IMPERIAL

Module Specification

Basic details

UID		Cohorts covered (Earliest cohort)	
Long title	Electric Vehicle Technologies		
New code	ELEC70099	New short title	

Brief description of module *(approx. 600 chars.)*

The aim of this module is to provide an overview of the technologies involved in making an electric vehicle (EV) along with those required to enable wide adoption of EVs. We will achieve this by performing a simple EV design and modelling process throughout the course of the lectures and coursework.

We will start with a system level view of the various components of an EV and through the course of the module dive deeper into a few key subsystems such as the battery, charging system and traction system. Throughout the module we will build a MATLAB simulation model of an EV, adding components as they are studied. This kind of model is crucial for estimating the performance of our designs but also to specify certain components (battery size, current ratings of components etc.). Over 3 coursework tasks you will build and augment this model to represent the vehicle you have designed, assessing its performance and range along the way in a method that is representative of industry techniques.

In addition to the EV model we will spend some time discussing the wider impacts of large scale EV rollout. Asking questions such as: How will the electricity networks need to change? How will user behaviour need to change? Are there any technologies that will be crucial?

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit	
Credit value	5	10	N	HECOS codes
FHEQ level	7			

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	30	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	75	*Incl. wider reading/ practice, follow-up work, completion of asses*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 2	Other	

Ownership

Primary department	Electrical Engineering
Additional teaching departments	
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N
External institution	N/A
External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Course Leader		Philip	Clemow
Lecturer		Paul	Mitcheson

Learning and teaching

Module description

Learning outcomes	By the end of this module you will be able to: 1.Describe and map the key systems that make up an EV and detail their function within the whole 2.Summarise the pros and cons of different battery chemistries, battery arrangements and different charging technologies. 3.Design and model a traction system for an EV including modelling the motor model and a Field Oriented Control system. 4.Summarise the key requirements and performance indicators of modules within an EV such as the: Charger, DC-DC Converter, Battery and Battery Management System. 5.List the impacts of EVs on the wider grid and environment including the potential future of adaptive and reactive charging (Demand-side response and Vehicle-to-grid). 6.Assemble and adapt an EV model for the purposes of design of its subsystems and performance assessment of the system as a whole 7.Research and develop your own model of an EV subsystem. 8. Apply general engineering skills to the breakdown and solving of more complex problems with open specifications and communicate this effectively in a concise report.

Module content	An EV consists of many subsystems, and desinging one requires some knowledge across a broad range of engineering disciplines. As this is an electrical engineering module we will not cover all of these topics to an equal level of detail. Topics that are not strictly electrical engineering but crucial for overall EV system design (such as batteries for example) will be covered at a lower level of detail than those that fit better in the electrical engineering field. Topics covered in this course: - Batteries (Chemistry choice, cell arrangements, management systems) - Traction system (Motors and Motor Drives) - Charging (General charging systems, wireless charging) - Other Key systems (DC/DC Converters, CAN bus comms, key load devices etc.) - Affect of EVs on the Grid (Vehicle to grid charging, impacts of wide roll out of EVs) - Safety and Design standards
Learning and Teaching Approach	The course will be taught largely through lectures. Weekly support sessions will be held for the coursework activities and any other questions that arise
Assessment Strategy	The module will be summatively assessed through a series of 3 MATLAB coursework activities where you will create your own EV simulation model in stages.
Feedback	Feedback will be provided for each of the coursework activities within 2 weeks. Formative feedback will be available througout but particularly during coursework support sessions
Reading list	Reading list will be on Leganto

Quality assurance

Date of first approval	July 2022
Date of last revision	May 2023
Date of this approval	
Module leader	Philip Clemow
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version

Assessment details

Grading method	Numeric	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Coursework	Adapt and assess an existing MATLAB model of an EV	10%	50%	N
Coursework	Design and simulate a control system for an EV Motor	40%	50%	N
Coursework	A selection of short investigations into different subsections of an EV and the wider impacts of EV adoptions	50%	50%	N
		100%		