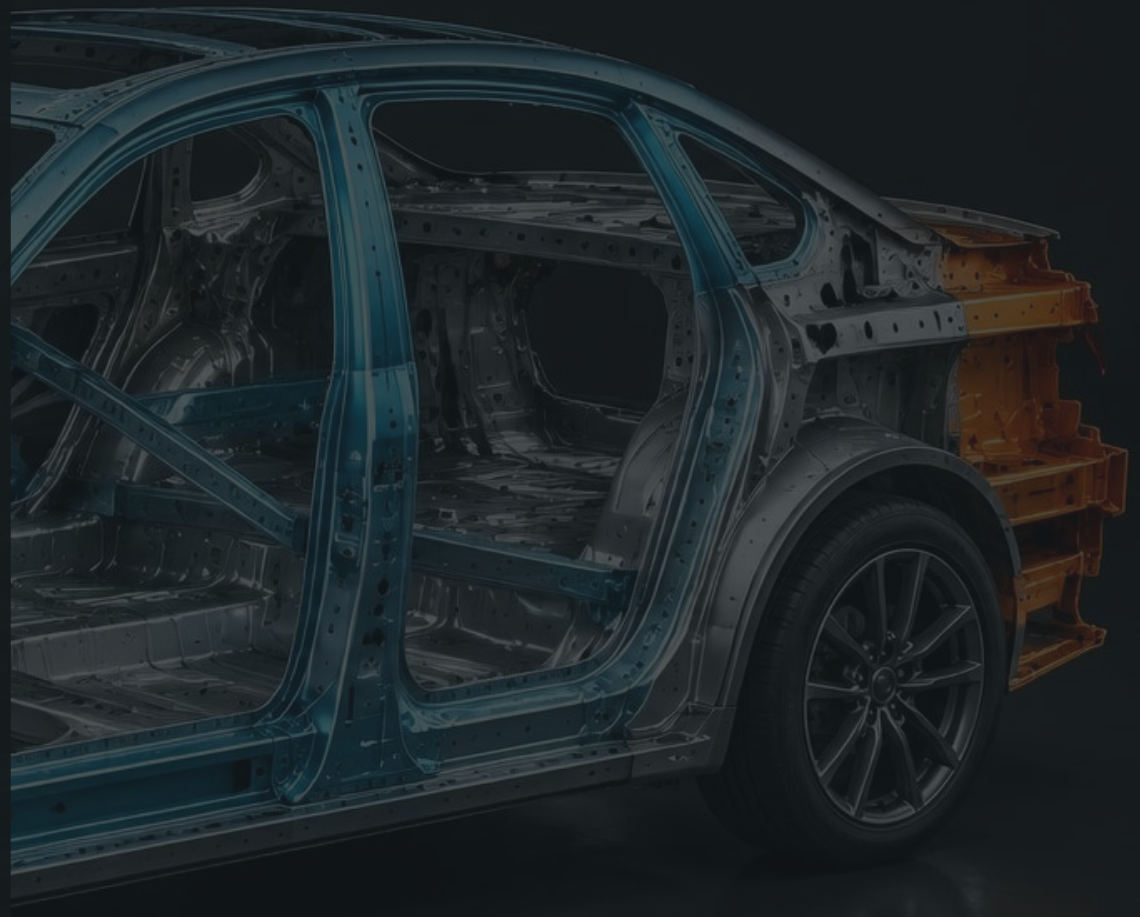
DAY 1

# Vehicle Body Engineering & Fundamental Maintenance

From structural design and crash safety to preventive care and diagnostics



**25 SEPTEMBER 2026 • GU CAMPUS, GREATER NOIDA**

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

DAY AGENDA

# One day. Two engineering lenses.

The revised workshop progression from structure to service.

### 8:45–10:45 / SESSION 1

Vehicle Body — Construction, Materials & Safety

### 10:46–11:30 / TEA BREAK

Networking with industry experts

### 11:30–1:30 / SESSION 2

Fundamental Maintenance — Preventive Care & Diagnostics

### 1:30 onward / LUNCH + FELICITATION

Close of Day 1

01

# Vehicle Body — Construction, Materials & Safety

How a body is designed, built and protected — and why those choices shape cost, weight, repairability and safety.

SESSION 1

# What you should be able to explain

Five outcomes connect engineering choices to customer and business value.

**01**

Classify body styles and explain the body’s system role

**02**

Compare body-on-frame, unibody and space-frame construction

**03**

Evaluate materials on weight, cost, crash performance and repairability

**04**

Explain crumple zones, safety cages and pillar structures

**05**

Trace the Body-in-White manufacturing and corrosion-protection sequence

SESSION 1 / CONCEPT

# The body is more than an outer shell

It integrates safety, structure, efficiency, comfort and brand expression.

