

INDUSTRIAL WORKSHOP · 26 SEPTEMBER 2026

Automotive Futuristic Technology

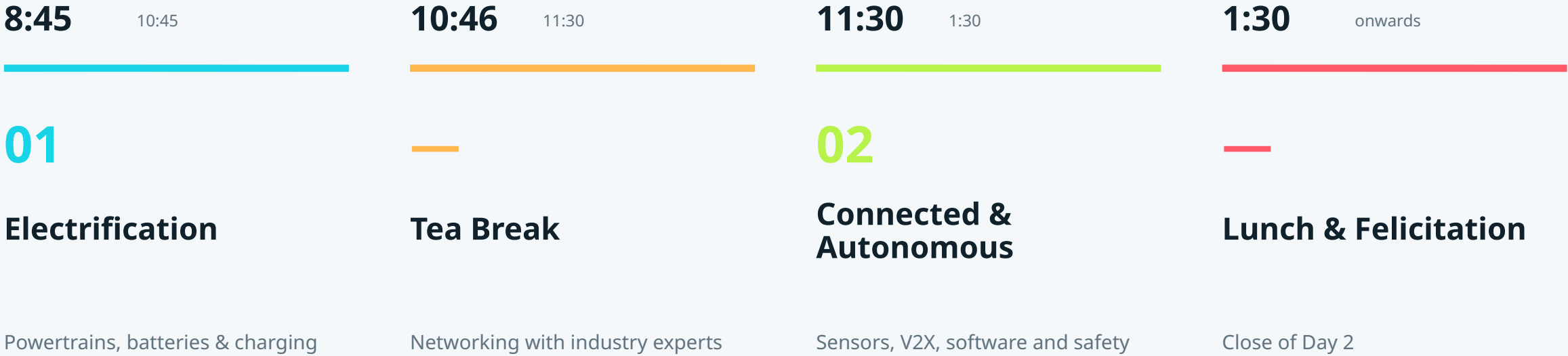
Electrification, connectivity and autonomy
reshaping the vehicle

DAY 2

Session 1 8:45–10:45 • Session 2 11:30–1:30



Schedule at a Glance



01

SESSION 1 • 8:45–10:45

Electrification

Powertrains, Batteries & Charging

Why powertrain choice is now a business decision — not only an engineering one.



Learning Objectives

- 1 Differentiate ICE, hybrid, BEV and FCEV powertrains
- 2 Identify the core EV powertrain components
- 3 Compare AC, DC, swapping and bidirectional charging
- 4 Explain regenerative braking and range impact
- 5 Outline India's key EV policy instruments

