

## Descriptions of Courses

### AT501 Structural Analysis in Statics and Dynamics

The first half of this course covers advanced strength and applied elasticity about structures composed of conventional metals, or advanced materials including composites and polymers. Also, the fracture and failure of structures and machine components are also treated.

The second half of this course deals kinetics of rigid bodies. The motions of rigid bodies due to external forces are studied.

### AT502 Thermodynamics and Fluid Flow

This course is a principal introductory lecture for the students majoring mechanical engineering. This class covers the past progress and the future development of automobile engine based on the understanding of concept of engine. Also the principle of fluid flow including aerodynamics design skills will be intensively studied.

### AT503 Analog Electronic Engineering

This course deals with resistive circuits, operational amplifier, capacitance and inductance, and first- and second-order transient circuits.

### AT504 Digital Electronic Engineering

The purpose of this course is to introduce the fundamental concepts and design methods of logic circuits and to learn the operating principles of computer systems and their design methodology. Starting from Boolean algebra, this course deals with combinational logic design and sequential logic design. Then, it proceeds to computer system design including datapath and controller designs. Pipelining and cache techniques required to achieve high performance are also covered in this course.

### AT505 Automobile Mechatronics

A multifunctional, interdisciplinary design and manufacturing approach on mechatronics systems is required for a modern automobile to achieve a much higher level of ride comfort, handling safety, and fuel economy. The objectives of this course is to present a cohesive overview on the analysis and design of electromechanical systems with components of sensors, actuators, controllers, digital logic, microprocessors, and realtime software.

### AT511 Introduction to Fuel Cell and Hybrid Vehicles

This course aims overall understanding of fuel cell systems by studying mechanism, thermodynamics, electrochemical energy conversion and loss, major balance-of-plants such as fuel processors, power conditioning systems, gas moving systems for fuel cells. The course also provides lectures on constructing materials of fuel cells in detail. Finally this course let students get overall knowledge about automotive application of fuel cell system.

The other half part of this course focuses on the introduction to hybrid vehicles of (fuel cell or internal combustion engine) - (battery or supercapacitor) system. The course will cover basic principles and strategy of the hybrid system as well as theory of electrochemical systems (battery and supercapacitor) and controls.

### AT512 Finite Element Analysis for Structures

In this course, the students are introduced to the basic principles and techniques of the finite element method required for the analysis of structural problems, which is indispensable in the design of automobiles and their components. Programming skills for 1-D and 2-D finite element program will be taught. Hand-on experiences on the modeling and analysis of practical structure problems using commercial codes will also be emphasized.

#### AT513 Endurance Reliability

This class provides graduate students in ATMP the ability to handle fatigue phenomena, reliability assessment, methods of life prediction, and life enhancement of the frame, parts and critical components of automobiles. It includes Macro/micro aspects of fatigue of metals, constant amplitude fatigue tests, multiaxial fatigue, reliability assessment with Weibull distribution, fatigue from real load histories and reliability evaluation of electronics parts of automobile.

#### AT514 Vehicle Dynamics and Control

The purpose of the course is to understand the basics of power transmission mechanism and steering, braking and suspension systems as well as mechanics between tire and various road surfaces. Two commercial softwares, Carsim and Simulink, will be taught to enhance the understanding of the dynamics of vehicle with and without various active chassis controls. The term project will be assigned to the student groups to deepen their understanding.

#### AT531 Automobile Power Electronics Systems

This course deals with the semiconductor power conversion circuits and their applications, the characteristics and design of passive components, the characteristics and circuits of semiconductor switching devices, design and control techniques of basic power conversion circuit, and the characteristics and control techniques of DC motor and AC motor.

#### AT532 Control System Design for Automobile

This course is intended to present the design concept for control systems using state equation and transfer function representation. Topics include the analysis tools and the design tools for continuous time systems and discrete time systems. Emphasis is placed upon application of the tools to automobiles.

