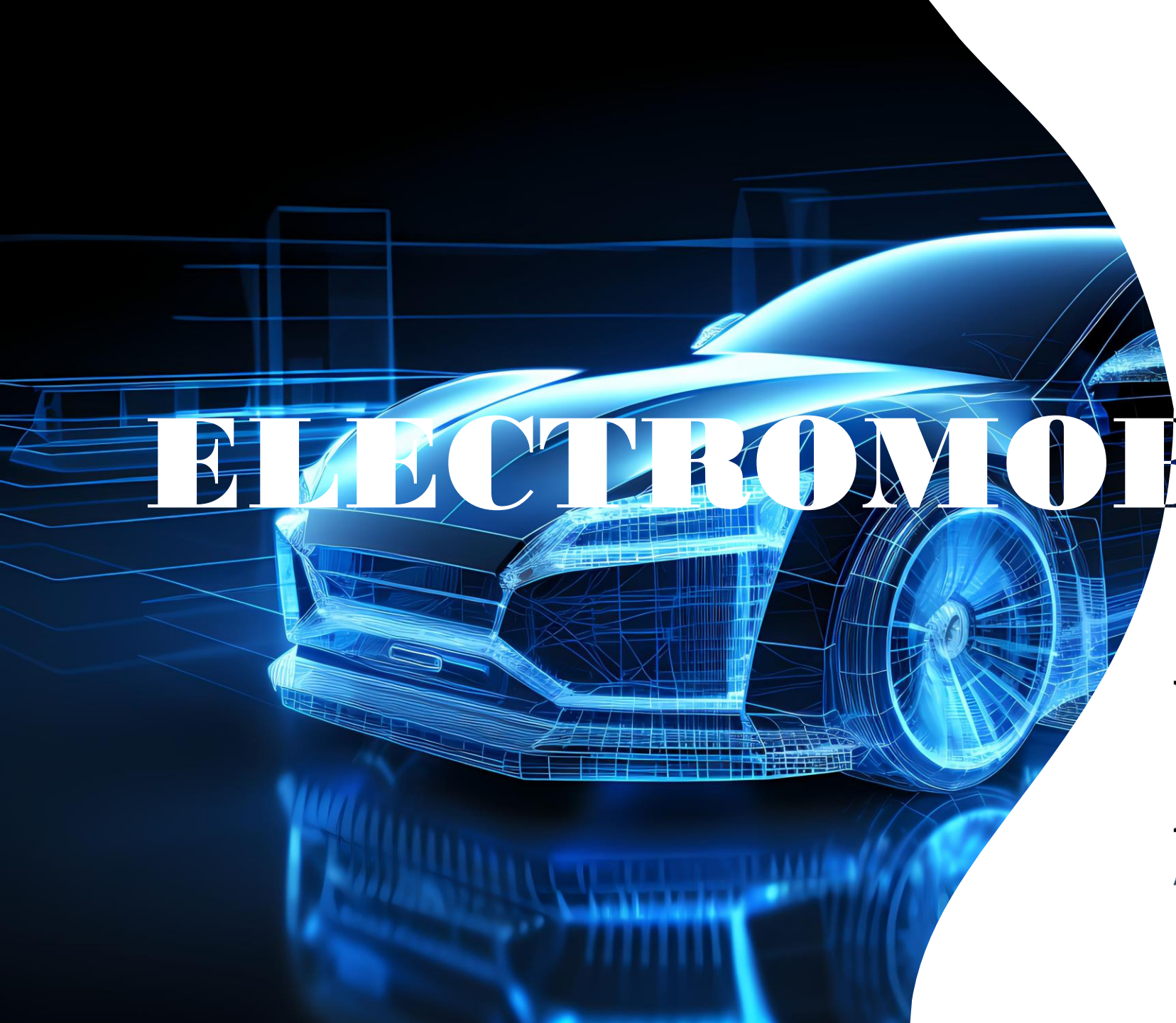

ELECTBOMOBILITY

DBF

ACADEMY FOR APPLYIED ENGINEERING

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Electromobility

DBF Academy for Applied Engineering

“Where Engineering Meets Real-World Application”

