
TAIST-Tokyo Tech Automotive and Advanced Transportation Engineering Program
**Master of Engineering Program in Automotive and Advanced Transportation Engineering
M.Eng. (Automotive and Advanced Transportation Engineering)**

Compulsory courses	12	Credits
Elective courses	12	Credits
Seminar	2	Credits
Thesis	12	Credits
Total	38	Credits

01277001	3 (3-0-6)	FUNDAMENTAL OF AUTOMOTIVE AND ADVANCED TRANSPORTATION ENGINEERING
01277002	3 (3-0-6)	BASICS OF AUTOMOTIVE AND ADVANCED TRANSPORTATION DESIGN
01277003	3 (2-1-5)	PRACTICE OF AUTOMOTIVE AND ADVANCED TRANSPORTATION DESIGN
01277005	3 (3-0-6)	NUMERICAL METHODS FOR ENGINEERING
01277101	3 (3-0-6)	AUTOMOTIVE STRUCTURAL SYSTEM ENGINEERING
01277102	3 (3-0-6)	AUTOMOTIVE COMFORT MECHANICS ENGINEERING
01277104	3 (3-0-6)	ADVANCED INTERNAL COMBUSTION ENGINE ENGINEERING AND FUTURE POWER TRAIN
01277105	3 (3-0-6)	ADVANCED PRODUCTION ENGINEERING
01277115	3 (3-0-6)	ADVANCED MATERIAL SCIENCE AND ENGINEERING
01277201	2 (0-4-0)	SEMINAR IN AUTOMOTIVE AND ADVANCED TRANSPORTATION ENGINEERING
01277303	12 (0-36-0)	THESIS

The highlight topics are “Electric Vehicle and Rail Transportation System, Artificial Intelligence (AI) and Internet of Things (IoT) for Intelligent Vehicle and Advanced Transportation Engineering, Automation System and Robotics for Advanced Production Engineering in Automotive Industry”.

01277001 3 (3-0-6)
FUNDAMENTAL OF AUTOMOTIVE AND ADVANCED TRANSPORTATION ENGINEERING

Introduction to automotive engineering systems and ground vehicle design: Engine type and parts; Power train; Body and chassis; Automotive electrical system; Transmission systems; Suspension systems; Steering systems; Tire and wheel; Handling;

Maintenance, troubleshooting and repairs; and Alternative fuel engine. Automotive industry standard software for examining various design parameters influencing vehicle performance and handling.

The basic concepts of electrical drive systems for automotive and rail transportation applications. Introduction to artificial intelligence (AI) and internet of things (IoT) for intelligent vehicle and advanced transportation engineering, automation system and robotics for advanced production engineering in automotive industry.

01277002 3 (3-0-6)

BASICS OF AUTOMOTIVE AND ADVANCED TRANSPORTATION DESIGN

Basics of Computer Aided Design (CAD): Overview of CAD; Theory of curved line and curved surface; Theory of mesh generation; and theory of reverse engineering. Basic of Computer Aided Engineering (CAE): Overview of CAE; Technology for analysis; Finite Element Method; Boundary Element Method; Optimization analysis; and Application examples. CAE model: Generation of CAE model from CAD; Generation of CAE model from measured data; Generation of CAE model from experiments; and Identification of CAE model.

Basics of vehicle handling and brake dynamics design: Tire cornering characteristics, Vehicle equation of motion, Basics and simulation of vehicle and rail transportation system braking design.

Basic of various computational intelligence design for intelligent vehicle: Introduction to computational intelligence; Neural networks; Fuzzy logic: Swarm intelligence and evolutionary computation.

01277003 3 (2-1-5)

PRACTICE OF AUTOMOTIVE AND ADVANCED TRANSPORTATION DESIGN

Design of SAE-Formula Car: Planning of vehicle, Harmonization of performance and components; Concept of frame structures; Analysis of strength and stiffness with CAD/CAE. Analysis of SAE-formula car: Tuning of engine performance and gear ratio; Braking effort and brake-lock; Performance of circling movements and maneuverability.

Design of battery system and electric motor for drivetrain system in electric vehicle and rail transportation system.

Design of mechatronical system, automation system and robotics for advanced production engineering in automotive industry.

01277005 3 (3-0-6) NUMERICAL METHODS FOR ENGINEERING

Programming concepts and techniques. Modern programming languages and computational tools for engineering problems. Numerical methods as applied to practical engineering problems. Introduction to finite element methods.

01277101 3 (3-0-6) AUTOMOTIVE STRUCTURAL SYSTEM ENGINEERING

Overview on vehicle and rail transportation system research and development: Vehicle planning and design; Process from advanced research to marketing; Past and the future prospect.

Vehicle and electric train components: Propulsion; Engine; Body; and Suspension.

Vehicle and electric train characteristics: Performance of man-machine-environment system; Active safety and passive safety. Suspension and drive-train systems: Suspension system; Steering system; Tire and its interaction with road surface; Braking system; Friction and tribology; Drivetrain; Stability and maneuverability analysis; and Advanced control system.

