AUTOMOTIVE DESIGN AND MANUFACTURING ENGINEERING (INTERNATIONAL PROGRAM) (B.ENG)

Automotive design and manufacturing engineering are a highly demanded profession, which is linked to the national and global boosted growth of automotive industry. Automotive design involves the development of motor vehicles with a primarily concern on design of mechanical components and the creation of the product concept. Manufacturing engineering deals with all aspects of manufacture, from production control to materials handling to automation.

Our ADME graduates, being specialized, are trained in both automotive design and manufacturing engineering. Our program trains students to have a solid background in both fields with a flexibility to choose to specialize in either topic. This advantage doubles the job opportunities for our graduates, whilst serving the local and international automotive industry with qualified and versatile engineers with a broad academic background.

Each student is required to accumulate a minimum of 144 credits to graduate for Bachelor of Engineering Program in Automotive Design and Manufacturing Engineering (International Program) which also includes 2 credits of industrial training and 3 credits of senior project.

Curriculum board

Wanchalerm Pora	Ph.D. (London)
Sunhapos Chatranuwathana	Ph.D. (Michigan)
Witaya Wannasuphoprasit	Ph.D. (Northwestern)
Surapong Sirikulvadhana	M.S. (Michigan)
Prabhath De Silva	Ph.D. (USA)
Nuksit Noomwongs	D.Eng. (TUAT)

Professors

Mechanical Engineering

Pramote Dechaumphai	Ph.D. (Old Dominion)
Viboon Sangveraphunsiri	Ph.D. (Georgia Tech)

Associate Professors

Mechanical Engineering

Asi Bunyajitradulya	Ph.D. (UC Irvine)
Kuntinee Maneeratana	Ph.D. (London)
Ratchatin Chanchareon	D.Eng. (Chula)
Nopdanai Ajavakom	Ph.D. (UC.Berkeley)
Witaya Wannasuphoprasit	Ph.D. (Northwestern)
Niphon Wansophark	D.Eng. (Chula)
Chanat Ratanasumawong	D.Eng. (Tokyo Tech)
Thanyarat Singhanart	Ph.D. (Tokyo)
Alongkorn Pimpin	Ph.D. (Tokyo)
Boonchai Lertnuwat	Ph.D. (Tokyo)

Electrial Engineering

Wanchalerm Pora	Ph.D. (London)

Industrial Engineering

Somkiat Tangjitsitchareon	D.Eng. (Kobe Japan)
Oran Kittithreerapronchai	Ph.D. (Georgia)

Metallurgical and materials Engineering

Seksak Asavavisithchai	Ph.D. (Nottingham)

Assistant Professors

Electrial Engineering

Suree Pumrin	Ph.D.(Washington)

Mechanical Engineering

Sunhapos Chantranuwathana	Ph.D. (Michigan)
Nuksit Noomwongs	D.Eng. (TUAT)
Tawan Paphapote	Ph.D.C.(USA)

Industrial Engineering

Somchai Puajindanetr	Ph.D. (London)

Lecturer

Electrial Engineering

Boonchuay Supmonchai	M.Eng. (Chula)

ISE Staffs

Yan Zhao	Ph.D. (London)
Prabhath De Silva	Ph.D. (USA)

Guest lecturer

Kaukeart Boonchukosol	Poitiers (Frence)

Visiting Professor (USA)

Stanley Peter Lynch	Ph.D. (UK)

Curriculum

Total number of credits requirement	138	credits
General Education	30	credits
Core Courses	102	credits
Basic Sciences	30	credits
Basic Engineering	8	credits
Digital skill: Big data & AI	6	credits
21st Century skill	6	credits
Compulsory	49	credits
Approved Electives	3	credits
Free Electives	6	credits

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1. General Education — **30 credits**

Social Science	3	credits
Humanity	3	credits
Science and Mathematics	3	credits
Interdisciplinary	3	credits
Foreign Language	12	credits
5501214	Communication and Presentation Skills	3(3-0-6)
5501225	Technical Writing	3(3-0-6)
XXXXXX	General Education (Foreign Language)	6 credits

	General Education (Special)	6 credits
2140111	Exploring Engineering World	3(3-0-6)
2183282*	Introduction to Modern Automotive Engineering	3(3-0-6)