### PROTECT

Occupant safety cage

### CARRY

Powertrain + suspension

### SHAPE

Aerodynamics + energy use

### REFINE

Noise, vibration + harshness

### SIGNAL

Brand identity + segment

**BODY STYLES / Sedan • Hatchback • SUV/Crossover • MPV • Coupe • Pick-up**

SESSION 1 / CONCEPT

# Three construction architectures

Every architecture is a compromise between ruggedness, mass, volume and tooling cost.

## BODY-ON-FRAME

Separate ladder chassis + bolted body

Best fit: Pick-ups, rugged SUVs, commercial vehicles

Durable / repairable / heavy

## UNIBODY

Body and chassis form one welded shell

Best fit: Most passenger cars and crossovers

Light / refined / predictable crash path

## SPACE FRAME

Load-bearing skeleton + non-structural skins

Best fit: Low-volume performance and select EVs

Very light / flexible skins / costly

**CLASS PROMPT  Which architecture is beneath the vehicle you arrived in today — and what evidence supports your answer?**

SESSION 1 / DECISION MATRIX

# Body material trade-offs

No material wins every dimension; programme priorities determine the mix.

| | | | | |
|---|---|---|---|---|
| Mild / HSS steel | Baseline | Low | Easy | Mass-market panels + structure |
| AHSS / UHSS | 10–15% lighter | Moderate | Specialist welding | Pillars + sills |
| Aluminium | 30–40% lighter | High | Specialist repair | Bonnets, doors, premium/EV |
| Composites / CFRP | Lightest | Very high | Difficult | Low-volume performance |
| Engineering plastics | Light | Low–moderate | Replaceable | Bumpers, fenders, trim |

**Management lens / Lightweighting can lower energy use — but specialist repairs may raise ownership and insurance cost.**

# Design deformation. Preserve survival space.

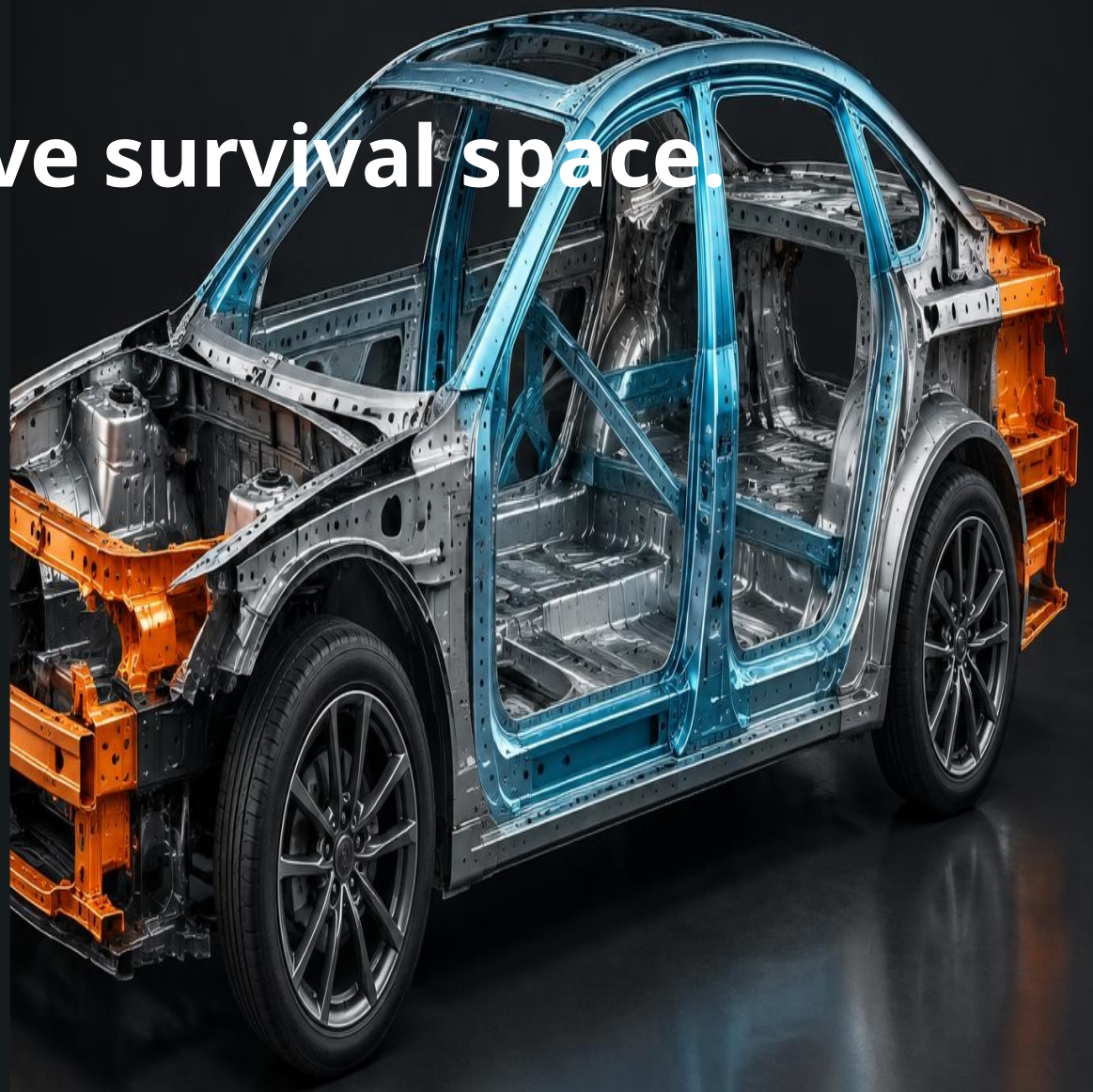
**CRUMPLE ZONES**
Progressively absorb kinetic energy

