

# AUTOMOTIVE AND MOBILITY SYSTEMS ENGINEERING

The Automotive and Mobility Systems Engineering (AMSE) program's objectives are (i) to provide the students with strong, automotive-related engineering knowledge, (ii) develop their systems-thinking approach to automotive-related problems, and (iii) develop their teamwork skills in solving product design, development, and manufacturing problems. To meet these objectives, the curriculum of the program is designed to achieve the following education goals:

1. Provide depth in the area of automotive systems engineering.
2. Provide breadth across the engineering disciplines of electrical, industrial, mechanical, materials, and manufacturing engineering and provide this breadth from an engineering systems perspective.

To be admitted to the AMSE program a candidate must meet the requirements for the Bachelor of Science degree at this campus or the equivalent of these requirements. Undergraduate degrees must be from an accredited program, and for regular admission must be with an average of *B* or better. Each applicant should present complete, official transcripts of all prior college work. Applicants who meet the general admission criteria but do not have adequate preparation in required areas of engineering will be asked to take appropriate undergraduate courses as a condition for full admission to the program. Such courses, when elected, will not count towards the degree requirements.

The program requires at least 30 semester hours of graduate coursework selected in accordance with the chosen concentration area. A minimum cumulative GPA of 3.0 or higher is required for good academic standing and graduation. A course, in which a grade lower than C is earned, cannot be used to fulfill the degree requirements.

The Automotive Mobility Systems Engineering program is made up of two major components:

1. Core courses (12 credit hours).
2. Concentration courses (18 credit hours).

This program can be completed fully online, in person, or a combination of both.

## Core Courses

The core is intended to provide a unified graduate-level preparation in interdisciplinary topics. It consists of two required core courses (six credit hours) and at least two courses (six credit hours) selected among the elective core courses listed below based on the student's background and declared concentration area. A third elective core course (optional, 3 credit hours) can be taken and applied to the concentration requirement.

Code	Title	Credit Hours
<b>Required Core Courses</b>		
AENG 500	Automobile: An Integrated Syst	3
AENG 517	Vehicle Mobility Systems	3

Code	Title	Credit Hours
<b>Elective Core Courses (6 credits are required, additional 3 credit hours optional)</b>		
Select two courses from the following:		6-9
AENG 502	Modeling of Automotive Systems	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I	
AENG 547	Automotive Powertrains I	
AENG 581	Materials Sel in Auto Design	
AENG 587	Automotive Manuf Processes	
AENG 596	Internal Combustion Engines I	
IMSE 515	Fundamentals of Program Mgt	
	or IMSE 516 Project Management and Control	
	or IMSE 517 Managing Global Programs	

<sup>1</sup> This course is required for students with background not closely related to electrical or computer engineering if they pursue the concentration in Vehicle Electrification or the concentration in Intelligent Vehicle Systems.

## Concentration Courses

The program offers five concentration areas to meet diverse needs of its students. Each student must declare a concentration based on his/her interests and background. The student is required to take six courses (18 credit hours) to satisfy the concentration requirement. The concentration areas are: Vehicle Powertrain and Performance, Vehicle Design and Manufacturing, Vehicle Electrification, Intelligent Vehicle Systems, and General Study.

## Capstone Project/Thesis

Students can complete an optional faculty-guided Capstone Project AENG 698 (3 or 6 credit hours) or an optional Master's Thesis AENG 699 (6 credit hours) as a part of the concentration requirement. Capstone project can be completed individually or by a student team. Thesis must be completed as an individual work. Capstone projects and thesis must be selected over two semesters.

## Concentrations

Students must declare one of the following concentrations:

### Concentration Courses

The student is required to take six courses (18 credit hours) to satisfy the concentration requirement. At least four of these courses (12 credit hours) must be from the Intelligent Vehicle Systems Concentration. The other two courses (6 credit hours) must be from the Concentration Electives.

Students with background not closely related to electrical or computer engineering must take AENG 505 Introduction to Embedded Systems and AENG 510 Vehicle Electronics I before taking courses of the Intelligent Vehicle Systems Concentration.