2. Core Course — **102 credits**

	Basic Sciences	30 credits
2301107	Calculus I	3(3-0-6)
2301108	Calculus II	3(3-0-6)
2301312	Differential Equations	3(3-0-6)
2302103	General Chemistry Laboratory	1(0-3-0)
2302105	Chemistry for Engineers	3(3-0-6)
2304153	Physics for Engineers	3(3-0-6)
2304154	Physics and Electronics for Eng.	3(3-0-6)
2304193	Physics Laboratory for Eng.	1(0-3-0)
2304194	Physics and Electronics Laboratory for Engineers	1(0-3-0)
2184201	Probability and Statistics for Automotive Engineering	3(3-0-6)
2301216	Linear Algebra	3(3-0-6)
2301215	Multivariable Calculus	3(3-0-6)

	Digital Skills: Bigdata & AI	6 credits
2100201*	Introduction to Artificial Intelligence	3(3-0-6)
2182570*	Digital System and IoT In Automotive Technology	3(3-0-6)

	Interdisciplinary and 21st Century Skills	6 credits
2147104*	Engineering Design Thinking	3(3-0-6)
2132344	Management for Automotive Industry	3(3-0-6)

	Basic Engineering	8 credits
2183103*	Fundamentals of Engineering Graphics	2(1-3-2)
2183212	Statics	3(3-0-6)

2189101	Engineering Materials	3(3-0-6)

	Compulsory Courses	49 credits
2140301	Industrial Training	2(0-6-0)
2142413*	Manufacturing Process for Automotive Engineering	2(2-0-4)
2182214*	Fundamentals of Electrical Circuits	2(2-0-4)
2182215*	Fundamentals of Electrical Machines	2(2-0-4)
2182216*	Electrical Engineering Laboratory	1(0-3-0)
2183221	Thermodynamics	3(3-0-6)
2183213	Mechanics of Material	3(3-0-6)
2183323	Fundamentals of Fluid Mechanics and Heat Transfer	3(3-0-6)
2183261	Mechanical Engineering Laboratory	2(1-3-2)
2190101	Computer Programming	3(3-0-6)
2190151	Computer Programming Laboratory	1(0-3-0)
2183231	Dynamics	3(3-0-6)
2183325*	System Modeling and Vibrations	2(2-0-4)
2183332	CAD/CAM/CAE	3(2-3-4)
2142242	Vehicle Dynamics	3(3-0-6)
2183351	Mechanical Engineering Design	3(3-0-6)
2184344*	XEV Propulsion System	3(3-0-6)
2183427*	Modern Vehicle System Design	3(3-0-6)
2182431*	System Dynamics and Controls	2(2-0-4)
2142499	Automotive Engineering Project	3(0-6-3)

	Approved Electives	3 credits
2142352	Finite Element Methods and Applications	3(3-0-6)
2142411	Automotive Hvac Fundamentals	3(3-0-6)
2142422	Vehicle Aerodynamics	3(3-0-6)
2142423	Power Train Systems	3(3-0-6)
2142426	Noise, Vibration and Harshness	3(3-0-6)
2142428	Automotive Diagnostics and Maintenance	3(3-0-6)
2142433	Failure Analysis and NDT	3(2-3-4)
2142453	Concept Car Design	3(3-0-6)
2142461	Automation and Robotics	3(3-0-6)
2142481*	Independent Project I	1(0-2-1)
2142482*	Independent Project II	1(0-2-1)
2142483*	Independent Project III	1(0-2-1)
2142488	Measurement, Instrumentation And Data Acquisition	3(3-0-6)
2142492	Selected Topics in Automotive Engineering I	3(2-3-4)
2142493	Selected Topics in Automotive Engineering II	3(2-3-4)
2142495	Independent Studies	3(0-6-3)
2145421	Introduction to Computational Fluid Dynamics	3(3-0-6)
2182442	Embedded Systems in Automotive Engineering	3(3-0-6)
2182444	Power Electronics for Automotive Engineering	3(3-0-6)
2182445*	Battery Design and Management	3(3-0-6)
2182446*	Process Management and Lean Manufacturing	3(3-0-6)
2184410*	Fundamental of Autonomous Vehicle	1(1-0-2)
2184411*	System Dynamics and Controls Project	2(1-3-3)

2184412*	Product Planning and Control	2(2-0-4)
2184413*	Quality Control and Management for Automotive Industry	2(2-0-4)
2190445*	Software Engineering for Embedded Systems	3(3-0-6)

3. Free Electives   **6   credits**

     Select 6 credits from any courses offered in English by any International Programs in Chulalongkorn University.