Mechanics of thin-walled structures for automobiles and electric train: Concept of stiffness and strength for automotive and electric train structures; Fundamentals of solid mechanics; Deformations of tension; Compression and torsion; Measurement of structural deformation; Theory of thin plates; Theory of monocoque structures; Theory of structural collision and concept of impact energy absorption

01277102 3 (3-0-6) AUTOMOTIVE COMFORT MECHANICS ENGINEERING

Electronics and control engineering: Introduction of electronics and control in automobiles and rail transportation system; Electric control of engines and transmission; Electronics in operation monitoring; Electric control in braking systems; and Electric control systems for automotive and electric train mobility and safety.

Aerodynamics and air conditioning: Fundamentals of fluid-dynamics; Computational fluid dynamics (CFD); Aerodynamics in vehicles and bogies; Thermodynamics in air-conditioners and air-conditioning systems in vehicles and electric train.

Vibration and noise engineering: Introduction of automotive and railway electric train vibration and noise problems; Measurement and data processing for vibration and noise; Modeling for vibration and noise analysis and comfortability; Numerical simulation of vibration and noise; and Structural design and technology for vibration and noise reduction

01277104 3 (3-0-6)**ADVANCED INTERNAL COMBUSTION ENGINE ENGINEERING AND FUTURE POWER TRAIN**

Flow and combustion diagnostics in IC engines: Flow diagnostics in IC engines; and Combustion diagnostics in IC engines.

Zero emission technologies: Production and control of NO_x; Production and control of particulate matters; and Advanced zero emission technologies.

Future power train for sustainable community: Energy consumption and environmental protection; Future energy systems for sustainability; Present status and future prospect of sustainable mobility; Battery electrical vehicle and; Hybrid vehicle; Fuel cell vehicle; and Rail transport application.

01277105 3 (3-0-6) ADVANCED PRODUCTION ENGINEERING

Fundamentals of production technology: Production processes for automotive engineering; Integrated and intelligent manufacturing system; Structure and function of machine tools; Computer numerical control (CNC) of machine tools; and Practical training of CAD/CAM and CNC machine tools.

Welding and joining technologies: Physics and basic engineering in welding and joining; Welding and joining processes; Equipments for welding and joining; Behavior of materials in welding and joining; Design and construction of joints; Analyses of joints; and Examples of welding and joining process.

Quality management and production planning: Problem solving using statistical quality control (SQC) tools; Process control; Quality design by experimental study; Reliability engineering; Scheduling methods; and Inventory control

01277115 3 (3-0-6) ADVANCED MATERIAL SCIENCE AND ENGINEERING

The fundamental thermodynamic laws for materials science: Materials behave under various circumstances. Non-equilibrium phenomena like phase transformation and solidification: Atomic diffusion; Diffusion less phenomena.

Physical metallurgy: Structures and morphology, Thermal properties, Corrosion resistance, Electrical and Magnetic properties.

Fracture mechanics: Controlling fatigue and fracture of crystalline and amorphous solids. The study electron optics: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). Computational methods: Phenomena in Materials science.

01277201 2 (0-4-0)

SEMINAR IN AUTOMOTIVE AND ADVANCED TRANSPORTATION ENGINEERING

A seminar in which the students must study some specific topics related to automotive and advanced transportation engineering, make a presentation and discussion.

01277303 12 (0-36-0) THESIS

This course provides an opportunity for a student to do research under the supervision of his/her advisor. The research emphasizes a case study with the aim of the effectiveness in automotive and advanced transportation engineering.

The experimental research is to solve problems and make the succession in the topic related to the field of automotive and advanced transportation engineering under the supervision of the advisor. The complete thesis must be proposed to the department and library. The final exam will include an oral defense of a thesis. Registration will be required according to the regulations toward completion of the thesis.

RESEARCH FIELDS

Materials Science and Production Engineering

Failure Analysis and Surface Technology, Near Net Shape Metal Manufacturing, Engineering Metallurgy, Metal Deformation Technology, Macro-Micro Modeling of Steel Processing and Forming, Polymer Technology, Ceramic Technology, Composite Materials, etc.

Powertrain Engineering

Internal Combustion Engines, Fuels and Lubricants, Wear, Emissions and AfterTreatment Technology, Bioenergy, Electrochemical Materials and System, Battery and Fuel Cell, etc.

Automotive Structural and Vehicle Dynamics

CAD/CAE, Mechanical Design, Optimization and Analysis, Noise and Vibrations, Vehicle Dynamics, Automation and Robotics, UAV Control and Navigation, etc.

Automotive Electrical, Electronics and Control

Automotive Electrical and Electronics System, Mechatronics and Control, Vehicle Control and Simulation, Image Processing, Intelligent Vehicle, Solar Energy Technology, etc.