Code	Title	Credit Hours
<b>Intelligent Vehicle Systems Concentration</b>		
Select four courses from the following:		12
AENG 555	Vehicle Stability & Control	
ECE 515	Vehicle Electronics II	
ECE 531	Intelligent Vehicle Systems	
ECE 532	Auto Sensors and Actuators	
ECE 533	Active Automotive Safety Sys	
ECE 565	Digital Control Systems	
ECE 566	Mechatronics	
ME 543	Vehicle Dynamics	
ME 565	Mechatronics	
Code	Title	Credit Hours
<b>Concentration Electives</b>		
Select two additional courses from the following:		6
AENG 502	Modeling of Automotive Systems <sup>1</sup>	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I <sup>1</sup>	
AENG 547	Automotive Powertrains I <sup>1</sup>	
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	
AENG 555	Vehicle Stability & Control	
AENG 562	Energy Management of Electrified Vehicles	
AENG 566	Vehicle Thermal Management	
AENG 576	Battery Systems, Modeling, and Control	
AENG 581	Materials Sel in Auto Design <sup>1</sup>	
AENG 584	Lightweight Automotive Alloys	
AENG 586	Design & Mfg: Ltwt Auto Mat	
AENG 587	Automotive Manuf Processes <sup>1</sup>	
AENG 589	Auto Assembly Systems	
AENG 596	Internal Combustion Engines I <sup>1</sup>	
AENG 598	Energy Sys for Auto Vehicles	
AENG 650	Anyls&Des for Veh Crshwrthnss	
AENG 698	Capstone Proj(Case Stud/Dsn)	
AENG 699	Master's Thesis	
ECE 515	Vehicle Electronics II	
ECE 517	Adv Pwr Electrncs&Motor Drvs	
ECE 519	Adv Topics in EMC	
ECE 530	Energy Storage Systems	
ECE 531	Intelligent Vehicle Systems	
ECE 532	Auto Sensors and Actuators	
ECE 533	Active Automotive Safety Sys	
ECE 5462	Elec Aspects of Hybrid Vehicle	
ECE 5463	Fundamentals of Electric Vehicles	
ECE 565	Digital Control Systems	
ECE 566	Mechatronics	
ECE 580	Digital Signal Processing	
ECE 615	Advanced Power Electronics	
ECE 646	Adv Elec Drive Transportation	

IMSE 515	Fundamentals of Program Mgt <sup>1</sup> or IMSE 516 Project Management and Control or IMSE 517 Managing Global Programs
IMSE 561	Tot Qual Mgmt and Six Sigma
IMSE 567	Reliability Analysis
IMSE 577	Human-Computer Interaction
IMSE 593	Vehicle Package Engineering
ME 543	Vehicle Dynamics
ME 545	Acoustics and Noise Control
ME 548	Automotive Powertrains II
ME 558	Fracture and Fatigue Considerations in Design
ME 565	Mechatronics
ME 570	Powertrain NVH of Electrified Vehicles
ME 582	Injection Molding
ME 583	Mechanical Behavior of Materials
ME 587	Automotive Composites
ME 591	Degradation of Materials
ME 592	Fundamentals of Fuel Cells
ME 595	Digital Manufacturing
ME 597	Internal Combustion Engines II
ME 598	Engine Emissions

<sup>1</sup> This is a core elective course. Only one such course is allowed as a concentration requirement.

## Concentration Courses

The student is required to take six courses (18 credit hours) to satisfy the concentration requirement. At least four of these courses (12 credit hours) must be from the Vehicle Design and Manufacturing Concentration. The other two courses (6 credit hours) must be from the Concentration Electives.

Code	Title	Credit Hours
<b>Vehicle Design and Manufacturing Concentration</b>		
Select four courses from the following:		12
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	
AENG 584	Lightweight Automotive Alloys	
AENG 586	Design & Mfg: Ltwt Auto Mat	
AENG 589	Auto Assembly Systems	
AENG 650	Anyls&Des for Veh Crshwrthnss	
IMSE 561	Tot Qual Mgmt and Six Sigma	
IMSE 567	Reliability Analysis	
IMSE 577	Human-Computer Interaction	
IMSE 593	Vehicle Package Engineering	
ME 558	Fracture and Fatigue Considerations in Design	
ME 582	Injection Molding	
ME 583	Mechanical Behavior of Materials	
ME 589	Composite Materials	
ME 591	Degradation of Materials	
ME 595	Digital Manufacturing	