AUTOMOTIVE DESIGN AND MANUFACTURING

ENGINEERING CURRICULUM

(INTERNATIONAL PROGRAM)

(B.ENG)

COURSE NO.	SUBJECT	CREDITS	COURSE NO.	SUBJECT	CREDITS
	FIRST SEMESTER			**FIFTH SEMESTER**	
2190101	Computer Programming	3	2183325*	System Modeling and Vibrations	2
2190151	Computer Programming Laboratory	1	2182215*	Fundamentals of Electrical Machines	2
2301107	Calculus I	3	2182216*	Electrical Engineering Laboratory	1
2189101	Engineering Materials	3	2183323	Fundamentals of Fluid Mechanics and Heat Transfer	3
2183101	Fundamentals of Engineering Graphics	2	2183261	Mechanical Engineering Laboratory	2
2304153	Physics for Eng.	3	2183332	CAD/CAM/CAE	3
2304193	Physics Lab for Engineers	1	5501225	Technical Writing	3
5501112	Communicative English I	3			16
		19			
	SECOND SEMESTER			**SIXTH SEMESTER**	
2140111	Exploring Engineering World	3	2142424	Vehicle Dynamics	3
2302105	Chemistry for Eng.	3	2183351	Mechanical Engineering Design	3
2302103	General Chemistry Laboratory	3	2184344*	XEv Propulsion System	3
2301108	Calculus II	3	2142344	Management for Automotive Industry	3
2304154	Physics and Electronics for Eng.	3	2301215*	Multivariable Calculus	3
2304194	Physics and Electronics Lab for Eng.	1	XXXXXX	General Education	3
5501123	Communicative English II	3			18
		18			
	THIRD SEMESTER			**SUMMER SEMESTER**	
2142413*	Manufacturing Process Engineering for Automotive	2	2140301	Industrial Training	2
2183212	Statics	3			
2183221	Thermodynamics	3		**SEVENTH SEMESTER**	
2183282*	Introduction to Modern Automotive Eng.	3	2183427*	Modern Vehicle System Design	3
2184201	Probability and Statistics for Auto Eng.	3	2182431*	System Dynamics	2
2301312	Differential Equations	3	XXXXXX	Compulsory Elective I	3
		17	XXXXXX	General Education	3
			XXXXXX	General Education	3
	FOURTH SEMESTER		XXXXXX	Free Elective	3
2147104*	Engineering Design Thinking	3			17
2182214*	Fundamentals of electrical circuits	2			
2183213	Mechanics of Materials	3		**EIGHTH SEMESTER**	
2183231	Dynamics	3	2142499	Automotive Engineering Project	3
2301216*	Linear Algebra	3	2182570*	Digital System and IoT Automotive Technology	3
5501214	Communication and Presentation Skills	3	2100201*	Introduction to Artificial Intelligence	3
		17	XXXXXX	General Education	3
			XXXXXX	Free Elective	3
					15

TOTAL CREDITS FOR GRADUATION   **138**

COURSES DESCRIPTIONS IN AUTOMOTIVE DESIGN AND MANUFACTURING ENGINEERING (B.ENG)

General Education

2140111 Exploring Engineering World   3(3-0-6)

Engineering topics related to daily life: energy, resources, environment manufacturing, process, industry, material, automotive, infrastructure, information system and bio engineering.

**2183282* Introduction to Modern Automotive   3(3-0-6)
Engineering**

Lecture: Basic Principles of automotive systems, components, and design; internal combustion engine; transmission; chassis (suspension; steering; brake); body; vehicle aerodynamics; automotive electronics; basic vehicle dynamics (performance and handling). Introduction to next generation automotive; electric vehicle; connected vehicle; autonomous vehicle; mobility services. Basic Principles of XEV system configuration, components, and design; HEV; PHEV; BEV; FCEV. Introduction to automotive industry and eco systems. Workshop: Hand-on study of automotive systems and components; names and functions of components and parts; basic mechanical parts; engine; electronic systems; transmission and drivetrain; brake systems; steering mechanism; basic diagnosis.