Course Format

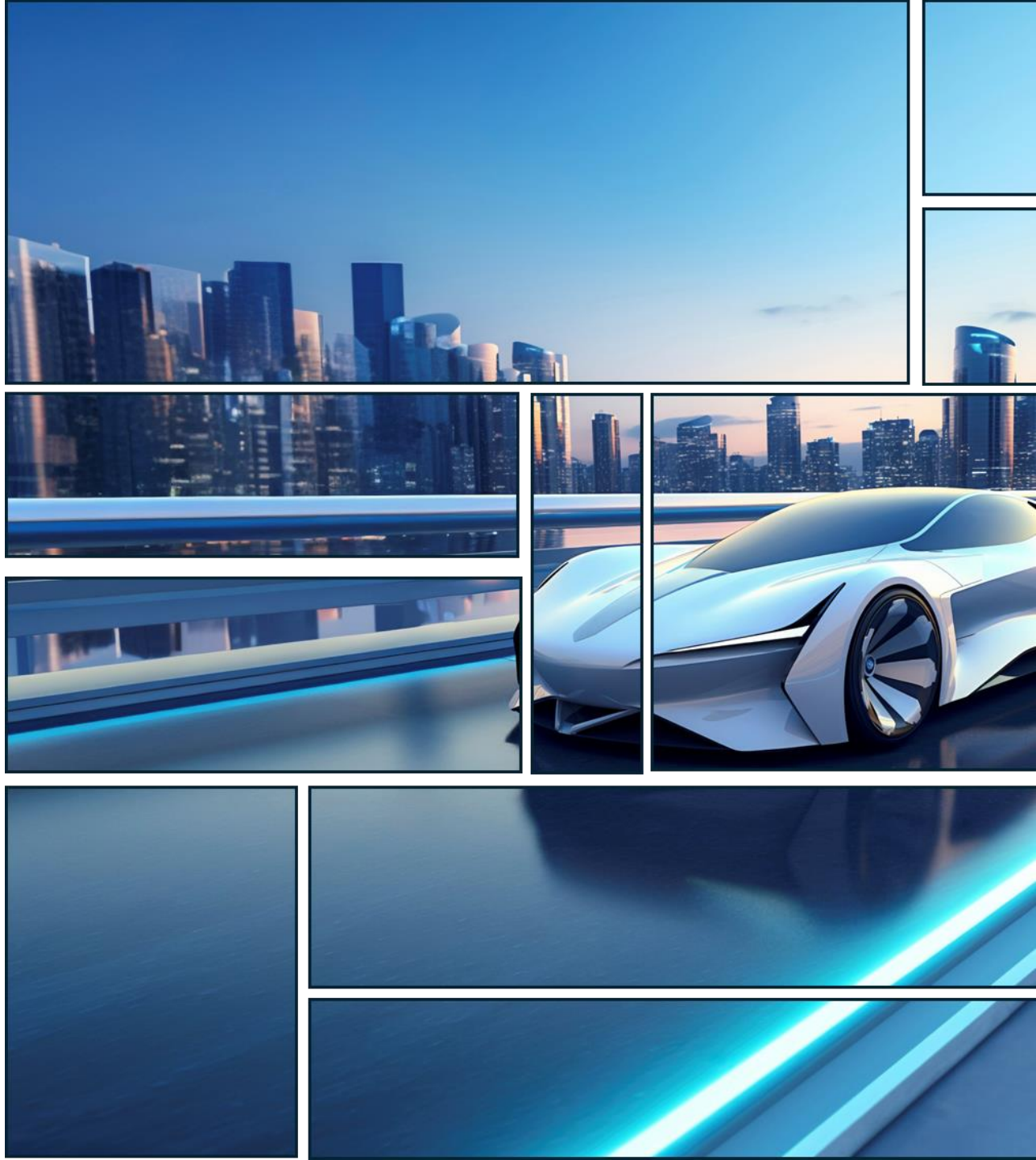
Type: Block Lecture
Duration: 5 Lecture Days + 1 Exam Day
Daily Schedule: 6 hours per day
Delivery Mode: In-person or online
Assessment: Final exam (written or oral, to be discussed with host university)
Suggested Credit: approx. 2 ECTS (based on student workload; final decision to be coordinated with the university)

Target Audience

Bachelor students in: Electrical Engineering, Mechatronics, Energy Technology, Automotive Engineering, Mechanical Engineering and Industrial Engineering

Course Outcome

Students will develop a strong foundation in electromobility technologies, including electric drive systems, battery storage, vehicle integration, and charging infrastructure. The course also covers environmental impact, regulations, and future trends, preparing students to contribute to the development and implementation of electric vehicle solutions.