#### AT551 Experiment Design and DFSS

This course enables participants to apply DFSS(Design for Six Sigma) as the means for maximizing customer satisfaction and performances in their products and processes. Exercises and each case studies help participants apply what they learn at practical fields by themselves.

#### AT552 New Product Development and Project Management

This course will review the importance and current trend of new product development (NPD) in the world automobile industry to survive under the dynamic competitive environment. This course will also discuss how to develop NPD strategy and manage NPD processes in terms of organization, lead time, cost and knowledge. Also this course will explain how to manage NPD projects efficiently and effectively. Successful cases will be discussed. In addition, computer packages for project management will be demonstrated.

#### AT611 Powertrain System

Powertrain System' offers the students to acquire the ability to study the engine technologies and its environmental problems. Design factors of advanced powertrain concepts and new engine systems are introduced to reduce exhaust emissions and to improve fuel economy are studied.

#### AT612 Vehicle NVH (Noise, Vibration, and Harshness)

This course is aimed at providing fundamental knowledge on vehicle noise, vibration, and harshness. Basic characteristics of automotive noise and vibration and analysis techniques for modeling paths and receiver systems will be covered: characteristics of sources, human response, identification of sources and paths, analysis of vibro-acoustics fields. Passive measures such as mountings, damping materials, sound-proofing materials, and silencing systems will be studied and the concurrent issues in automotive NVH will be

discussed.

#### AT613 Materials and Processes of Automobile Manufacturing

Various kinds and characteristics of materials and processes of automotive manufacturing are treated. Metals such as high strength steels and aluminum alloys, plastics, ceramics are studied in view point of their characteristics for automotive manufacturing. The principle and applications of casting, joining and forming of sheet metals and production systems are explained for efficient design of automobile assembly.

#### AT631 Automobile Sensors and Telemetry

Recently ubiquitous paradigms are established as developing communication and computing devices, So telemetry (transmitting data from remote testing or measuring devices is called telemetry) is more useful in real environment. Most promising applications are mobile phone and automobile. In case of automobile, telemetry is already used for navigation using GPS. This lecture will review the sensors of vehicle and discuss about new technology of automobile such as ITS via telemetry.

#### AT632 Intelligent Vehicle Control System

This course deals with intelligent control schemes for vehicle. To implement the intelligent vehicles, fuzzy logic control, various schemes for evolutionary optimization, and reinforcement learning are studied.

#### AT633 Automobile Embedded System Programming

As a core technology for automotive electronic control, various hardware and software components and system implementation aspects of embedded control system is covered. Covered topics include bus-based processor based board, open-source embedded Linux operating system, PC-based system programming including system startup, module programming, character device, block device, interrupt processing.

#### AT651 Product Data Management/Product Lifecycle Management

This course introduces the concepts and theories of Product Data Management (PDM)/Product Lifecycle Management (PLM). The concepts include product structure management, workflow management, electronic vault management, project management and collaborative interoperability. The theories include the key backgrounds of PDM/PLM systems such as product development process and data base. This course also provides the opportunities of PDM/PLM practices.

#### AT698 Automobile Special Topics in Mechanical Engineering

This course covers theory and application of mechanical automotive technologies, and opens depending upon the requirement. The detail of the course is announced before the opening.

#### AT699 Automobile Special Topics in Electrical Engineering

This course covers theory and application of electrical automotive technologies, and opens depending upon the requirement. The detail of the course is announced before the opening.

#### AT960 M.S. Thesis

An advisor and a research topic is selected and researched for basic understanding and application of a specific topic in automobile engineering.

#### AT962 Industry Training

At least 4 week of practical training in the industry.

#### AT963 Project I

Complete a practical project related to automobile.

AT964 Project II

Complete a practical project related to automobile.

AT965 Individual/Group Study in M.S.

An advisor and a research topic is selected and researched for basic understanding and application of a specific topic individually or in a group.

AT967 Automobile Technology Seminar

The course is composed of invited lectures from experts in automobile engineering and