**5501214 Communication and Presentation   3(3-0-6)
Skills Condition: PRER 5501123**

Practice using English for social communication and giving oral presentation on engineering related topics.

**5501225 Technical Writing   3(3-0-6)
Condition: PRER 5501123**

Practice in writing summaries composing different types and styles of writing in the field of engineering and writing reports of studies and experiments.

Core Course

2301107 Calculus 1   3(3-0-6)

Limit, continuity, differentiation and integration of real-valued functions of a real variable and their applications; techniques of integration; improper integrals.

**2301108 Calculus 2   3(3-0-6)
Condition: PRER 2301107**

Mathematical induction; sequences and series of real numbers; Taylor series expansion and approximation of elementary functions; numerical integration; vectors, lines and planes in three-dimensional space; calculus of vector valued functions of one variable; calculus of real valued functions of two variables; introduction to differential equations and their applications.

**2301312 Differential Equations   3(3-0-6)
Condition: PRER 2301108**

Existence and uniqueness theorem of solution of first order equations; initial value problem; Laplace transform; Taylor series expansion of elementary functions; numerical methods; general linear equations; solution in series; linear partial differential equations boundary value problems.

2302103 General Chemistry Laboratory   1(0-3-0)

Standard solution preparation; qualitative analysis; titration; electrochemistry, pH metric titration; spectroscopy; calculation and evaluation of data; calibration curve; introduction to polymer.

2302105 Chemistry for Engineers   3(3-0-6)

Stoichiometry and basis of the atomic theory; properties of the three states of matter and solution; thermodynamics; chemical equilibrium; Oxidation-reduction; chemical kinetics; the electronic structures of atoms and the chemical bond; periodic table; nonmetal and transition metal.

2304153 Physics for Engineers   3(3-0-6)

Mechanics of particles and rigid bodies; properties of matter; fluid mechanics; heat; vibrations and waves; elements of electromagnetism; optics; modern physics.

**2304154 Physics and Electronics for   3(3-0-6)
Engineers**

Electricity DC circuits; AC circuits; basic electronics; electrical actuators.

2304193 Physics Laboratory for Engineers   1(0-3-0)

Measurement and precision; experiments on simple harmonic motion; radius of gyration; dynamics of rotation; velocity of sound; viscosity of fluids.

**2304194 Physics and Electronics   1(0-3-0)
Laboratory for Engineers**

Resistance and electromotive force measurements; experiments on ammeter; voltmeter; oscilloscope; AC circuit; transistor; lenses and mirrors; polarization; interference; diffraction.

**2184201 Probability and Statistics for   3(3-0-6)
Automotive Engineering**

Engineering basis in statistics and probability; discrete and continuous probability distribution; joint probability distribution; parameter estimation: esto,atpr. Bias, consistency; point estimation; interval estimation; automotive engineering applications in measurement and uncertainty, linear regression, introduction to random process; integration of statistics in automotive engineering applications; case studies.

2301216* Linear Algebra   3(3-0-6)

systems of linear algebraic equations; linear spaces; inner products; eigenvalues and eigenvectors; principal axis theorem.

**2301215* Multivariable Calculus   3(3-0-6)
Condition: PRER 2301108**

Vector; curves, planes and surfaces; derivatives of vector-valued functions; partial, total and directional derivatives; implicit differentiation; maxima-minima; gradient, divergence, curl; scalar and vector fields; line integral; surface integral and volume integral; integral theorems of vector analysis.

AI-Digital Bigdata

2100201* Introduction to Artificial Intelligence   3(3-0-6)

Introduction to artificial intelligence related to scope, historial background; Comcept for design; knowledge representation; memory structures; probabilistic reasoning; decision making; fuzzy logic; genetic algorithm; chaotic.

**2182570* Digital System and IOT   3(3-0-6)
in Automotive Technology**

Number systems and codes; Boolean algebra; minterms and maxterms; sum-of products and product-of-sums; Karnaugh maps; medium-scale combinational circuits; combinational circuit design; sequential circuits; embedded system architecture; microprocessor/microcontroller;

introduction to IoT; cloud platforms; application of IoT in automotive industry.

