

# MICHIGAN TECH ENGINEERING

## Hybrid electric vehicle engineering

***Courses, certificates, and professional Master's program***

*Curriculum funded by a US Department of Energy transportation electrification grant*

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# MICHIGAN TECH ENGINEERING

*Continuing education for professional engineers*

## Hybrid electric vehicle engineering

Michigan Tech offers courses, undergraduate and graduate certificate programs, and a professional Master's program focusing on hybrid electric vehicle (HEV) engineering.

The curriculum provides advanced knowledge and hands-on laboratories in the design, analysis, control, calibration, and operating characteristics of HEVs. The technologies required to achieve transportation electrification include clean and efficient internal combustion engines and e-machines, as well as emerging technologies for advanced batteries, fuel cells, and the recharging infrastructure required for each technology.

The curriculum is based on an online course in HEV technologies developed by Michigan Tech, General Motors, and AVL, delivered in southeast Michigan in partnership with The Engineering Society of Detroit (ESD) and selected by the Michigan Academy of Green Mobility for training automotive engineers. Development of the curriculum and mobile laboratory is funded by a Department of Energy grant under the Transportation Electrification program.

### Fall semester offerings

**Courses listed below in red will be available through online learning.**

**EE—Electrical and Computer Engineering**

**MEEM—Mechanical Engineering**

**MY—Materials Science and Engineering**

**CM—Chemical Engineering**

**ENT—Enterprise**

MEEM 4200 Principles of Energy Conversion

MEEM 4295 Intro to Propulsion Systems for HEV\*

MEEM 4296 Intro to Propulsion Systems for HEV Laboratory\*

EE 4295 Intro to Propulsion Systems for HEV\*

EE 4296 Intro to Propulsion Systems for HEV Laboratory\*

MEEM 5200 Advanced Thermodynamics

MEEM 5220 Fuel Cell Technology

MEEM 4260 Fuel Cell Technology

MEEM 5250 Internal Combustion Engines II

MEEM 4700 Dynamic Systems and Controls

MEEM 5670 Experimental Design in Engineering

MEEM 5700 Dynamic Measurement/Signal Analysis

CM 3974 Fuel Cell Fundamentals

CM 3977 Fundamentals of Hydrogen as an Energy Carrier

CM 5760 Vehicle Battery Cells and Systems\*

MY 5760 Vehicle Battery Cells and Systems\*

ENT 3974 Fuel Cell Fundamentals

ENT 4900 Senior Enterprise Project Work I/Nonengineering Majors

EE 5221 Advanced Electric Machines

EE 3120 Electric Energy Systems

EE 4227 Power Electronics

EE 4228 Power Electronics Lab

EE 4221 Power System Analysis 1

EE 4261 Classical Control Systems

EE 4900 Design Fundamentals

\*dual-listed in two departments

### Propulsion Systems for HEVs

These courses, EE/MEEM 4295 and 5295 together with their associated laboratory courses 4296 and 5296, undertake a comprehensive study of hybrid electric vehicle performance and system optimization. Powertrain component analysis and modeling techniques focusing on power flows and losses are developed to quantify vehicle performance over drive cycles. Students will develop vehicle and subsystem requirements in the form of a Vehicle Technical Specification (VTS) and develop a vehicle model for simulation. These tools are applied to design and develop the control and calibration for the hybrid powertrain to meet the VTS.

### Classroom seats available in Southfield, Michigan

Four courses are offered in partnership with The Engineering Society of Detroit (ESD) and will take place in ESD classrooms in Southfield, MI.

**MEEM/EE 4295 Intro to Propulsion Systems for HEV**

**CM/MY 5760 Vehicle Battery Cells and Systems**

**EE 5221 Advanced Electric Machines**

**EE 4227 Power Electronics**

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