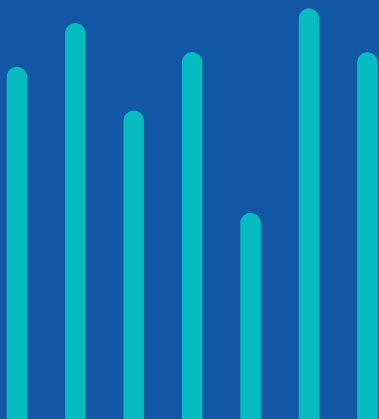




CERTIFICATE PROGRAM IN
**APPLIED EV DESIGN
& INTEGRATION**

(INCLUDES FUEL CELL)



The transportation is transforming
& we need to get ready
- James Campbell

PROGRAM OVERVIEW

The country's first electric vehicle training programme, aiming to cover all main areas of EV design and integration. This 5-month curriculum is globally approved by the Automotive Skills Development Council (ASDC). Industry experts from across the world will participate in Live Online sessions that will be interactive and incorporate industry-relevant, real-time projects.



Hands-on Model-based Systems Engineering

Practice sessions on SciLab / MATLAB & Excel



Online Training Sessions (Live And Self-paced Formats)

Video Recordings (with 1 Year of LMS access)



Industry Expert Trainers

Professionals worked on global EV Platforms



In-lab Practical On Hardware Model

Hardware characterization, modeling, and simulation



Capstone Project On Real Topic

Work on a project, get it evaluated by experts, get recommended by them



Industry Valued Certification

Joint certificate by Automotive Skills Development Council (ASDC) with online proctored assessment



Networking

Meet & network with your fellow cohorts



Placement Assistance

Preparation Support, Mock Interviews, Resume Building & Mentorship by Industry Experts

KEY OUTCOMES OF THE PROGRAM

- ▶ Understanding the prospect and need of EV in the emerging markets and how one can align their career with it.
- ▶ Battery chemistry selection, sizing and modeling of battery parameters using sci-lab, Battery Management System - Power control
- ▶ Modeling of vehicle accessories & LVDC systems and CCCV charge controller using Sci-Lab
- ▶ Fuel cell sizing and its integration with vehicle for optimum performance of the vehicle and the subsystems
- ▶ Vehicle energy calculation and vehicle modeling using Scilab and Simulation of an Electric Vehicle
- ▶ Mapping diagnostic actions for various ASILs, risk assessment, and reliability estimation in excel
- ▶ Selection, sizing, and modeling of EV motor in sci-lab and understanding of Vehicle accessories & LVDC systems
- ▶ Integration of Battery, motor, and vehicle using sci-lab and analysis of route energy. Control strategies and PID modeling in sci-lab
- ▶ Total cost ownership (TCO) analysis of EV for different scenarios and understanding of the entire ev ecosystem

LEARN FROM THE GURUS



Rahul Bagdia

(BHTC & Research Assistant
at University of Michigan)



Vikrant Vaidya

(TATA Motors, General Motors,
Jaguar - Land Rover)



EVACAD ALUMNI WORKING ON VARIOUS ROLES AT



GLOBALLY ACCREDITED JOINT CERTIFICATE BY AUTOMOTIVE SKILLS DEVELOPMENT COUNCIL (ASDC)



CURRICULUM DETAILS

Module 1 - Introduction to EV Technologies

1. Need of Electric Vehicles (EV) for sustainability
Live online interactive session with the Gurus + [Assignment-1](#) **WEEK 1**
2. Traction Motors - Introduction & Selection **WEEK 2**
3. Regenerative Braking
Live online interactive session with the Gurus + [Assignment-2](#)
4. Battery - Unit cells & modules **WEEK 3**
5. Battery - Packs and accessories
Live online interactive session with the Gurus + [Assignment-3](#)
6. Power electronics and power converters **WEEK 4**
7. Vehicle accessories & LVDC systems
8. EV charging systems
Live online interactive session with the Gurus + [Assignment-4](#)

Module 2 - EV Integration & Systems Engineering

9. Basics of vehicle dynamics **WEEK 5**
10. Longitudinal vehicle dynamics
11. Powertrain functional integration in vehicle
Live online interactive session with the Gurus + [Assignment-5](#)
12. Introduction to Fuel Cells **WEEK 6**
13. PEM Fuel Cell integration in vehicle
Live online interactive session with the Gurus + [Assignment-6](#)