Interdisciplinary and 21ˢᵗ Century Skills

2147104* Engineering Design Thinking 3(2-3-4)
Principles of Design Thinking; Design thinking process: defining design problems from the real complicated problem, Emphaty, product, information, and patent reviews, brain storming, concept generation and evaluation, conceptual design using CAD; Phycology of design; Design Thinking Project to create a real prototype.

2142344 Management for Automotive 3(3-0-6)
           Industry
Study of modern management principle; Learn the methods of increasing productivity in automotive industry, human relation; industrial safety, commercial laws, basis of engineering economy, finance, marketing, project management in automotive industry.

Basic Engineering
2183103* Fundamentals Engineering 2(1-3-2)
Lettering; orthographic projections; sketching and drawing; pictorial drawing; dimensioning; tolerancing and geometrical tolerancing; section; working drawing; mechanical parts drawing; introduction to CAD.

2183212 Statics 3(3-0-6)
Force systems; resultants; equilibrium; structure; distributed force; friction; virtual work; stability.

2189101 Engineering Materials 3(3-0-6)
Important engineering materials: metals, plastics, asphalt, wood and concrete; phase diagram and its interpretation; testing and meaning of various properties; macroscopic and microscopic structure which are correlating with properties of the engineering materials; production process of products from engineering materials.

2142232* Manufacturing Process 3(2-3-4)
           for Automotive Engineering
Introduction of automotive and parts manufacturing, product planning and manufacturing, System and process in automotive and parts manufacturing, Quality control in automotive parts manufacturing

Compulsory Course
2140301 Industrial Training 2(0-12-0)
Engineering practice in related areas under supervision of experienced engineers in private sectors or government agencies.

2142413* Manufacturing Process 2(2-0-4)
           for Automotive Engineering
Introduction of automotive and parts manufacturing, product planning and manufacturing, System and process in automotive and parts manufacturing, Quality control in automotive parts manufacturing

2142414* Fundamentals of Electrical Circuits 2(2-0-4)
DC circuits; electric power and sign convention; transient and steady-state responses; AC circuits; phasor and impedance; power and power factor in AC circuits; threephase AC circuits; three-phase power.

2182210* Electrical Engineering Laboratory 1(0-3-0)
Laboratory topics related to the contents of 2182214 and 2182215

2183221 Thermodynamics 3(3-0-6)
Basic concepts; thermodynamic state and process; properties of pure substances and ideal gases; energy; the first law of thermodynamics and the first law analysis for isolated, closed, and open systems; entropy; the second law of thermodynamics and the second law analysis for isolated, closed, and opens systems; gas power cycles; Carnot, Otto, and Brayton cycles; refrigeration cycle; introduction to gas mixtures; introduction to combustion.

2183213 Mechanics of Material 3(3-0-6)
           Condition: PRER 2183212
Force and stress; stresses and strains relationship; Hooke's law; modulus of elasticity; stresses in beams; shear force; bending moment diagrams; deflection of beams; torsion; buckling of columns; Mohr's circle; combined stresses; failure criterion; safety factors.

2183323 Fundamentals of Fluid Mechanics 3(3-0-6)
           and Heat Transfer
Properties of fluid, fluid static; momentum and energy equations; equation of continuity and motion; steady incompressible flow. Modes of heat transfer: conduction, convection, radiation and applications of heat transfer, heat exchangers and heat transfer enhancement, boiling and condensation.

2183261 Mechanical Engineering Laboratory 2(1-3-2)
Experimentation and basic concepts; error and uncertainty analysis; measurement and instrumentation; data analysis; interpretation of experimental results; reporting of experimental results; basic experiments in solid mechanics, thermodynamics, fluid mechanics and basic engine testing.

2190101 Computer Programming 3(3-0-6)
Introduction to computer systems; problem-solving using computers; programming in high level languages; program structure, programming style and convention; control statements, data handling and processing; subprograms; classes and objects.

2190151 Computer Programming 1(0-3-0)
           Laboratory
Computer programming in Engineering; reviews of computer programming concepts; hands-on experience on computer programming using contemporary Engineering tools.

