Energy-saving and new energy vehicle technology

Course Code:

Class Hours: 48

Credit: 3

Applicable Major: Mechanical Engineering

Pre-requisite Courses: automotive science, electrical and electronic technology, automatic control theory

Objectives:

Through the study of this course, undergraduate and graduate students can master the background, technical overview and trends of energy-saving and new energy automotive technology development, master the composition, principle and technical key of battery electric vehicles and hybrid vehicles with comprehensive understanding on control and energy management theory. Further, this course aims to help students establish systemic view on the principle and design method power battery and its management system, electric drive system, electric auxiliary system, in-vehicle network and inter-vehicle network, development approach of chassis controller and Electromagnetic Compatibility technologies of energy-saving and new energy vehicles.

Teaching Methods:

Classroom lectures, material self-study and class discussion.

Contents:

1 A Brief Introduction to Energy-saving and New Energy Vehicles (*3 class hours)*

1.1 Current status and characteristics of automotive energy applications

1.2 Energy-saving, emission reduction and sustainable development of the automotive industry

1.3 The future of automotive energy and countermeasures

1.4 Concepts and categories of energy saving and new energy vehicles

1.5 Status and characteristics of energy conservation and new energy technology applications

1.6 Analysis of the development trend of energy saving and new energy technologies

2 Battery Electric Vehicle Technology *(5 class hours)*

2.1 Overall vehicle technology for battery electric vehicles

2.2 Performance analysis and parameter matching of battery electric vehicles

2.3 Energy management and integrated control of battery electric vehicles

2.4 Charging and promotion of battery electric vehicles

2.5 Assignments and group discussions: technical bottlenecks and solutions for pure electric vehicles

3 Fuel Cell Vehicle Technology *(5 class hours)*

3.1 Fuel cell and fuel cell engine

3.2 Overall technology of fuel cell electric vehicle

3.3 Energy management and integrated control of fuel cell electric vehicles

3.4 Fuel cell electric vehicle demonstration operation technology

3.5 Assignments and group discussions: technical bottlenecks and solutions for fuel cell electric vehicles

4 Hybrid Electric Vehicle Technology *(10 class hours)*

4.1 Introduction to Hybrid Electric Vehicles

4.2 Analysis of the configuration and working principle of hybrid electric vehicles

4.3 Overall vehicle technology for hybrid electric vehicles

4.4 Electromechanical coupling of hybrid electric vehicles

4.5 Hybrid electric vehicle electric and electric coupling

4.6 Hybrid vehicle engine technology

4.7 Hybrid Electric Vehicle Energy Management and Integrated Control

4.8 Assignments and group discussions: Technical bottlenecks and solutions for hybrid electric vehicles

5 Automotive Electric Drive System Technology *(8 class hours)*

5.1 Overview of Electric Drive Systems

5.2 DC motor drive system for vehicles

5.3 Vehicle AC induction motor drive system

5.4 Permanent magnet synchronous motor drive system for vehicles

5.5 Regenerative braking energy recovery technology

5.6 Assignments and group discussion: Matching strategies between electric drive system characteristics and vehicle performance

6 Electric Vehicle Power Battery and Management System *(5 class hours)*

6.1 Power Battery Overview

6.2 Common power battery extreme characteristics

6.3 Power Battery Group Application Technology

6.4 Power Battery Management System

6.5 Power Battery Modeling and State Estimation

6.6 Assignments and group discussion: Matching strategies between power battery characteristics and vehicle performance

7 Automotive Electrification System *(3 class hours)*

7.1 Overview of auxiliary systems for electric vehicles

7.2 Electric steering system

7.3 Electric air conditioning system

7.4 Electric brake system

7.5 Assignments and group discussions: Matching strategies for key components and performance of electrified auxiliary systems

8 Body Network and Car Networking Technology *(3 class hours)*

8.1 Body network system

8.2 Inter-vehicle network system

8.3 Networked Control Key Technologies

9 Control System Rapid Prototyping Technology *(3 class hours)*

9.1 Overview of New Energy Vehicle Control System

9.2 Control system hardware design key technology

9.3 Control System Software Architecture

10 New Energy and Energy-saving Automotive Electromagnetic Compatibility Theory and Technology *(3 class hours)*

10.1 Overview of Electromagnetic Compatibility

10.2 Key Technologies in Electromagnetic Compatibility Design

Assessment and Performance Evaluation:

The results are measured in terms of percentage.

The assignments and discussions account for 40% of the total score, and the final written examinations accounts for 60% of the total score.

References:

M. Ehsani, Y. Gao, S.E. Gay. Hybrid Electric and Fuel Cell Vehicles Fundamentals theory and design [M]. New York: CRC Press, 2005.

G. Pistoia. Electric and hybrid vehicles [M]. Elsevier, 2010.

Other Published Papers (Annual Updated).

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