Description of Courses

▣ Graduate Program

MO500 Introduction to Mobility Systems **3:0:3**

This course is mainly to enhance understanding on the mobility technology, and the future vehicle technology. We study the overview of sustainable transportation technology including road and railways, aviation, shipping, walking and cycling, freight, and ports and airports etc. In addition, the current status and future about the mobility technology, sustainable potential and risk analysis, and policy and its measures will be discussed.

MO501 Modeling and Control of Electric Propulsion Systems **3:3:4**

This course is designed to introduce students to the state-of-the-art Electrified Powertrain technologies based on modeling, dynamics, and controls approach. The course focuses on the system-level design and control problems of hybrid electric vehicles. We will introduce the basic concepts, terminology, and solve engineering problems of hybrid vehicles using system dynamics & controls approaches.

MO502 Intelligent Transportation System **3:3:4**

This course introduces methodologies and concepts for the analysis and design of intelligent transportation system; and discusses state-of-art information and communication technologies (ICT) that are readily applicable to real-world transportation problems.

MO505 Computational Analysis and Design for Electric Vehicles **3:3:4**

This course covers fundamental principles of computational analysis and design for the systematic and efficient development of emerging electric transportation systems. This course also provides case studies which involve multidisciplinary analysis such as structural analysis, thermal analysis, and electromagnetic analysis in order to help students to understand the course.

MO506 Fundamentals of Vehicular Electric Systems **3:0:3**

This course introduces the basic concept and operational principle of electronic circuits, electromagnetics and semiconductors and applications to motor, sensor, communication system, and wireless charging systems are explained based on the fundamentals to enhance the design ability for converging vehicle and transportation technology.

MO507 Transportation Infrastructure systems **3:0:3**

This course provides understanding on transportation-related infrastructures, and deals with planning of infrastructure systems, geometric and structural design, and evaluation of the systems. It covers facilities issues including railway systems, roadway design, pavement management systems, harbor and airport design, and expands to sustainability

issues.

MO508 Navigation and Sensing Systems 3:0:3

This course introduces GNSS (Global Navigation Satellite Systems), radar, and image processing technologies for vehicular navigation systems. Study subjects include the principles and signal analysis of the next generation GNSS, principles and signal processing techniques for radar, and the principles and image processing techniques for vision navigation.

MO510 Public Transportation Systems 3:0:3

This course introduces how to systemically understand public transportation systems. The scope ranges from the fundamental theories to real-world applications. Both traditional modes including buses, subways, and taxis, and emerging transit services associated with electric vehicles (EVs) and connected and autonomous vehicles (CAVs) will be discussed.

MO520 Electric Powertrain Engineering 3:0:3

This course introduces power electronics technology for implementing electric powertrain of electric vehicle. Particularly, energy storage, dc machine, induction machine, three-phase inverter, and motor control are covered in this lecture. Simulation is to be carried out to enhance the understanding of operation principles of electric powertrain.

MO531 Battery System Modeling and Control 3:0:3

This course introduces the principles and applications of battery modeling, control and diagnostic methodologies, with emphasis on battery electric and hybrid electric vehicle applications. In particular, various types of battery models such as equivalent circuit models and electrochemistry-based models are discussed, and these models are utilized to predict battery states and conditions such as state-of-charge (SOC) and state-of-health (SOH).

MO540 Railway System Engineering 3:0:3

This course introduces emerging railroad technologies based on the understanding of basic railroad engineering. This course also provides each student a chance of conducting in-depth research on the specific topics related with railroad engineering and presenting it.

MO560 The Principles and Applications of the Kalman Filter 3:0:3

The aim of this course is to provide a thorough introduction to the Kalman filter technique that is an essential tool for state estimation and optimal control. In addition, this course covers the applications of the Kalman filter for linear and nonlinear systems such as extended Kalman filter, unscented Kalman filter, robust Kalman filter, multi-model Kalman filter, and particle filter.

MO610 Traffic Safety **3:0:3**

Traffic safety has been one of the biggest public health concerns worldwide – account for 1.3 million deaths annually. This course covers engineering methodologies that analyze traffic safety data and develop countermeasures and introduces the state-of-art technologies for traffic safety.

MO611 Introduction to Transportation Economics **3:0:3**

The course aims to develop a critical economic perspective to transportation issues and problems, and to explore a set of quantitative methods that are valuable to transportation system analysis and evaluation. To this end, various economic concepts (econometrics and micro/macro-economics) will be explored to evaluate transportation systems and policy. Real-world cases will be reviewed and discussed to understand how these economic approaches are applicable to transportation systems.

MO642 Wireless Power Transfer System **3:0:3**

This course introduces the basic concept and principle of wireless power transfer system which are being developed in electric vehicle and electric railway system. Also, the analysis of equivalent circuit, system design methodology, maximization of efficiency and transfer power, and magnetic field shielding technology for human body protection from the magnetic field is explained.

MO643 Wireless Link Analysis **3:0:3**

This course is for provision of comprehensive knowledge on wireless link between railway train and infrastructure, both of which are indispensible for implementation of intelligent railway transportation systems. Lectures are focused on basic theoric field, magnetic field, electromagnetic field, and applications of the theories.

MO814 Special Topics on Intelligent Transportation Systems **3:0:3**

This course introduces various researches and technologies related to the intelligent transportation system as one of the core elements of the future transportation systems. Main topics include traffic analysis and modeling techniques for overall transportation operation and planning field, and traffic prediction techniques. The specific contents of the course will be notified before the offering.

MO829 Special Topics in Logistics **3:0:3**

This course is designed to review, evaluate and apply methods currently used in the field of logistics in order to design and analyze futuristic logistics system. The course aims to teach approaches to defining environmental issues in existing logistics systems and selecting the sustainable solution(s) to address the issues posed.

MO833 Special Topics on Electric Power Systems **3:0:3**

This course is an advanced course to introduce theories and applications of the electric

propulsion systems as one of the core elements of the future transportation systems. Main topics of the course include wireless electric power transfer system, battery system, and hybrid electric vehicles. The specific contents of the course will be notified before the offering.

MO843 Special Topics on Railway Vehicle Technology 3:0:3

This course is reserved for the selected special topics in the field of railway vehicle technology upon need-basis. The specific contents of this course will be determined before the offering and notified.

MO859 Special Topics in Ocean Transportation 3:0:3

This course covers the basic methodologies for design and assessment for offshore crane systems as maritime transportation system. In addition, it includes detailed case-studies such as Mobile Harbor and offshore wind farm installation system to review the methodologies covered in the lectures.

MO869 Special Topics on Unmanned Autonomous Systems 3:0:3

This course introduces state-of-the-art technologies and research trends in unmanned autonomous systems as one of the core elements of the future transportation systems. Main topics of the course include the principles of the self-driving systems, various sensor systems and sensor fusion techniques for smart vehicles, and the advanced driver assistance system. The specific contents of the course will be notified before the offering.

MO495 Individual Research

In this course, undergraduate students will select individual research topics in mobility engineering according to their interest and conduct research under the advisors' supervision.

MO960 MS Thesis

This is an independent research work supervised by the advisor(s), toward the Master's thesis.

MO966 Seminar(MS) 1:0:1

This course provides general understanding on mobility for master student The seminar topics include current technologies, policies and issues for mobility.

MO980 Ph.D. Thesis

This is an independent research work supervised by the advisor(s), toward the Ph.D's thesis.

MO986 Seminar(Ph.D.) 1:0:1

This course provides general understanding on mobility for master student The seminar topics include current technologies, policies and issues for mobility.