2183231 Dynamics 3(3-0-6)
Kinematics of three-dimensional curvilinear motion of a particle; kinetics of a particle: force and acceleration, work and energy, impulse and momentum; kinematics of planar motion of a rigid body: absolute and relative motion analysis; kinetics of planar motion of a rigid body: absolute and relative motion analysis; kinetics of planar motion at a rigid body; force and acceleration, work and energy, impulse and momentum; introduction to kinematics and kineties of three-dimensional motion of a rigid body.

2183325* System Modeling and Vibrations 2(2-0-4)
ODE system modeling and simulations; System responses with Laplace Transform; Transfer function and frequency response (Bode and Transmissibility); Application on vibrations of engine and suspensions.

2183332 Computer Aided Design/Computer 3(2-3-4)

Aided Manufacturing and Computer Aided Engineering

Introduction to CAD/CAM/CAE, 3D solid modeling, design concepts and implementation; link to manufacturing interface.

2142424   Vehicle Dynamics   3(3-0-6)
**   Condition: PRER 2183231**

Dynamics of motor vehicles; properties of pneumatic tire; suspension and steering mechanism; vehicle longitudinal dynamics; linear bicycle models; stability; linear engine models; pleasure in driving.

2183351   Mechanical Engineering Design   3(3-0-6)

Fundamentals of mechanical engineering design; properties of materials; theory of filure; fatigue; design of basic machine elements; design project of a simple mechanical machine.

2183427* Modern Vehicle System Design   3(3-0-6)

Lettering; orthographic projections; sketching and drawing; pictorial drawing; dimensioning; tolerancing and geometrical tolerancing; section; working drawing; mechanical parts drawing; introduction to CAD.

212431*   System Dynamics and Controls   2(2-0-4)

System dynamics modeling; responses; introduction to control systems; feedback control system characteristics; the performance of feedback control systems; the stability of linear feedback systems; essential principles of feedback; the root locus method; time-domain analysis and design of control systems; frequency response method; stability of the frequency domain and compensation; use of computer in the design of control systems.

2142499   Automotive Engineering Project   3(0-6-3)

Group or individual project on a subject related to automotive engineering and manufacturing.

Approved Elective Courses

2142352 Finite Element Methods   3(3-0-6)
**   and Applications**

Basic principles of finite element methods; applications of finite elements in analysis using computer programs.

2142411   Automotive Hvac Fundamental   3(3-0-6)

Fundamentals of fluid dynamics and heat transfer; automotive air handling system; engine coolant loop; heat exchanger characteristics; blower performance laws; automotive air conditioning system; key aspect in designing automotive climate control systemand its operation.

2142422   Vehicle Aerodynamics   3(3-0-6)

Effects of vehicle design on aerodynamics; wind tunnel testing; boundary layers and wakes; friction and pressure drag; aerodynamic forces and moments; center of pressure and vehicle stability.

2142423   Power Train Systems   3(3-0-6)

Manual and automatic transmission; basic operation of transmission; peripheral components.

2142426   Noise, Vibration and Harshness   3(3-0-6)

NVH and its importance for automotive industry. Sources of sound and vibration. Noise quality. Acceleration. Velocity, displacement, and sound pressure/intensity. DB Scales. Introduction to vibration. Free and forced vibration response of one and two degrees of freedom systems. Methods for determining natural frequencies and mode shapes for multi-degrees of freedom systems. Vibration measurement and control. Suspensions mounting systems. Road Simulators and wind tunnels. Noise and vibrations standards

2142428   Automotive Diagnostics and   2(1-3-2)
**   Maintenance**

Basic knowledge in Automobile components and its functions; troubleshooting guides, diagnostic tools for automobiles; do-it-yourself car care; knowledge in schedule services, maintenances and repair; defensive driving techniques.

2142433   Failure Analysis and   3(2-3-4)
**   Nondestructive Testing**

Analysis and diagnosis of the causes of failure; physics of failure; concepts of reliability, the use of failure analysis as part of the design process, time based/related failure modes, safety factors; case studies; elimination of failures through proper material selection, treatment and use; case histories; examination of fracture surfaces; laboratory investigations of different failure mechanisms.

2142453   Concept Car Design   3(3-0-6)

Introduction to concept car design; design process overview; functional objectives; conceptual package development; product benchmarking process; interior system and application; power train anatomy and layout; wheels and tires system; suspension and chassis system; bodies construction design; design integration.