120 MIN · INCLUDES TUTORIAL + QUIZ

Powertrain Options Compared

ICE

Mature infrastructure

Fast refuelling ·
tailpipe emissions

01

HEV

Engine + small
battery

Regeneration · no
plug required

02

PHEV

Engine + larger
battery

Plug-in electric range
+ fuel backup

03

BEV

Battery + motor

Zero tailpipe
emissions · low
running cost

04

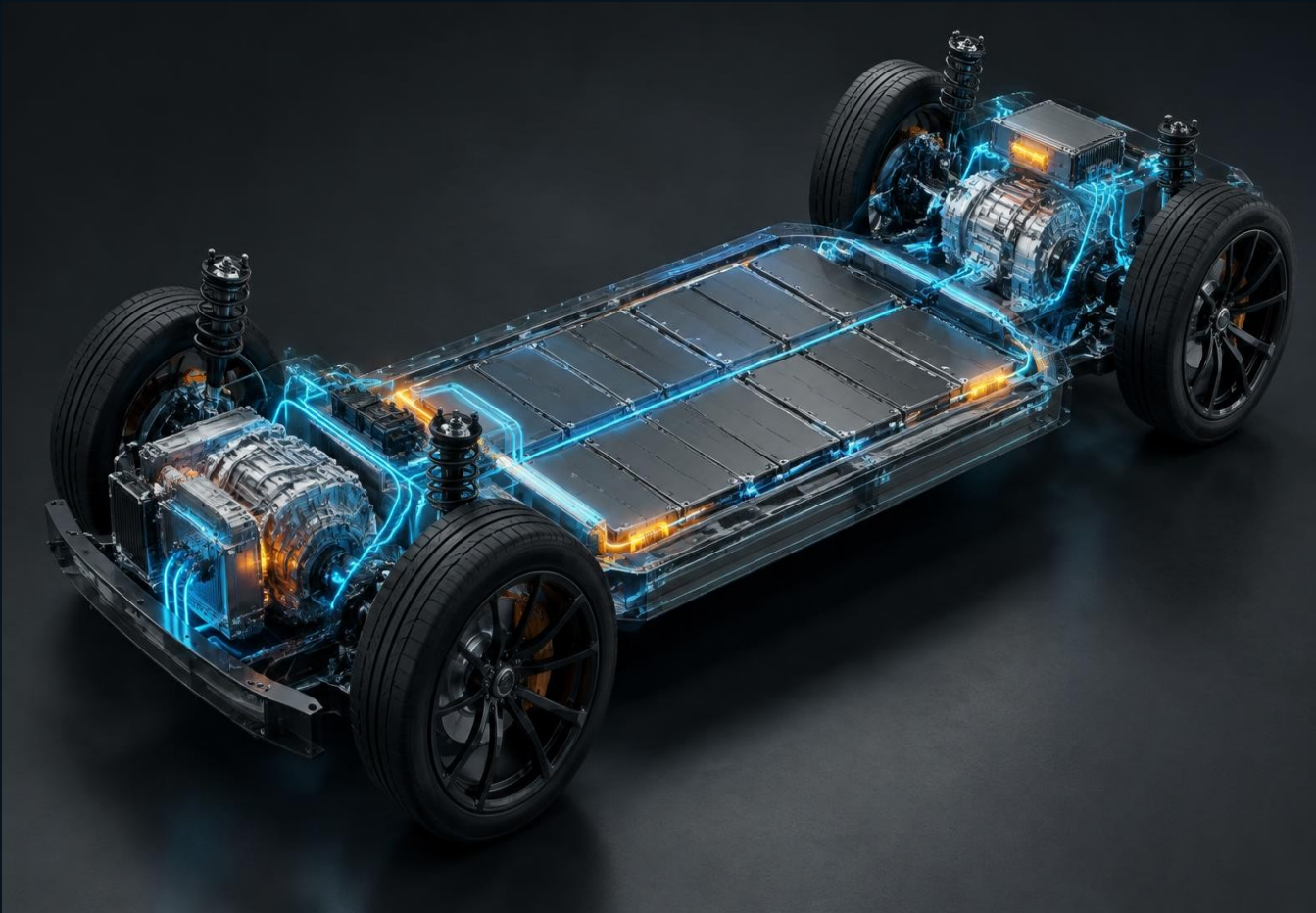
FCEV

Hydrogen fuel cell

Fast refuelling ·
nascent
infrastructure

05

Core EV Powertrain Components



1

BATTERY PACK

Stores propulsion energy; common chemistries include LFP and NMC

2

ELECTRIC MOTOR

Converts electrical energy into wheel torque

3

INVERTER

Converts DC to AC and controls torque delivery

4

BMS

Monitors cells, temperature, safety and balancing

5

ON-BOARD CHARGER

Converts grid AC into DC for the battery

The Charging Ecosystem

AC / HOME

3–22 kW

Type 2 • typically overnight



DC FAST

50–350 kW

CCS2 / GB-T • highway corridors



BATTERY SWAP

Minutes

2W / 3W fleet operations



V2G / SMART

Bidirectional

Vehicle supports home or grid



Regenerative Braking



UP TO 20%

Approximate city-driving range recovered through regeneration

1-PEDAL

Strong regeneration can enable one-pedal driving

LOWER WEAR

Reduced friction-brake use can lower service demand

India's EV Policy Push

FAME-II

2019–2024 • concluded

₹11,500 Cr

Demand incentives

PLI-AUTO

2021–2028

₹25,938 Cr

Advanced manufacturing

PM E-DRIVE

2024–2026

₹10,900 Cr

Successor support scheme

Schemes, outlays and timelines change. Verify current status before each teaching cycle.

EV vs ICE — Total Cost of Ownership

- 1 Compare a petrol hatchback and a similar BEV
- 2 Calculate 5-year energy + maintenance cost
- 3 Add the purchase-price difference
- 4 Find the BEV breakeven annual distance

DELIVERABLE

A one-page TCO comparison table with the calculated breakeven point — ready to present.