Module 3 - Controller Basics, Functional Safety (ISO26262), BMS, motor & Vehicle Controllers

14. Basics of control systems **WEEK 7**
15. Control strategies - Open loop, closed loop, etc.
Live online interactive session with the Gurus + [Assignment-7](#)
16. Battery Management Systems - SoC & SoH **WEEK 8**
17. Battery Management Systems - Power control
Live online interactive session with the Gurus + [Assignment-8](#)

CURRICULUM DETAILS

18. Vehicle Control & powertrain interfaces **WEEK 9**
19. Introduction to System Functional Safety
Live online interactive session with the Gurus + [Assignment-9](#)
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Module 4 - Virtual Model Based Systems Engineering

20. Virtual Modeling based EV development **WEEK 10**
21. Virtual Modeling Techniques
22. Vehicle Specs from Requirements
Live online interactive session with the Gurus + [Assignment-10](#)

23. Root Cause & Failure Mode Effect Analysis **WEEK 11**
24. Reliability Engineering as applied to EV
Live online interactive session with the Gurus + [Assignment-11](#)
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Module 5 - Total Cost of Ownership Modeling

25. Capital Expenses **WEEK 12**
26. Operational Expenses
27. Total Cost of Ownership
Live online interactive session with the Gurus + [Assignment-12](#)
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Module 6 - EV Customer Usage & Application Analysis

28. Introduction to application analysis **WEEK 13**
29. Customer profiling & data collection methods
Live online interactive session with the Gurus
+ ([Capstone Project part 1](#))

30. Statistical analysis of measured data **WEEK 14**
31. Duty cycles from measured data
Live online interactive session with the Gurus
+ ([Capstone Project part 2](#))
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Module 7 - Design Use Cases from Customer Usage & Application Analysis

CURRICULUM DETAILS

32. Mapping customer usage to failure modes
33. Design of Experiments (DoE)
Live online interactive session with the Gurus
+ (Capstone Project part - 3) **WEEK 15**

34. Concluding from simulation results
35. Using simulation results for decision making
Live online interactive session with the Gurus
+ (Capstone Project part - 4) **WEEK 16**

Module 8 - EV Supply Ecosystem

36. OEM sourcing & supplier selection process
Live online interactive session with the Gurus
+ (Capstone Project part - 5) **WEEK 17**

Module 9 - EV Policy & Regulation Landscape

37. EV regulations and policy landscape analysis
Live online interactive session with the Gurus
+ (Capstone Project part - 6) **WEEK 18**

Module 10 - EV Energy Infrastructure & High Voltage Safety

38. Charging power, energy, grid liability & mix
Live online interactive session with the Gurus
+ (Capstone Project part - 7) **WEEK 19**

39. Charging protocols and telematics
40. High voltage safety
Live online interactive session with the Gurus
+ (Capstone Project part - 8) **WEEK 20**

Evaluation

Final Exam - MCQ based Assessment
Project Report Submission **WEEK 21**

CAPSTONE PROJECT



Battery

Battery sizing for any EV vehicle category

We will learn how to select the battery chemistry and do battery pack sizing for any chosen electric vehicle.



Motors

Motor technology selection and defining motor functional specifications for any chosen EV vehicle category

We will gain skills in selecting the right motor technology for a proposed EV vehicle category. We will learn to select motors based on the target performance, range and acceleration gradeability.



Powertrain

Motor drive and controller design algorithm

This project will allow us to learn the real-world drive cycle, vehicle modeling, motor sizing and the gearing system selection to meet the vehicle's powertrain performance target and demonstrate the motor operating in the best efficiency zone.



Battery Management

Battery management and control features algorithm development

We will learn the BMS functionality modeling and high level calibration for SoC & SoH estimation. We will also analyze the battery's charging and discharging patterns.



Economy of EVs in design

Total cost of ownership analysis for any EV vehicle category

We will gain skills to conduct a total cost of ownership analysis for a proposed EV vehicle. We will also benchmark it against traditional technologies to evaluate the ROI.



