN bus and automotive networking: message framing, DBC files
- Model-Based Design (MBD): Simulink → auto-code generation workflow
- AUTOSAR architecture: software components, RTE, and BSW layers
- Over-the-Air (OTA) updates: software deployment in production EVs
- Tools: CANalyzer, CANoe, Vector tools — hands-on lab introduction

Week 10 — EV Testing, Validation & Data Analysis

- HIL (Hardware-in-the-Loop) and SIL (Software-in-the-Loop) testing
- Battery testing protocols: capacity, cycle life, abuse testing
- EMC/EMI testing requirements for high-voltage EV components
- Field data logging: tools, data formats (MDF4), and analysis pipelines
- Python for EV data analysis: parsing CAN logs, plotting efficiency maps
- Assignment: Analyze a real EV drive log dataset using Python

Week 11 — Supply Chain, Manufacturing & Cost

- EV supply chain structure: raw materials (lithium, cobalt, nickel) to pack
- Cell manufacturing process: electrode coating, cell assembly, formation
- Battery pack assembly automation and quality control workflows
- Cost structure of an EV battery pack: $/kWh trends and targets
- Domestic vs. offshore sourcing: IRA implications for North American OEMs
- Tools: Value stream mapping, basic cost modeling in Excel

Week 12 — Emerging Technologies & Future Trends

- Solid-state batteries: technology readiness, key players, timeline
- Silicon anode and lithium-sulfur battery developments
- 800V+ architectures: Hyundai E-GMP, Porsche J1 — engineering insights
- Autonomous driving integration with EV platforms
- Hydrogen fuel cell vehicles (FCEV): where they fit vs. BEV
- Mini Project: Technology readiness report on one emerging EV technology

PHASE 4 · WEEKS 13–16

Capstone Phase: Integrative Project & Career Launch

1

Week 13

Project Definition
Define scope, select one of three capstone tracks: Battery Pack Design, Charging Infrastructure, or EV Systems Analysis

2

Week 14

Development
Execute technical work using course tools. Weekly mentor check-ins. Iterative feedback on methodology and deliverables

3

Week 15

Documentation
Compile technical report, prepare presentation deck, refine visualizations, and simulate a professional design review

4

Week 16

Final Presentation
Live demo or presentation to a panel of industry mentors. Career coaching session and portfolio finalization

Capstone deliverables are portfolio-ready artifacts — engineering reports and decks you can share directly with recruiters and hiring managers.

Industry Example 1

Tesla's Battery Thermal Management: Solving Range Anxiety at Scale

The Business Problem

Tesla needed to maintain consistent battery performance across extreme temperature conditions — from -20°C winters in Norway to 45°C summers in Arizona — without sacrificing range, charge speed, or battery longevity. Thermal degradation was directly impacting customer satisfaction and warranty costs.

How Course Concepts Apply

- **BMS algorithms** dynamically adjust charge/discharge limits based on cell temperature
- **Liquid cooling loops** (glycol-water) maintain cells within a 15–35°C optimal window
- **Heat pump integration** (Model Y) reduced HVAC energy draw by up to 50% in cold weather
- **OTA software updates** refined thermal preconditioning logic post-launch

Tools & Technologies Used

- MATLAB/Simulink for thermal modeling
- CFD (ANSYS Fluent) for cooling channel design
- CAN/Ethernet for real-time thermal data logging
- Python analytics for field data review

Measurable Impact

- Battery degradation reduced to <10% after 200,000 miles
- Cold-weather range loss reduced from 40% → 20%
- Warranty cost reduction of ~$800/vehicle

Your Role as an Early Professional

Thermal simulation engineer, BMS calibration analyst, or field data engineer — all entry-level roles that contributed to this outcome.

Industry Example 2

GM's Ultium Platform: Designing a Scalable EV Architecture

The Business Problem

General Motors needed a single, flexible EV platform capable of underpinning 30+ vehicles across sedans, trucks, SUVs, and commercial vans — reducing development cost and time-to-market while meeting diverse performance targets.

Your Role as an Early Professional

- Systems integration engineer: CAN/LIN network mapping across variants
- Battery validation engineer: executing cell and module test protocols
- Software engineer: VCU application layer feature development
- Cost analyst: $/kWh modeling for pack configurations

How Course Concepts Apply

- **Modular cell design**: NMCA pouch cells in flexible module configurations (50–200 kWh)
- **800V architecture**: enables 350 kW charging capability, reducing charge time by ~50%
- **AUTOSAR-based VCU**: software reuse across all Ultium vehicles cuts SW development cost
- **Wireless BMS**: eliminates harness complexity inside packs, reducing weight and cost

Measurable Business Impact

- Platform R&D cost shared across 30+ models vs. per-vehicle development
- Battery cost target: below $100/kWh by 2025
- Production scale: Ultium Cells JV targeting 160 GWh/year North American capacity

ChargePoint & Fleet Electrification: Infrastructure at Enterprise Scale

The Business Problem

A major U.S. logistics company (analogous to UPS or Amazon Logistics) needed to electrify a 5,000-vehicle urban delivery fleet. The challenge: depot charging infrastructure didn't exist, grid capacity was constrained, and charge scheduling had to integrate with dispatch operations without disrupting delivery windows.

