Subject Description Form

Subject Code	EE548
Subject Title	Advanced Electric Vehicle Technology
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE512
Objectives	1. To acquire a high level of electric vehicles technology and future EV design 2. To understand the development of the impact of electric vehicles on society and security.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the advanced knowledge of the electric vehicle. b. Understand various advanced parts and components in electric vehicles. c. Understand the future energy sources and storage for electric vehicles. d. Impact of electric vehicles and emerging technologies.
Subject Synopsis/ Indicative Syllabus	1. ***Future EV design and demand:*** All electric parts and components design, configurable EVs, high speed vehicles, hyperloop vehicle, Magnetic levitation vehicle. 2. ***Advanced motor drive:*** In-wheel motor, anti-braking system (ABS), Continuously Variable Transmission (CVT), active suspension. 3. ***Advanced energy storage:*** Distributed energy storage, future battery, future fuel cell. 4. ***Power electronics for EV:*** High power density power electronics, High current power electronics. 5. ***EV and security:*** Advantage and disadvantage of EVs, Autocrypt V2G, EV accidents and safety, EV maintenance, Internet of Thing (IoT) for EVs, Intra vehicle security, Vehicle to Data Center security 6. ***Autonomous vehicles:*** Layers of autonomy, Unmanned ground vehicle (UGV), Advanced Driver Assistance Systems (ADAS), Smart sensors, radar, Lidar, Path control. 7. ***Future power sources for EV:*** Photovoltaic to EV, Catenary-free electric trains and Trolley bus, Non-Carbon fuel, New energy for EVs. 8. ***EV policy:*** Government Policy in EVs, Infrastructure of EVs, sustainability and the environment.
Teaching/Learning Methodology	Delivery of the subject is mainly through formal lectures, complemented by tutorials, worked examples and assignment. Self-learning on the part of students is strongly encouraged and extensive use of web resources will be made.

Teaching/Learning Methodology	Intended subject learning outcomes			
	a	b	c	d
1. Lectures	✓	✓	✓	✓
2. Tutorials	✓	✓	✓	✓
3. Assignment/mini-project	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Assignment/mini-project	15%	✓	✓	✓	✓
2. Test	25%	✓	✓	✓	✓
3. Examination	60%	✓	✓	✓	✓
Total	100 %				

The assignment is designed to assess students' understanding of the advanced electric vehicle principles and its impact to society and whether they can present the study clearly. Oral presentation for their assignment is needed. It includes the take-home-assignment and mini-project.

The test is designed to assess students' understanding of the topics that they have learnt relative to learning outcomes (a), (b), (c) and (d). The test is usually conduced in the mid-semester to measure students' performance.

Examination: questions are designed to assess learning (a), (b), (c) and (d). Students are required to answer questions that cover all of the learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	30 Hrs.
▪ Tutorial and presentation	9 Hrs.
Other student study effort:	
▪ Mini project or Assignment	27 Hrs.
▪ Self-study	49 Hrs.
Total student study effort	115 Hrs.

Reading List and References

1. Mark Daly, "Electric Vehicles: A Guide for Just About Anyone", Eninserv Limited, 2017.
2. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer New York, 2013.
3. Tom Denton, "Electric and Hybrid Vehicles", Routledge, Taylor & Francis Group, 2016.
4. Wanrong Tang, Y. J. Zhang, "Optimal Charging Control of Electric Vehicles in Smart Grids", Springer, 2017.
5. Hanky Sjafri. "Introduction to Self-Driving Vehicle Technology", Chapman & Hall/CRC Artificial Intelligence and Robotics Series, 2019.
6. S. Liu, L. Li, J. Tang, S.Wu, J.Gaudiot, "Creating Autonomous Vehicle Systems", Synthesis Lectures on Computer Science, 2020.