Hydrogen Fuel cell

Sizing the fuel cell and fuel cell tank for any EV vehicle category

In this project, we will learn a sizing of a hydrogen fuel cell for specific vehicle application. It will allow us to analyze the difference between pure li-ion and fuel cell powered electric vehicles.



WHO IS THIS PROGRAM FOR

Anyone and everyone who wants to learn more about the advancement of the e-Mobility sector and to upskill to get their career aligned with it.

Industry Profile

Automotive | Manufacturing
with any amount of experience in the mobility industry

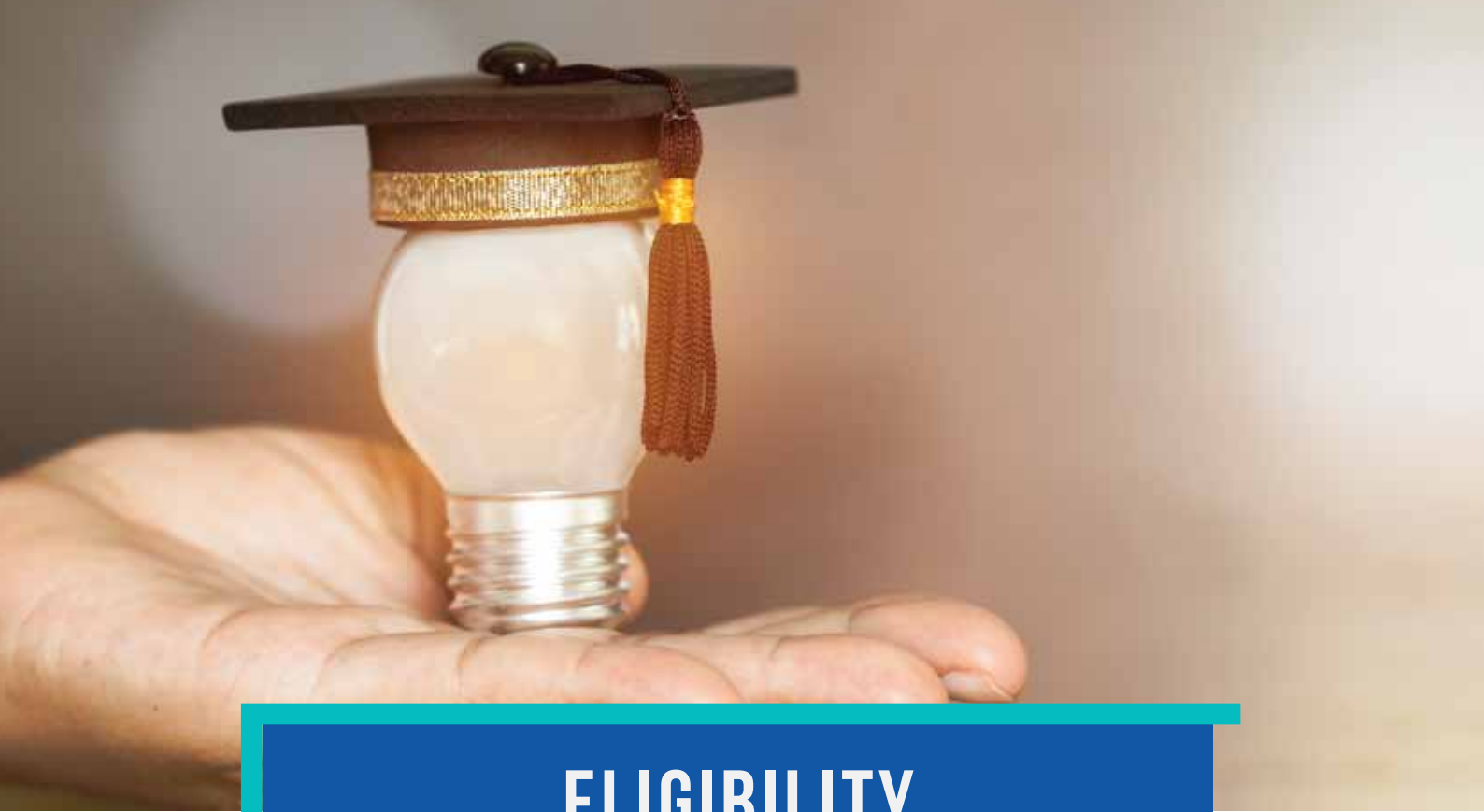
► Fresh graduates aspiring to work in the EV domain

► Entry/Mid level EV-Architecture

- At entry-level to get a thorough understanding of the fundamentals of applied ev design and integration.
- At Mid level to upskill the principles behind the ev design and relate it to future trends in the technology.

