

# The University Senate of Michigan Technological University

## Proposal 26-10

(Voting Units: Academic)

### “CERTIFICATE IN HYBRID ELECTRIC DRIVE VEHICLE ENGINEERING”

#### Introduction

This proposal recommends establishing an undergraduate certificate entitled “Certificate in Hybrid Electric Drive Vehicle Engineering” through the College of Engineering at Michigan Technological University. The Certificate is designed primarily for Electrical Engineering and Mechanical Engineering students, but is not restricted to them. Students completing this Certificate will have established a set of core competencies in hybrid, plug-in hybrid, and electric vehicles. The Certificate Advisor will be appointed by the Dean of the College of Engineering.

#### I. Title of Certificate

Certificate in Hybrid Electric Drive Vehicle Engineering

#### II. Catalog Description

The Certificate in Hybrid Electric Drive Vehicle Engineering provides the student with the foundational tools and knowledge needed to understand and work with hybrid, plug-in hybrid, and electric vehicles. It is recommended that students have an educational background of integral calculus and a physics course covering electricity and magnetism. Students not presently enrolled at Michigan Tech should contact the department to determine the appropriate elective courses.

#### III. Rationale

The light vehicle industry is facing a shortage of engineering talent needed to retool for the use of electric drives as the primary source of motive power. In recognition of this, the State of Michigan and the US Department of Energy put in place programs to encourage universities to offer programs that help address these education needs.

Michigan Tech has received support from both the DOE and Michigan for this curricular development and is creating several new courses in this area. Michigan Tech should offer certificates to students who complete a set of new and old courses in this area in order to give them a credential indicating their knowledge in this emerging field.

#### IV. List of Courses

##### Required Courses (9 Credits)

EE 3221 – Introduction to Motor Drives – 3

ME 4200 – Principles of Energy Conversion – 3

EE/ME 4295 – Introduction to Propulsion Systems for Electric Drive Vehicles – 3

##### Elective Courses (6 Credits)

CM 3230 – Thermodynamics for Chemical Engineers\*\*\*

EE 3120 – Electric Energy Systems – 3\*

EE 4261 – Classical Control Systems – 3

EE 4227 – Power Electronics – 3

EE 4901 – EE Design Project 1 – 1\*\*

EE 4910 - EE Design Project 2 – 3\*\*

EE/ME 4296 Introduction to Propulsion Systems for Electric Drive Vehicles Lab – 1

ENG 3200 – Thermodynamics/Fluid Mechanics – 3\*\*\*

MEEM 4220 – Introduction to IC Engines– 3

MEEM 4700 – Dynamic Systems and Controls – 4

MEEM 4901 – Senior Capstone Design I – 2\*\*

MEEM 4910 – Senior Capstone Design II – 2\*\*

MY 3100 – Materials Processing 1\*\*\*

Maximum of 3 credits of the following:

ENT 3950 – Enterprise Project Work III – 1\*\*

ENT 3960 – Enterprise Project Work IV – 1\*\*

ENT 4950 – Enterprise Project Work V – 2\*\*

ENT 4960 – Enterprise Project Work VI – 2\*\*

ENT 4961 – Enterprise Project Work VII – 1\*\*

\* not allowed for students majoring in Electrical Engineering

\*\* requires Certificate advisor approval of project

\*\*\* not allowed for students majoring in Mechanical Engineering

Total Credits 15

### **Course Prerequisites that are not part of the Certificate:**

CM 3230 – CH 3510 and MA 3160 and (MA 3520(C) or MA 3521(C) or MA 3530(C) or MA 3560(C))

EE/ME 4295 – (MEEM2200 or ENG3200) and (MEEM4700 or EE4261)

EE 3120 – EE2110 OR EE3010

EE 4261 – EE 3160

EE 4901 – (EE 3305 or EE 3173) and (EE 3130 or EE 4431) and EE 4900(C)

ENG 3200 – MA 2160 and CH 1100 or CH 1110 or CH 1112 or (CH 1150 and CH 1151) and PH 2100 and ENG 1102

ME 4200 – MEEM 3230(C)

to be changed to (ME 3230 OR CM 3230 OR ENG 3200 OR MY 3100)

MEEM 4220 – MEEM 3210

MEEM 4700 – MEEM 3700

MEEM 4901 – MEEM 3000(C) and MEEM 3502(C) and MEEM 3900

MY 3100 – MY 2100

Typical course sequence for a Chemical Engineering student:

CM 3230 – Thermodynamics for Chemical Engineers – 3

EE 3120 – Electric Energy Systems – 3 (prereq is EE 3010, not part of Certificate or the CM program)

EE 3221 – Introduction to Motor Drives – 3 (prereq is EE3120)

ME 4200 – Principles of Energy Conversion – 3 (prereq is CM 3230)

EE/ME 4295 –Introduction to Propulsion Systems for Electric Drive Vehicles – 3

Typical Course sequence for an Electrical Engineering student:

ENG 3200 – Thermodynamics/Fluid Mechanics – 3

EE 3221 – Introduction to Motor Drives – 3 (prereq is a required course for EEs)

ME 4200 – Principles of Energy Conversion – 3 (prereq ENG 3200)

EE/ME 4295 –Introduction to Propulsion Systems for Electric Drive Vehicles – 3

At least 3 credits from the elective list

Typical course sequence for a Materials Science and Engineering student:

MY 3100 – Materials Processing 1 – 3

EE 3120 – Electric Energy Systems – 3 (prereq is EE 3010, not part of the Certificate, or MSE program)

EE 3221 – Introduction to Motor Drives – 3 (prereq is EE3120)

ME 4200 – Principles of Energy Conversion – 3 (prereq is required course for MEs)

EE/ME 4295 –Introduction to Propulsion Systems for Electric Drive Vehicles – 3

Typical course sequence for a Mechanical Engineering student:

EE 3120 – Electric Energy Systems – 3 (prereq is required course for MEs)

EE 3221 – Introduction to Motor Drives – 3 (prereq is EE3120)

ME 4200 – Principles of Energy Conversion – 3 (prereq is required course for MEs)

EE/ME 4295 –Introduction to Propulsion Systems for Electric Drive Vehicles – 3

At least 3 credits from the elective list

### **V. Estimated Cost**

All the courses except EE/ME 4295 and EE/ME 4296 are existing courses and are presently being taught on a regular basis. The new courses will be developed with funding from the Department of

Energy.

**Senate Introduction: 31 March 2010**

**Adopted by Senate: 14 April 2010**

**Approved by administration: 21 April 2010**