## SUBJECT DESCRIPTION FORM

Subject title: Hybrid and Electric Car Technology

Subject code: EE543

Credit value: 3

Responsible staff and department:

Dr. T.F. Chan and Prof. K.W. Cheng, EE

Pre-requisite: Nil

Recommended background knowledge:

A degree or equivalent in engineering.

Mutual exclusions:

EE512 Electric Vehicles

Learning approach:

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|---|---|
| Lecture | 30 hours |
| Tutorial/Visit | 6 hours |
| Group Discussions & Presentations | 6 hours |
| Total | 42 hours |

Assessment:

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|---|---|
| Coursework | 40% |
| Examination | 60% |

The continuous assessment will consist of a formal test, a term paper, and presentation.

Objectives:

To provide practising engineers with a general knowledge of modern hybrid and electric vehicle technologies, and to understand their impact and significance on our society.

Programme Learning Outcomes:

Upon satisfactory completion of the subject, students are expected to achieve the following programme outcomes:

PO 1- To provide students with knowledge in automotive structures and systems;
PO 2- To enhance students with knowledge in car design and development;

Subject Learning Outcomes:

1. Have acquired a good understanding of modern hybrid and electric vehicle technologies.

2. Able to appreciate the impact and significance of hybrid and electric vehicle technologies on our society.

3. Able to appreciate the development trend of future hybrid and electric vehicles.

**Keyword syllabus:**

***Introduction to Hybrid and Electric Vehicles:*** Historical perspective. Comparison between EV and HEV: performance, advantages and impacts. Market and promotion: infrastructure needs, legislation and regulation.

***Hybrid and Electric Vehicle Design Options:*** EV configurations: fixed vs. variable gearing, single- vs. multiple-motor drive, in-wheel drives. HEV configurations: series hybrid and parallel hybrid, torque coordination and control, generator/motor requirements. Vehicle parameters, driving cycles and performance specifications.

***Vehicle Dynamics and Motor Drives:*** Road load: vehicle kinetics; effect of velocity, acceleration and grade. EV drivetrain and components. Motor drive systems and control strategies. Efficiency mapping.

***Energy Storage:*** Battery systems: battery parameters, types and characteristics, charging schemes and charger design, monitoring techniques. Capacitor systems: supercapacitors, ultracapacitors. Hydrogen storage. Flywheel systems.

***Emerging Technologies:*** Fuel cell and alternative fuel electric vehicles (FEVs and AFEVs). Case studies on commercialised HEVs and EVs. Research and development activities.

Indicative reading list and references:


1. Husain Iqbal, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press, 2003.
2. Larminie James and Lowry John, *Electric Vehicle Technology Explained*, Wiley, 2003.
3. Miller John M., Propulsion Systems for Hybrid Vehicles," IEE Power & Energy Series 45, 2004.
4. Ehsani Mehrdad Gao Yimin, Gay Sebastian E. and Emadi Ali, *Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press, 2004.
5. Selected papers from relevant journals and conference proceeding