► Working professionals at all levels in

- Professional working at engineering levels for powertrain integration, sub-system integration, vehicle validation, product development, etc
- Technical experts working in the areas of virtual product development, retrofitting, etc



ELIGIBILITY

Background: This programme is tailored to help you improve your engineering skills as a student, recent graduate, or working professional with following expertise.

- 0-3+ years of experience with

- Electrical Engineering
- Electronics Engineering
- Mechatronic engineering
- Automobile Mechanical engineering

- B.E./ B. Tech.

- M.E./ M.Tech.

- Research Scholar/ Doctorate



SPECIALIZED ROLES ONE CAN APPLY FOR

This programme is tailored to help you improve your engineering skills as a student, recent graduate, or working professional with following expertise.

- ▶ Performance Engineers
- ▶ Lead Engineers
- ▶ Integration Engineers
- ▶ Powertrain Engineers
- ▶ Vehicle Engineers
- ▶ Vehicle Validation Engineer
- ▶ System Validation Engineers
- ▶ Sub-systems Engineers
- ▶ Chief Engineers / Assistant Chief
- ▶ Engineer
- ▶ Assistant Engineers
- ▶ Powertrain Chief Engineers
- ▶ Functional Engineer
- ▶ Performance Integration Engineers
- ▶ Attributes Engineers
- ▶ EV Operators
- ▶ Vehicle Assembling
- ▶ EV Entrepreneurs
- ▶ EV Technical Consultants
- ▶ Value Engineering Teams From OEMs
- ▶ Technical Experts
- ▶ EV Product Developer
- ▶ Cost Engineering Teams
- ▶ EV Research Scholars
- ▶ Retrofitters



THE ADMISSION PROCESS

Our Admission Process verifies that our program is the right fit for you. We make sure our batches form relevant teams within, to carry out the assignments and to work collectively on our precisely designed Capstone Projects



FEES

Total Amount : INR 1,15,000



OUR GURUS



MR. RAHUL BAGDIA

MD, pManifold EV Academy

Academics: Dual Masters in Robotics & Control from
University of Michigan, Ann Arbor, US

20+ years of extremely diverse global experience in various industries like energy & utilities, electric vehicles, health & life sciences, banking & finance and education. Has worked with Government of India for Electric Vehicle Program Management Cell in areas of policy making, EV infrastructure development, distribution networks and power generation. He has been instrumental in supporting Policy and Technical Standards Development for Electric Vehicles for various countries.

OUR GURUS

MR. VIKRANT VAIDYA

President, pManifold EV Academy

Academics: Master in Energy Systems Engineering from
University of Michigan, Ann Arbor, US



20+ years of experience in vehicle development & integration - IC Engine, Hybrid Electric as well as Battery Electric Vehicles - for global platforms of Tata Motors, General Motors, Jaguar-Land Rover and Groupe PSA's upcoming BEV for emerging markets. Expertise in product development through powertrain-vehicle integration, model-based controller development and powertrain-in-vehicle calibration. A recruiter & technical trainer for 10+ years & has three records of the invention in hybrid powertrain, battery controls & repurposing.



MR. VIVEK SAHASRABUDDHEY

Founder, Flekz AutoTech Pvt. Ltd.

Academics: MBA from SP Jain Institute, Mumbai & BE in
Mechanical from Govt. College of Engineering,
Amravati

30+ years industry expertise in 4 organizations for 9 functions. More than 24 programs from ideation to launch. Took 12+ strategic initiatives. 6000+ customer interactions across Europe, South Africa, ASEAN and India. Worked across value chain from production to market research including start-ups. Experienced in OEM sourcing and technical selection process

OUR GURUS

MR. HEMANT PADHYE

Director, Pro Business Innovations

Academics: MBA from Pune University & BE in Mechanical from Nagpur University



33+ years' experience in Automotive/Powertrain Industry. Electric Vehicle and Electric Drives Domain Expertise including EV Integration. Launched 45+ major automotive programs in last 20 years (Passenger Cars and Powertrains). Experienced in RCA & FMEA.