2142461   Automation and Robotics   3(3-0-6)

Basic automation systems, equipment, sensors, actuators, material handling system, robots and their applications.

2142481* Independent Project I   1(0-2-1)

Self-study on topics related to automotive engineering with consent of the instructor, the study may be theoretical or experimental in nature

2142481* Independent Project II   1(0-2-1)

Self-study on topics related to automotive engineering with consent of the instructor, the study may be theoretical or experimental in nature

2142481* Independent Project III   1(0-2-1)

Self-study on topics related to automotive engineering with consent of the instructor, the study may be theoretical or experimental in nature

2142488   Measurement, Instrumentation   3(3-0-6)
**   and Data Acquisition**

Basic electromechanical techniques used in modern instrumentation and control systems; use of transducers and actuators; signal conditioning, grounding, and shielding; signal processing and feedback control methods with emphasis on frequency domain techniques; low-level measurements; lock-in technique.

2142492   Selected Topics in Automotive   3(2-3-4)
**   Engineering I**

Selected interesting topics in automotive engineering

2142493　Selected Topics in Automotive　3(2-3-4)
　　　　　　　Engineering II

Selected interesting topics in automotive engineering.

2142495　Independent Studies　3(0-6-3)

Self-study on topics related to automotive engineering with consent of the instructor, the study may be theoretical or experimental in nature.

2145421 System Dynamics and Controls　3(3-0-6)

System dynamics modeling; responses; introduction to control systems; feedback control system characteristics; the performance of feedback control systems; the stability of linear feedback systems; essential principles of feedback; the root locus method; time-domain analysis and design of control systems; frequency response method; stability of the frequency domain and compensation; use of computer in the design of control systems.

2142442　Embedded Systems in　3(3-0-6)
　　　　　　　Automotive Engineering

Microprocessor architecture; introduction to embedded systems; programming concepts in C; software engineering practices; buses; device drivers and interrupt; inter-process communication; real-time operating system; hardware/software co-design.

2182444　Power Electronics　3(3-0-6)
　　　　　　　for Automotive Engineering

Fundamentals of power electronics. DC-DC converters, DC-AC converters, AC-DC converters. Fundamentals of energy-storage technologies and power converters for EV, HEV and PHEV.

2182445*　Battery Design and Management　1(1-0-2)

Fundamental of electrochemical cells, Battery terminology, Battery components, Lithium-ion battery, Introduction to battery management system (BMS), Equivalent circuit cell model simulation, Battery state of charge (SOC) estimation, Battery state of health (SOH) estimation, Battery pack balancing and power estimation, Thermal model and management of battery

2182446*　Process Management and Lean　2(2-0-4)
　　　　　　　Manufacturing

Introduction to process management; key techniques and managing approaches commonly used in automotive industry; application and case studies.

2184410*　Fundamental of Autonomous　1(1-0-2)
　　　　　　　Vehicle

Basic Principles of autonomous driving system; terminology; system architecture; design considerations and safety assessment of autonomous vehicle. Basic demonstration of autonomous vehicle prototype.

2184411*　System Dynamics and　2(1-3-3)
　　　　　　　Controls Project

Project on system dynamics and controls. For example, simulation of mathematical model of dynamical systems, constructing and evaluation of real-word dynamical system, and construction of control systems with microcontrollers.

2184412*　Product Planning and Control　2(2-0-4)

The role of production planning and control in the manufacturing system; strategic planning of manufacturing systems; demand forecasting; inventory control, planning, scheduling, and control of operation; capacity planning.

2184413*　Quality Control and Management　2(2-0-4)
　　　　　　　For Automotive Industry

Introduction to metrology and characterization; principles of destructive and nondestructive testing as applied in automotive part manufacturing. concept of quality control, quality improvement, quality assurance, quality management, cost of quality; quality management systems: ISO series; failure mode and effects analysis; basic quality control tools; statistical process control: control charts, process capability analysis, measurement system analysis, acceptance sampling plans.

2190445*　Software Engineering for　3(3-0-6)
　　　　　　　Embedded Systems

Concept of embedded systems, software development life cycle, requirements gathering, software implementation, testing, software development, project management, software tools.