Day 1: Introduction to Electromobility

History and Evolution of Electric Vehicles

Explore the early inventions of electric cars, the rise of internal combustion engines and the resurgence of EVs due to environmental concerns and technological advances.

Comparison of EVs with Internal Combustion Engine Vehicles

Analyze key differences in drivetrain architecture, energy efficiency, emissions and maintenance requirements. Understand where EVs outperform and where challenges remain.

Overview of the Current EV Market and Future Trends

Examine market penetration, major players (e.g., Tesla, BYD, VW), global policy impacts and trends like solid-state batteries, autonomous driving and EV-sharing platforms.

By the end of this session, students will be able to:

Understand the historical development of electric vehicles
Compare electric and internal combustion vehicle systems
Analyze current EV market trends and projections

Day 2: Electric Drive Systems

Fundamentals of Electric Motors Used in EVs

Learn how induction motors, permanent magnet synchronous motors (PMSM) and switched reluctance motors operate and differ. Understand torque-speed characteristics and control needs.

Power Electronics and Control Systems

Explore the role of inverters, DC-DC converters and motor controllers in managing power flow. Study switching principles, efficiency optimization and vector control strategies.

Regenerative Braking and Energy Efficiency

Understand how EVs recover kinetic energy during braking, convert it back to electrical energy and increase overall efficiency. Discuss regenerative braking limits and control strategies.

By the end of this session, students will be able to

Understand electric motor principles in electric vehicles
Explore power electronics and control strategies
Analyze regenerative braking and energy flow

Day 3: Energy Storage and Battery Technologies

Types of Batteries Used in EVs (Li-ion, Solid-State, etc.)

Compare chemistries such as LFP, NMC and emerging technologies like solid-state batteries. Understand energy density, safety, cycle life and cost factors.

Battery Management Systems (BMS)

Discover how BMS ensures safe operation, monitors cell voltages and temperatures, manages charging/discharging and protects the battery pack from damage.

Charging Technologies and Infrastructure

Differentiate between AC and DC charging, fast and ultra-fast chargers and smart charging concepts. Learn about global standards (e.g., CCS, CHAdeMO) and grid connection issues.

By the end of this session, students will be able to

Compare key battery types used in EVs
Understand BMS functions and safety roles
Describe charging technologies and infrastructure design