MR. DIPANKAR DEBNATH

Asst. Prof., Electrical Dept., IIT Kharagpur

Academics: M.E. from IEST Shibpur, West Bengal & B.E. from NIT Agartala, Tripura

6+ years of teaching experience in the area of Electrical Engineering. His research interest includes design of integrated power electronic converter topologies, solar photovoltaic based standalone/off-grid systems for rural areas, multi-functional inverter for grid integration of renewable energy sources, study of micro-grid, motor and motor controller design for EV, etc.

OUR GURUS

MR. SHEKHAR MALANI

MD, Devise Electronics

Academics: MS in Electrical Engg. – Control Systems,
University of Southern California



20+ years of diverse experience in automotive powertrain industry. 10+ EV powertrain system integration project. 20+ Embedded products developed across multiple domains. Experience in engine, vehicle, aftertreatment and power-train controls for multiple emission regulations, and electric vehicles. Expertise in Vehicle Controllers, System Functional Safety, Charging protocols and telematics, High Voltage safety



MRS. ABHANSHA SOMVANSHI

Consultant, Transport Planning, pManifold

Academics: Masters of Planning (Urban Transport
Systems) from CEPT University

4+ years' experience in the field of urban planning, transport planning and e-Mobility for public transportation, strategic planning for urban transport, public transport systems planning and traffic modelling, feasibility projects for urban transport.

WHAT OUR LEARNERS **HAVE TO SAY...**

“ This intense theory + hands-on modeling course with a strong teaching style has equipped me with knowledge to lead the internal strategy and new initiatives team at the company to plan adding the right EV sub-systems and engage our OEM clients. An overall content is well designed and sufficient to develop EV skills and deployable to real time work.

-Amit Markan,
Group Manager, Volvo

“ A very good program which covers all fundamental topics in the EV engineering world and successfully prepares engineers to deal with EV basic modeling and simulation. The hands-on portion of the course is also of great importance.

-Rafael Tovo,
Safety & Reliability Engineer, Delta System Solutions

“ The program was highly beneficial for me to understand the basics of EV and sub-system engineering concepts. In a short span of time, we got exposure to virtual modeling that can act as the first step to understand the broader requirements in a cost-effective manner.

-Praveen Rajurkar,
Head (Synergy & Allied Business), Gulf Oil

WHAT OUR LEARNERS HAVE TO SAY...

“Through this program, I was able to reflect and discuss real-life EV product design, development and testing issues. I was able to apply knowledge and engage my products team better depending on the customer's vehicle usage patterns. We are now looking forward to in-build model-based design in our processes strongly.

-Saurabh Agrawal,
Head of Software Products, Revolt Motors

“It was a good learning experience for me. I can apply these learnings in my day to day activities as I am working in the energy management segment for electric vehicles.

-Prashant Kumar Badiger,
Technical Lead, Hella Automotives

“This program and trainers have taken us into a deep-dive of EVs and related sub-systems engineering. I will definitely recommend this course to not only professionals but also students and recent graduates interested in electric mobility.

-Anirudh Narla,
Associate Researcher, ICCT



ABOUT EVACAD

A team of business experts that formulated **EVACAD** has more than **150 years** of combined experience with **e-Mobility**. With joint certification from the **Automotive Skills Development Council (ASDC)**, our programmes now have global recognition. Being a brainchild of pManifold, we set our courses and knowledge content to high standards. Our applications and practise-based learning programmes are designed to help you develop your current skill set while staying relevant to industry standards and procedures utilised by the top business players around the globe.

EVACAD is a strategic research and consulting firm founded in **2010**, that is facilitating the development and growth of the smart and clean tech markets in the **energy, e-mobility, solar, LVDC, environmental, and urban sectors**. For quicker reforms, a better customer experience, and profitable market expansion, it is assisting businesses and industries in innovating and changing their solutions, services, and business models. Its work and clientele are located all over the world, including in **India, the ASEAN Nations, the USA, Europe, and other places**.

I believe the Auto industry will change more in the next 5-10 years than it has in the last 50.

- Mary Barra

(CEO and Chairman - General Motors)



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