Code	Title	Credit Hours
<b>Concentration Electives</b>		
Select two additional courses from the following:		6
AENG 502	Modeling of Automotive Systems <sup>1</sup>	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I <sup>1</sup>	
AENG 547	Automotive Powertrains I <sup>1</sup>	
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	
AENG 555	Vehicle Stability & Control	
AENG 562	Energy Management of Electrified Vehicles	
AENG 566	Vehicle Thermal Management	
AENG 576	Battery Systems, Modeling, and Control	
AENG 581	Materials Sel in Auto Design <sup>1</sup>	
AENG 584	Lightweight Automotive Alloys	
AENG 586	Design & Mfg: Ltw Auto Mat	
AENG 587	Automotive Manuf Processes <sup>1</sup>	
AENG 589	Auto Assembly Systems	
AENG 596	Internal Combustion Engines I <sup>1</sup>	
AENG 598	Energy Sys for Auto Vehicles	
AENG 650	Anyls&Des for Veh Crshwrthnss	
AENG 698	Capstone Proj(Case Stud/Dsn)	
AENG 699	Master's Thesis	
ECE 515	Vehicle Electronics II	
ECE 517	Adv Pwr Electrncs&Motor Drvs	
ECE 519	Adv Topics in EMC	
ECE 530	Energy Storage Systems	
ECE 531	Intelligent Vehicle Systems	
ECE 532	Auto Sensors and Actuators	
ECE 533	Active Automotive Safety Sys	
ECE 5462	Elec Aspects of Hybrid Vehicle	
ECE 5463	Fundamentals of Electric Vehicles	
ECE 565	Digital Control Systems	
ECE 566	Mechatronics	
ECE 580	Digital Signal Processing	
ECE 615	Advanced Power Electronics	
ECE 646	Adv Elec Drive Transportation	
IMSE 515	Fundamentals of Program Mgt <sup>1</sup>	
	or IMSE 516 Project Management and Control	
	or IMSE 517 Managing Global Programs	
IMSE 561	Tot Qual Mgmt and Six Sigma	
IMSE 567	Reliability Analysis	
IMSE 577	Human-Computer Interaction	
IMSE 593	Vehicle Package Engineering	
ME 543	Vehicle Dynamics	
ME 545	Acoustics and Noise Control	
ME 548	Automotive Powertrains II	
ME 558	Fracture and Fatigue Considerations in Design	
ME 565	Mechatronics	
ME 570	Powertrain NVH of Electrified Vehicles	

ME 582	Injection Molding
ME 583	Mechanical Behavior of Materials
ME 589	Composite Materials
ME 591	Degradation of Materials
ME 592	Fundamentals of Fuel Cells
ME 595	Digital Manufacturing
ME 597	Internal Combustion Engines II
ME 598	Engine Emissions

<sup>1</sup> This is a core elective course. Only one such course is allowed as a concentration requirement.

## Concentration Courses

The student is required to take six courses (18 credit hours) to satisfy the concentration requirement. At least four of these courses (12 credit hours) must be from the Vehicle Electrification Concentration. The other two courses (6 credit hours) must be from the Concentration Electives.

Students with background not closely related to electrical or computer engineering must take AENG 505 Introduction to Embedded Systems and AENG 510 Vehicle Electronics I before taking courses of the Vehicle Electrification Concentration

Code	Title	Credit Hours
<b>Vehicle Electrification Concentration</b>		
Select four courses from the following:		12
AENG 562	Energy Management of Electrified Vehicles	
AENG 576	Battery Systems, Modeling, and Control	
ECE 515	Vehicle Electronics II	
ECE 517	Adv Pwr Electrncs&Motor Drvs	
ECE 519	Adv Topics in EMC	
ECE 530	Energy Storage Systems	
ECE 532	Auto Sensors and Actuators	
ECE 533	Active Automotive Safety Sys	
ECE 5462	Elec Aspects of Hybrid Vehicle	
ECE 5463	Fundamentals of Electric Vehicles	
ECE 565	Digital Control Systems	
ECE 580	Digital Signal Processing	
ECE 615	Advanced Power Electronics	
ECE 646	Adv Elec Drive Transportation	
ME 592	Fundamentals of Fuel Cells	

Code	Title	Credit Hours
<b>Concentration Electives</b>		
Select two additional courses from the following:		6
AENG 502	Modeling of Automotive Systems <sup>1</sup>	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I <sup>1</sup>	
AENG 547	Automotive Powertrains I <sup>1</sup>	
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	