**SAFETY CAGE**
UHSS resists cabin deformation

**A / B / C PILLARS**
Manage roof-crush and side-impact loads

**CRASH BOXES**
Contain low-speed repair cost

PLAY IIHS: Understanding Car Crashes



# From coil to complete vehicle

Body-in-White is the structural shell before paint, trim and powertrain installation.

### 01 STAMPING

Coils pressed into panels

### 02 BIW + WELDING

Panels joined into a shell

### 03 E-COAT + PAINT

Corrosion barrier + finish

### 04 FINAL ASSEMBLY

Glass, trim, closures + powertrain

PLAY Toyota Virtual Plant Tour

TUTORIAL / 20 MINUTES

# Body architecture + material decision

Work in groups of 4–5. Build a decision, not just an engineering description.

Urban hatchback

Premium mid-size SUV

Battery-electric crossover

Light commercial pick-up

## YOUR TASK

Choose the architecture and primary material mix. Justify against target price, weight/efficiency, crash safety and repair cost.

## DELIVERABLE

One-page decision matrix plus a two-minute pitch. Nominate one spokesperson; expect one challenge question from the class.

**DECISION TEST / Would the customer understand why your choice is worth paying for?**

SESSION 1 / QUICK CHECK

# Questions 1–3

Choose one answer. Be ready to explain the engineering reason.

**1. Which construction integrates body and chassis into one shell?**

A. Body-on-frame  B. Unibody / monocoque  C. Space frame  D. Ladder frame

**2. Which material cuts panel weight roughly 30–40% versus steel?**

A. Mild steel  B. AHSS  C. Aluminium  D. UHSS

**3. What is the primary purpose of a crumple zone?**

A. Increase top speed  B. Absorb crash energy progressively  C. Reduce vehicle weight  D. Improve economy

SESSION 1 / QUICK CHECK

# Questions 4–6

Choose one answer. Be ready to explain the engineering reason.

**4. Body-on-frame is most commonly retained in:**

A. Compact hatchbacks B. Sports cars C. SUVs and pick-ups D. City EVs

**5. UHSS is primarily used in:**

A. Bumpers B. A/B-pillars and safety cage C. Bonnet skin D. Interior trim

**6. E-coating in BIW primarily provides:**

A. Paint gloss B. Corrosion protection C. Lower cabin noise D. Lower vehicle mass

SESSION 1

# Answer key

Check both the answer and the reason.

**Q1 / B**

Unibody integrates body + chassis

**Q2 / C**

Aluminium cuts panel weight

**Q3 / B**

Progressive energy absorption

**Q4 / C**

Ruggedness + payload

**Q5 / B**

Protects passenger cell

**Q6 / B**

E-coat is a corrosion barrier

02

# Fundamental Maintenance — Preventive Care & Diagnostics

Read a service schedule, a warning light and an OBD-II code as fluently as a product specification.

SESSION 2

# What you should be able to apply

Five outcomes move from strategy to customer communication.

**01**

Distinguish preventive, predictive and corrective maintenance

**02**

Apply a manufacturer’s periodic maintenance schedule

**03**

Prioritise core service items and typical intervals

**04**

Interpret dashboard warnings and basic OBD-II codes

**05**

Connect maintenance quality to total cost and resale value

SESSION 2 / STRATEGY

# When should the vehicle be serviced?

The answer shifts as connected data improves visibility into actual component condition.

## PREVENTIVE

Scheduled by time or mileage.

Predictable and safe; may replace parts before necessary.

## CORRECTIVE

Repair after failure.

Low short-term spend; high downtime, damage and safety risk.

## PREDICTIVE

Triggered by sensor, OBD or telematics data.

Better timing; depends on reliable data and diagnosis.