Questions 1–3

1

Which powertrain produces zero tailpipe emissions?

A ICE B Hybrid (HEV) C Battery-electric (BEV) D None

2

Which component converts DC battery power to AC for the motor?

A BMS B Inverter / power electronics C On-board charger D Battery pack

3

DC fast charging typically operates in which power range?

A 3–7 kW B 11–22 kW C 50–350 kW D 1–2 kW

Questions 4–6

4 Regenerative braking primarily helps by:

A Increasing top speed B Recovering energy during deceleration C Reducing weight D Increasing tyre life only

5 FAME-II was primarily a:

A Manufacturing scheme B Demand-side incentive C Charging regulation only D Import tariff policy

6 PLI-Auto is designed to incentivise:

A EV buyers directly B Domestic advanced automotive manufacturing C Fuel retailers D State transport corporations only

Answer Key

1

C

BEVs have no tailpipe

2

B

Inverter converts DC to AC

3

C

DC fast charging is high-power

4

B

Regeneration recovers braking energy

5

B

FAME-II targeted buyer-side demand

6

B

PLI-Auto rewards domestic manufacturing

02

SESSION 2 • 11:30-1:30

Connected & Autonomous Vehicles

From driver assistance to a connected, software-defined fleet.

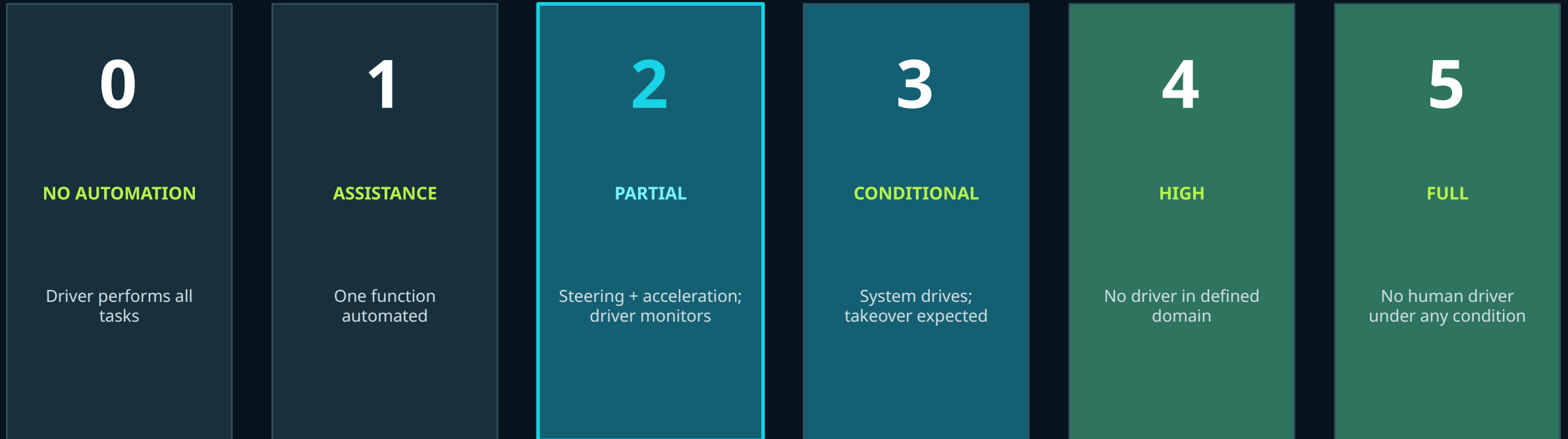


Learning Objectives

- 1 Explain SAE automation levels 0–5
- 2 Describe camera, radar, LiDAR and ultrasonic sensing
- 3 Explain V2X communication and ecosystem roles
- 4 Describe telematics, OTA and business implications
- 5 Identify cyber risks and mitigation approaches

120 MIN · INCLUDES TUTORIAL + QUIZ

SAE Levels of Driving Automation



MOST CURRENT INDIAN ROAD ADAS

The ADAS Sensor Suite

CAMERA

Semantic detail

Lanes · signs · objects

Weather sensitive

RADAR

Range + velocity

Works in poor visibility

Lower visual detail

LiDAR

Precise 3D geometry

High-resolution mapping

Higher cost

ULTRASONIC

Short range

Parking · low-speed manoeuvres

Limited distance

SENSOR FUSION / COMBINE MODALITIES FOR REDUNDANCY + ACCURACY

Connectivity Building Blocks

V2V Vehicles

Hazard + collision warnings

V2I Infrastructure

Signals + road conditions

CONNECTED VEHICLE

V2P Pedestrians

Crossing safety alerts

V2N Network

Cloud + cellular services

Telematics turns vehicle data into fleet visibility, diagnostics and driver insights. OTA delivers software features and fixes without a service visit.