AENG 555	Vehicle Stability & Control
AENG 562	Energy Management of Electrified Vehicles
AENG 566	Vehicle Thermal Management
AENG 576	Battery Systems, Modeling, and Control
AENG 581	Materials Sel in Auto Design <sup>1</sup>
AENG 584	Lightweight Automotive Alloys
AENG 586	Design & Mfg: Ltwt Auto Mat
AENG 587	Automotive Manuf Processes <sup>1</sup>
AENG 589	Auto Assembly Systems
AENG 596	Internal Combustion Engines I <sup>1</sup>
AENG 598	Energy Sys for Auto Vehicles
AENG 650	Anyls&Des for Veh Crshwrthnss
AENG 698	Capstone Proj(Case Stud/Dsn)
AENG 699	Master's Thesis
ECE 515	Vehicle Electronics II
ECE 517	Adv Pwr Electrncs&Motor Drvs
ECE 519	Adv Topics in EMC
ECE 530	Energy Storage Systems
ECE 531	Intelligent Vehicle Systems
ECE 532	Auto Sensors and Actuators
ECE 533	Active Automotive Safety Sys
ECE 5462	Elec Aspects of Hybrid Vehicle
ECE 5463	Fundamentals of Electric Vehicles
ECE 565	Digital Control Systems
ECE 566	Mechatronics
ECE 580	Digital Signal Processing
ECE 615	Advanced Power Electronics
ECE 646	Adv Elec Drive Transportation
IMSE 515	Fundamentals of Program Mgt <sup>1</sup>
or IMSE 516	Project Management and Control
or IMSE 517	Managing Global Programs
IMSE 561	Tot Qual Mgmt and Six Sigma
IMSE 567	Reliability Analysis
IMSE 577	Human-Computer Interaction
IMSE 593	Vehicle Package Engineering
ME 543	Vehicle Dynamics
ME 545	Acoustics and Noise Control
ME 548	Automotive Powertrains II
ME 558	Fracture and Fatigue Considerations in Design
ME 565	Mechatronics
ME 570	Powertrain NVH of Electrified Vehicles
ME 582	Injection Molding
ME 583	Mechanical Behavior of Materials
ME 587	Automotive Composites
ME 591	Degradation of Materials
ME 592	Fundamentals of Fuel Cells
ME 595	Digital Manufacturing
ME 597	Internal Combustion Engines II
ME 598	Engine Emissions

<sup>1</sup> This is a core elective course. Only one such course is allowed as a concentration requirement.

## Concentration Courses

The student is required to take six courses (18 credit hours) to satisfy the concentration requirement. At least four of these courses (12 credit hours) must be from the Vehicle Powertrain and Performance Concentration. The other two courses (6 credit hours) must be from the Concentration Electives.

Code	Title	Credit Hours
<b>Vehicle Powertrain and Performance Concentration</b>		
Select four courses from the following:		12
AENG 555	Vehicle Stability & Control	
AENG 562	Energy Management of Electrified Vehicles	
AENG 566	Vehicle Thermal Management	
AENG 576	Battery Systems, Modeling, and Control	
AENG 598	Energy Sys for Auto Vehicles	
ECE 5463	Fundamentals of Electric Vehicles	
ME 543	Vehicle Dynamics	
ME 545	Acoustics and Noise Control	
ME 548	Automotive Powertrains II	
ME 570	Powertrain NVH of Electrified Vehicles	
ME 597	Internal Combustion Engines II	
ME 598	Engine Emissions	
<b>Concentration Electives:</b>		
Select two additional courses from the following:		6
AENG 502	Modeling of Automotive Systems <sup>1</sup>	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I <sup>1</sup>	
AENG 547	Automotive Powertrains I <sup>1</sup>	
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	
AENG 555	Vehicle Stability & Control	
AENG 562	Energy Management of Electrified Vehicles	
AENG 566	Vehicle Thermal Management	
AENG 576	Battery Systems, Modeling, and Control	
AENG 581	Materials Sel in Auto Design <sup>1</sup>	
AENG 584	Lightweight Automotive Alloys	
AENG 586	Design & Mfg: Ltwt Auto Mat	
AENG 587	Automotive Manuf Processes <sup>1</sup>	
AENG 589	Auto Assembly Systems	
AENG 596	Internal Combustion Engines I <sup>1</sup>	
AENG 598	Energy Sys for Auto Vehicles	
AENG 650	Anyls&Des for Veh Crshwrthnss	
AENG 698	Capstone Proj(Case Stud/Dsn)	
AENG 699	Master's Thesis	
ECE 515	Vehicle Electronics II	
ECE 517	Adv Pwr Electrncs&Motor Drvs	
ECE 519	Adv Topics in EMC	
ECE 530	Energy Storage Systems	