**CONNECTED SHIFT / Continuous inspection creates the health record that supports all three strategies.**

SESSION 2 / SERVICE PLANNER

# Core periodic service items

Intervals are typical teaching references; always check the manufacturer schedule.

| | | |
|---|---|---|
| Engine oil + filter | 5,000–10,000 km / 6 months | Accelerated engine wear |
| Air filter | 10,000–15,000 km | Lower power, higher consumption |
| Brake pads / discs | 20,000–40,000 km | Reduced stopping power |
| Coolant | ~40,000 km / 2 years | Overheating and engine damage |
| Battery + terminals | Check every visit / 3–5 years | Starting and electrical failure |
| Tyres | Rotate 8,000–10,000 km | Uneven wear, poor handling |

SESSION 2 / PROCESS

# Anatomy of a service visit

A good customer experience is a controlled flow of evidence, work and communication.

**01 INTAKE**

Concern, mileage, history

→

**02 SCAN**

OBD + visual inspection

→

**03 EXECUTE**

Fluids, filters, wear parts

→

**04 VERIFY**

Quality check + road test

→

**05 HANDOVER**

Invoice, warranty, next date

**SERVICE MANAGEMENT PRINCIPLE / Every recommendation should be traceable to inspection evidence.**

SESSION 2 / DIAGNOSTICS

# Read the warning. Judge the urgency.

**CHECK ENGINE**
Retrieve DTC; diagnose engine/emissions fault

**OIL PRESSURE**
Stop safely — engine seizure risk

**BATTERY / CHARGING**
Check alternator and battery

**BRAKE SYSTEM**
Check fluid, pads and safe operation

**OBD-II / Standard diagnostic interface** • **P0XXX / Standard powertrain code family**

PLAY OBD2 explained

TUTORIAL / 20 MINUTES

# Maintenance planner + service-advisor role-play

Work in pairs. Convert technical need into customer confidence.

## PROFILE A

4-year-old petrol hatchback
52,000 km
Last service: 8 months ago

Mark each item: OVERDUE / DUE SOON / MONITOR

## PROFILE B

2-year-old diesel SUV
60% highway use

Swap advisor/customer roles and repeat the explanation in plain language.

**DELIVERABLE / Two prioritised maintenance checklists ready to hand to a customer.**

SESSION 2 / QUICK CHECK

# Questions 1–3

Choose the safest and most operationally sound answer.

**1. Which strategy relies on real-time condition data?**

A. Preventive  B. Corrective  C. Predictive  D. Statutory

**2. An oil-pressure warning while driving means:**

A. Continue  B. Stop safely and switch off  C. Check next service  D. Ignore if quiet

**3. OBD stands for:**

A. On-Board Diagnostics  B. Overall Body Design  C. Operational Brake Device  D. On-Board Drivetrain

SESSION 2 / QUICK CHECK

# Questions 4–6

Choose the safest and most operationally sound answer.

**4. Skipping coolant replacement primarily risks:**

A. Tyre wear B. Engine overheating C. Battery drain D. Brake fade

**5. Tyre rotation is primarily done to:**

A. Increase speed B. Promote even wear C. Reduce engine load D. Improve paint

**6. A code such as P0301 is generated by:**

A. Infotainment B. ECU via OBD-II C. Tyre sensor only D. Insurance company

SESSION 2

# Answer key

The best answer protects safety, uptime and customer trust.

**Q1 / C**

Predictive uses live condition data

**Q2 / B**

Stop: engine seizure risk

**Q3 / A**

On-Board Diagnostics

**Q4 / B**

Coolant protects against overheating

**Q5 / B**

Rotation promotes even tread wear

**Q6 / B**

ECU generates DTCs through OBD-II

DAY SUMMARY

# Four ideas to carry into the industry

Engineering literacy strengthens marketing, service and ownership decisions.

### BODY = SYSTEM

Structure, safety, aerodynamics, NVH and brand

### ARCHITECTURE = TRADE-OFF

Weight, cost, use case and repairability

### MAINTENANCE = VALUE

Safety, uptime, total cost and resale

### DATA = NEXT ADVANTAGE

OBD + telematics enable predictive care

NEXT / DAY 2 — AUTOMOTIVE FUTURISTIC TECHNOLOGIES

STUDENT HANDOUT

# Day 1 — follow-along page

Capture the decisions and language you can reuse in class discussion.

01 The vehicle body combines structural, safety and brand roles.

02 Unibody dominates passenger cars; body-on-frame serves rugged use cases.

03 Material choice balances mass, cost, crash performance and repairability.

04 Crumple zones deform; the safety cage preserves survival space.

05 Preventive and predictive maintenance protect safety and resale value.

06 OBD-II converts vehicle faults into structured diagnostic evidence.

MY TAKEAWAY

MY QUESTION

**CLASSROOM CHALLENGE / Explain one maintenance recommendation without using technical jargon.**