Cybersecurity in Connected Vehicles

ATTACK SURFACE

Infotainment · telematics · OTA · V2X

KEY RISKS

Remote access · privacy breach · GPS spoofing

DEFENCE

Secure boot · encryption · detection · OTA patching



Global automotive cybersecurity and software-update management regulations

Feature-to-Level Mapping + Connected-Car Pitch

- 1 Map six driver-assistance features to SAE 0–5
- 2 Design one connected feature for an Indian urban commuter
- 3 Name the required sensor, V2X, telematics or OTA capability
- 4 Prepare a 90-second pitch

DELIVERABLE

A completed feature-to-SAE-level map plus a one-paragraph pitch for the new connected feature.

Questions 1–3

1

At which SAE level can the vehicle handle all driving within a defined domain?

A Level 2 B Level 3 C Level 4 D Level 1

2

Which sensor produces precise 3D mapping using laser pulses?

A Camera B Radar C LiDAR D Ultrasonic

3

V2I communication refers to:

A Vehicle-to-vehicle B Vehicle-to-infrastructure C Vehicle-to-pedestrian D Vehicle-to-network

Questions 4–6

4

OTA updates allow manufacturers to:

A Replace hardware remotely B Push software without a service visit C Change registration D Eliminate all recalls

5

Combining camera, radar and LiDAR data is called:

A Sensor fusion B Sensor swapping C Data hybridisation D Signal cloning

6

UN R155 / R156 primarily govern:

A Emissions B Cybersecurity + software updates C Crash ratings D Fuel labels

Answer Key

1

C

Level 4 handles a defined domain fully

2

C

LiDAR produces precise 3D maps

3

B

V2I is vehicle-to-infrastructure

4

B

OTA delivers software remotely

5

A

Sensor fusion combines modalities

6

B

R155 / R156 cover cyber + OTA

Innovation Radar — What Is Coming Next

SOLID-STATE CELLS

Public-road prototypes are moving battery research into vehicle validation.

Mercedes-Benz + BMW road trials

MEGAWATT CHARGING

MCS standardization targets heavy-duty charging with much shorter depot stops.

CharIN · IEC TS 63379

ZONAL COMPUTE

Central compute + zonal electronics can simplify wiring and accelerate OTA delivery.

Software-defined vehicle architecture

BIDIRECTIONAL ENERGY

ISO 15118-20 and related standards support vehicle-to-home and vehicle-to-grid pathways.

V2H · V2G

END-TO-END DRIVING AI

Integrated neural driving stacks are being demonstrated for complex urban navigation.

Research + production pilots

HYDROGEN PATHWAYS

Fuel cells remain under development for selected commercial and long-range use cases.

Heavy-duty + infrastructure-dependent

Watch & Discuss

HYDROGEN CONCEPT

Hyundai Motor Group

INITIUM fuel-cell concept film

[PLAY VIDEO ↗](#)

AI-POWERED VEHICLES

SAE International

Digital chassis and software-defined experiences

[PLAY VIDEO ↗](#)

URBAN AUTONOMY

NVIDIA

L2++ driving stack navigating San Francisco

[PLAY VIDEO ↗](#)

Discussion prompt: Which technology solves a real customer or infrastructure problem — and what must mature before scale?

Four ideas to carry forward

- 1 Electrification is a spectrum — choose by use case and infrastructure.
- 2 EV economics depend on battery cost, charging access and total ownership cost.
- 3 Automation is graduated; most current Indian-road ADAS remains Level 2.
- 4 Connectivity creates recurring value — and new cybersecurity obligations.

Tomorrow's vehicle is electric, connected, updateable — and accountable.