ECE 531	Intelligent Vehicle Systems
ECE 532	Auto Sensors and Actuators
ECE 533	Active Automotive Safety Sys
ECE 5462	Elec Aspects of Hybrid Vehicle
ECE 5463	Fundamentals of Electric Vehicles
ECE 565	Digital Control Systems
ECE 566	Mechatronics
ECE 580	Digital Signal Processing
ECE 615	Advanced Power Electronics
ECE 646	Adv Elec Drive Transportation
IMSE 515	Fundamentals of Program Mgt <sup>1</sup> or IMSE 516 Project Management and Control or IMSE 517 Managing Global Programs
IMSE 561	Tot Qual Mgmt and Six Sigma
IMSE 567	Reliability Analysis
IMSE 577	Human-Computer Interaction
IMSE 593	Vehicle Package Engineering
ME 543	Vehicle Dynamics
ME 545	Acoustics and Noise Control
ME 548	Automotive Powertrains II
ME 558	Fracture and Fatigue Considerations in Design
ME 565	Mechatronics
ME 570	Powertrain NVH of Electrified Vehicles
ME 582	Injection Molding
ME 583	Mechanical Behavior of Materials
ME 587	Automotive Composites
ME 591	Degradation of Materials
ME 592	Fundamentals of Fuel Cells
ME 595	Digital Manufacturing
ME 597	Internal Combustion Engines II
ME 598	Engine Emissions

<sup>1</sup> This is a core elective course. Only one such course is allowed as a concentration requirement.

## Concentration Courses

Students with interests, which cannot be matched by any of the other four concentrations, have an option of pursuing the General Study Concentration. The student is required to take six courses (18 credit hours) to satisfy the concentration requirement.

Code	Title	Credit Hours
<b>General Study Concentration</b>		
Select six courses from the following:		18
AENG 502	Modeling of Automotive Systems <sup>1</sup>	
AENG 505	Intro to Embedded Systems <sup>1</sup>	
AENG 510	Vehicle Electronics I <sup>1</sup>	
AENG 545	Vehicle Ergonomics I <sup>1</sup>	
AENG 547	Automotive Powertrains I <sup>1</sup>	
AENG 550	Design of Automotive Chassis	
AENG 551	FEM in Auto Structure Design	
AENG 555	Vehicle Stability & Control	

AENG 562	Energy Management of Electrified Vehicles
AENG 566	Vehicle Thermal Management
AENG 576	Battery Systems, Modeling, and Control
AENG 581	Materials Sel in Auto Design <sup>1</sup>
AENG 584	Lightweight Automotive Alloys
AENG 586	Design & Mfg: Lwt Auto Mat
AENG 587	Automotive Manuf Processes <sup>1</sup>
AENG 589	Auto Assembly Systems
AENG 596	Internal Combustion Engines I <sup>1</sup>
AENG 598	Energy Sys for Auto Vehicles
AENG 650	Anyls&Des for Veh Crshwrthnss
AENG 698	Capstone Proj(Case Stud/Dsn)
AENG 699	Master's Thesis
ECE 515	Vehicle Electronics II
ECE 517	Adv Pwr Electrncs&Motor Drvs
ECE 519	Adv Topics in EMC
ECE 530	Energy Storage Systems
ECE 531	Intelligent Vehicle Systems
ECE 532	Auto Sensors and Actuators
ECE 533	Active Automotive Safety Sys
ECE 5462	Elec Aspects of Hybrid Vehicle
ECE 5463	Fundamentals of Electric Vehicles
ECE 565	Digital Control Systems
ECE 566	Mechatronics
ECE 580	Digital Signal Processing
ECE 615	Advanced Power Electronics
ECE 646	Adv Elec Drive Transportation
IMSE 515	Fundamentals of Program Mgt <sup>1</sup> or IMSE 516 Project Management and Control or IMSE 517 Managing Global Programs
IMSE 561	Tot Qual Mgmt and Six Sigma
IMSE 567	Reliability Analysis
IMSE 577	Human-Computer Interaction
IMSE 593	Vehicle Package Engineering
ME 543	Vehicle Dynamics
ME 545	Acoustics and Noise Control
ME 548	Automotive Powertrains II
ME 558	Fracture and Fatigue Considerations in Design
ME 565	Mechatronics
ME 570	Powertrain NVH of Electrified Vehicles
ME 582	Injection Molding
ME 583	Mechanical Behavior of Materials
ME 587	Automotive Composites
ME 591	Degradation of Materials
ME 592	Fundamentals of Fuel Cells
ME 595	Digital Manufacturing
ME 597	Internal Combustion Engines II
ME 598	Engine Emissions

<sup>1</sup> This is a core elective course. Only one such course is allowed as a concentration requirement.