Day 4: Vehicle Integration and System Design

Integration of Electric Powertrains into Vehicle Platforms

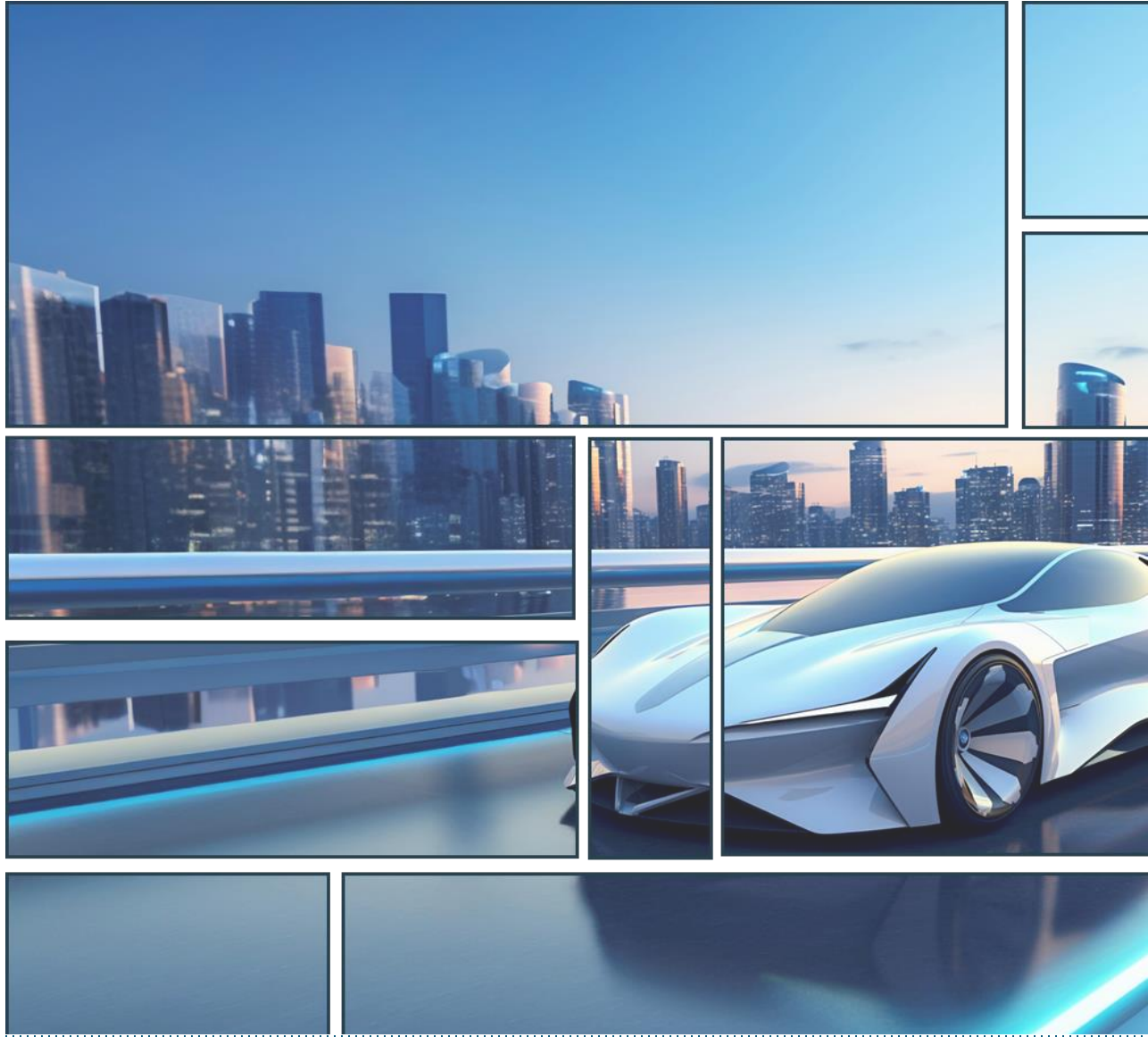
Understand how electric motors, inverters, batteries and control units are spatially and functionally integrated into modern vehicle chassis and platforms.

Thermal Management Systems

Explore liquid and air-cooling systems for batteries, inverters and motors. Learn how thermal performance affects system life, safety, and efficiency.

Safety Standards and Testing Procedures

Review international standards (e.g., ISO 26262, UN ECE R100) and test procedures for crash, fire, EMC and HV insulation. Understand functional safety requirements for EVs.



By the end of this session, students will be able to

Integrate electric powertrains into vehicle systems
Understand thermal management solutions
Recognize industry standards and safety protocols

Day 5: Environmental Impact and Policy

Life Cycle Assessment (LCA) of EVs

Analyze environmental impacts from raw material extraction to vehicle end-of-life. Compare the carbon footprint of EVs vs. combustion vehicles under different electricity mixes.

Government Policies and Incentives

Survey incentive programs, tax breaks, zero-emission vehicle (ZEV) mandates and the impact of regulations like CO_2 fleet targets in the EU, US, and China.

Outlook and Challenges in Electromobility

Discuss remaining barriers such as charging infrastructure gaps, battery raw material sourcing and grid impact — and how future technologies and policies aim to solve them.

By the end of this session, students will be able to

Assess environmental impacts using LCA
Identify policy instruments and EV incentives
Discuss future challenges and opportunities in the EV sector

Day 6: Examination

The final exam format (written or oral) will be discussed with the host university. It will assess:

- Technical knowledge of electromobility systems
- Application of design principles
- Environmental, market, and policy awareness