



Battery Modeling and Simulation

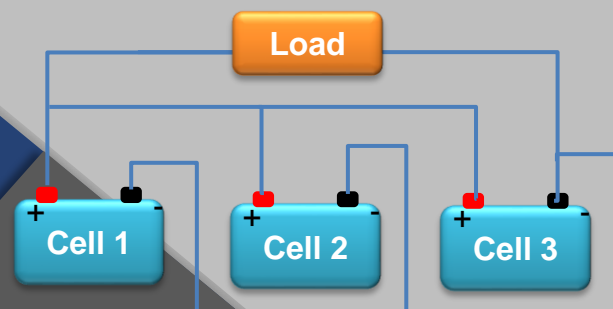
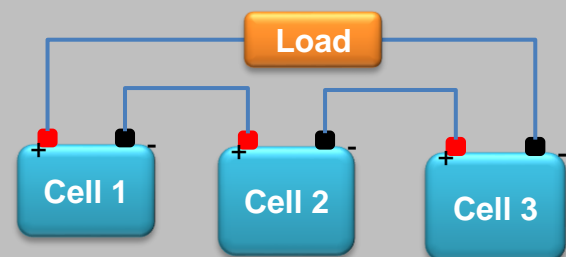
Global Online Training Program

This one-of-a-kind, online training program will provide you an overview of batteries and their integration aspects for e-mobility. This program will introduce the concepts and terminology, the global best practices in virtual model-based development, EV sub-system working principles, systems engineering and basics of control systems.

Hands-on practice by using SciLab / MatLab

You can learn here...

- Understanding of battery electro chemistries
- How to rightly size, and select EV battery
- How to integrate a battery pack for EV Applications
- To understand the requirements of a battery-management system in an electric vehicle
- How to model, simulate, and enable product decisions using the results



Program Uniqueness



Industry Valued Certification
 Joint Certification with **ASDC**
 on completion



Hands-on Modeling
 Modeling Tutorials and
 Handholding (on Excel &
 Scilab)



Live VC Support
 Join & resolve your queries
 from anywhere



Global EV Experts
 Trainers worked on global
 EVs platforms



**Attend Virtual Class OR
 Learn at your Own Pace**
 Theory sessions and Modeling
 Tutorials



Easy time outside work
 Virtual classes in evening (IST)

PROGRAM STRUCTURE

Module	#	Session Topic	#	Modeling Tutorial
1. Battery Basics	1	Basics of Electrochemistry	1	Simple Electric Circuit using Sci-Lab
	2	Electric Circuits - R-L-C and Kirchhoff's Law	2	Measurements on cells in series and parallel configurations
	3	Electric Circuits - Batteries in Series and Parallel	3	Simple Unit cell model in Sci-Lab
	4	Battery Specifications	4	Battery sizing calculations using Excel
	5	Battery Chemistries	5	Vehicle modeling using Sci-Lab
2. EV Application	6	EV Battery Pack Configuration	6	Battery Pack sizing based on vehicle requirements using Excel
	7	Vehicle Modeling	7	Modeling of battery heat generation and Ageing using Excel
	8	Battery Pack Selection & Sizing	8	Modeling of effect of temperature and c-Rate on battery using Sci-Lab
	9	Battery Thermal & Ageing Aspects	9	Modeling corrections for SoC and SoH using Sci-Lab.
3. Battery Management Systems	10	Cell balancing	10	Modeling of CC-CV charge controller using Sci-Lab.
	11	Operational Sensitivity	11	Transient Battery Model- R-RC & R-RC-RC using Sci-Lab.
	12	Basics of Control Systems	12	Battery pack Modeling using Sci-Lab.
	13	BMS Functions - SoC and SoH estimation	13	Modeling of Regeneration with vehicle and battery pack models in Sci-Lab
	14	BMS Functions - Charge Control, Diagnostics, etc.	14	Battery charging Time / Swap Ratio Calculation Using Excel.
4. Battery Modeling & Simulation	15	Battery Analytical Representation		
	16	Battery Pack Modeling		
5. EV Charging Systems & Ecosystem	17	BMS Modeling & Integration		
	18	Battery Charging & Swapping		
	19	Secondary Use & Recycling		
	20	Regulations – Batteries & Chargers		

Live VC Support- Biweekly on Saturday - 15:00 TO 17:00 (IST)

Evaluation

Final Exam

Project Review

20 Sessions
With Theory and Modeling Tutorials

Attend Virtual Class OR
Learn at your own pace

Live Support sessions
for model troubleshooting

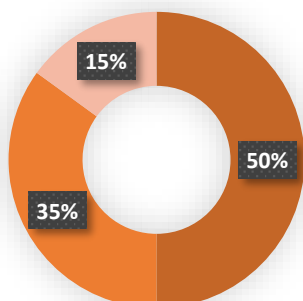
On Every other Saturday at 15:00 IST

3 Assignments

1 Final assessment
1-hour online e-proctored MCQ based exam by **ASDC**

Certification after course completion based on

- Assignment
- Mini Project
- Final assessment



Evaluation Criteria

- Mini-Project work
- MCQ based assessment
- Assignments

Our Trainers:



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.



Mr. Vikrant Vaidya

CEO, 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. Vikrant Garud

Master Trainer
pManifold EV Academy

Academics: Masters in Automotive Materials and Manufacturing, ARAI Academy Pune

7+ years of experience as a Researcher, Author cum eminent academician. Expertise in advanced and Smart automotive materials and working on implementation of it for various automotive applications. Have worked on various projects of CVRDE and VRDE, published 20+ research articles in the field of various automotive applications. Also, listed in FISITA's world database of experts and part of editorial board member of Elsevier since last 3 years.

Program Formats:

- Self Paced
- Live Online
- Customized

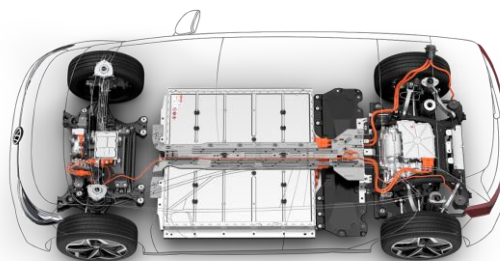
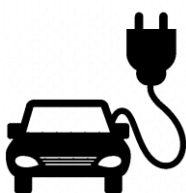
Who can Enroll?

- Working Professionals, Consultants, Researchers
- Students pursuing master degree in engineering, Faculties
- Battery modeling enthusiasts

Up to 100% Scholarship available for Live online batches

[Click here to learn more and Enroll !](#)

[Apply Now](#)



About Us

pManifold EV Academy:

A knowledge share vertical of 'pManifold Business Solutions PVT LTD', is working globally to build EV System skills among practitioners, EV enthusiasts, academia's, etc. Providing a wide range of live online, hybrid, and self paced training programs in product development to planning aspects, etc.

It is also working at organizational (B2B) level to deploy customized training programs.

ASDC:

ASDC is the first Sector Skill Council of India in Automobile sector and is founded to build a sustainable skill development ecosystem to ensure adequate availability of quality workforce to meet the automotive industry requirements. Currently, ASDC is working curriculum development, Standardisation, Training of trainers as well as certification.