How Course Concepts Apply

- **Charging level selection**: Level 2 overnight + selective DCFC for mid-shift top-ups
- **OCPP protocol**: ChargePoint EVSE units communicate with central fleet management via OCPP 2.0
- **V2G potential**: parked fleet batteries participate in demand response programs, generating revenue
- **Load management**: smart charging software staggers vehicle charging to stay within utility demand limits

Tools & Technologies

- ChargePoint Fleet software for scheduling and telematics
- AutoGrid / Enel X for demand response integration
- Python scripting for energy cost optimization models
- CAD tools for depot electrical layout design

Measurable Impact

- Fuel cost reduction: $0.08/mile (electric) vs. $0.32/mile (diesel)
- Carbon reduction: ~4,200 tonnes CO_2/year eliminated
- IRA tax credit capture: ~$3.5M annually from commercial EV incentives

Early professionals in charging infrastructure, fleet energy management, and grid integration are among the fastest-growing EV job categories in 2024–2025.

Tools & Technology Stack

The Professional Toolkit You'll Build in This Program

🔧 Simulation & Modeling

- MATLAB / Simulink
- ANSYS Fluent (thermal CFD)
- Battery Design Studio
- GT-Suite for vehicle system simulation

🖥️ Software & Coding

- Python (data analysis, CAN log parsing)
- AUTOSAR toolchains (EB Tresos)
- Model-Based Design (Simulink Coder)
- Git for version control

📡 Automotive Networks

- CANalyzer / CANoe (Vector)
- PCAN / Peak tools
- DBC file creation and editing
- ISO 15118 / OCPP protocol familiarity

📊 Engineering & Analysis

- Excel for cost modeling and BOM analysis
- PowerBI / Tableau for data dashboards
- FMEA templates (IQ-FMEA / Excel-based)
- Value Stream Mapping tools

Job Roles & Skills Progression

Aligned Job Roles

- Battery Systems Engineer
- BMS Software / Calibration Engineer
- EV Powertrain Engineer
- Thermal Systems Engineer
- Charging Infrastructure Engineer
- Automotive Controls Engineer (VCU/AUTOSAR)
- EV Test & Validation Engineer
- EV Product Manager / Business Analyst
- Fleet Electrification Consultant
- Energy Storage Systems Analyst

Skills Progression Map

1

2

3

1 Job Ready

Full system integration, FMEA, ISO 26262, Python analytics, capstone portfolio, live industry presentation

2 Intermediate

BMS design, thermal modeling (ANSYS), CAN communication, charging infrastructure planning, test protocols

3 Beginner

EV types, battery chemistry, motor fundamentals, drive cycles, powertrain architecture concepts

Your Next Step

Key Takeaways & Your EV Career Roadmap

What You'll Walk Away With

Deep Technical Fluency

From battery chemistry to vehicle-level systems integration — you'll speak the language of EV engineering with confidence.

Industry-Standard Toolset

Hands-on experience with MATLAB, Python, CANoe, ANSYS, and AUTOSAR-adjacent workflows used in top OEM and Tier 1 environments.

A Professional Portfolio

Capstone project, mini-projects, and assignments that demonstrate real competency to recruiters and hiring managers in the EV space.

Career Network & Mentorship

Access to industry mentors, peer cohort, and structured career coaching sessions to accelerate your job search after completion.

Your Post-Program Roadmap

01

Finalize Portfolio

Polish your capstone, clean up project files on GitHub, and write a strong project summary for LinkedIn and your resume.

02

Target Job Applications

Apply to EV-specific roles at OEMs (GM, Ford, Rivian, Lucid), Tier 1 suppliers (BorgWarner, Aptiv), and battery companies (QuantumScape, Northvolt).

03

Continue Upskilling

Pursue SAE certifications, IEEE EV papers, and advanced MATLAB/Python courses to stay current as the industry evolves rapidly.

04

Engage the Community

Join SAE International, EV advocacy groups, and LinkedIn communities. Attend EV Tech Expo, The Battery Show, or regional meetups.