Motor Control Systems for Advanced Automotive Propulsion Systems

Purpose
The purpose of this course is to prepare skilled technicians and engineers for jobs in the electric and hybrid electric vehicle industry.

Course Objectives and Outcomes
The primary objective of this course is to equip students, working engineers, and technicians with motor control skills in the hybrid and electric vehicle sector. Upon successful completion of this course, the following outcomes will be achieved:

1. Students can describe and calculate transient performance of DC motors, including rise time, settling time, peak time and overshoot

2. Students can program Matlab/Simulink to observe transient performance of DC motors

3. Students can calculate steady-state errors of DC motors and can program Matlab/Simulink to observe steady-state errors of DC motors

4. Students know how to select parameters of PID controller for DC/AC motors

5. Students can observe and further identify fault sources of DC Motors using Simulink

6. Students will have better team-working and communication abilities

Course Contents
The main course contents include:

1. Model DC motors under time- and frequency- domains

2. Calculate and plot the transient performance of DC motors, including rise time, settling time, peak time, and overshoot using detailed formulas

3. Program Matlab/Simulink codes to observe transient performance of DC motors. Students can observe different responses of the transient performance parameters

4. Calculate steady-state errors of DC motors and program Matlab/Simulink to observe steady-state errors of DC motors and use that information to design of PID controllers

5. Understand how and why to select parameters of PID controllers for specific performance of DC/AC motors and decide which transient and/or steady-state error performance will be affected by a specific PID parameter

6. Testing PID controllers on an emulator so that they can troubleshoot and adjust PID parameters for AC/DC motors to meet specified transient performance and steady-state errors

7. Students can observe and further identify fault sources of DC Motors using Simulink. Students will calculate, via Simulink, what will happen if a fault occurs such as a reduced armature resistance, an overload current, a reduced exciting field due to burned coils, etc.