# EEPE 7V91 Special Topics in Power Electronics
# Electric Drives in Vehicle Traction Applications

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**Instructor**

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Office hours: Tuesdays & Thursdays between 5:15 pm-6:00 pm and by appointment

Teaching assistant: Yuan Qi, ECSN 4.520, yxq131230@utdallas.edu,

TA office hours: Wednesdays between 2:00 pm and 3:00 pm and by appointment

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**Course Description & Contents**

Introduction to electrified vehicle powertrain systems

- Topologies; electric vehicles, hybrid and fuel-cell hybrid electric vehicles
- Architectures of hybrid electric vehicles
- Drivetrain components
- Specifications, requirements and challenges

Design, performance analysis and control of electric drive systems

- Fundamental concepts
- Permanent magnet synchronous machine drives
- Induction machine drives
- Switched reluctance machine drives

Future trends

- Vehicle architectures and drivetrain topologies
- High speed vs. high torque electric drive systems

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**Student Learning Objectives & Outcomes**

Upon successful competition of the course, students should be will know:

- Operation and topologies of electrified vehicles
- The state of art of electrified vehicles such as Toyota Prius and Mirai, Nissan Leaf, and Tesla Model S
- Design of electric vehicle propulsion systems
- Electromagnetic fields in electric machines
- Steady state simulation of an electric drive system

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**Suggested Course Materials**

1. Ehsani, M. and Gao, Y. and Emadi, A., **"**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", 2nd Edition, CRC Press LLC, 2009.
2. Mi, C. and Masrur, M. A. and Gao, D. W., "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, May 23, 2011.
3. Chau, K. T., "Electric Vehicle Machines and Drives: Design, Analysis and Application" Wiley-IEEE Press, August 2015.
4. Emadi, A., "Advanced Electric Drive Vehicles", CRC Press, 2014.

**Assignments & Academic Calendar**

| Dates | Topics |
|---|---|
| 05.24.16 | Introduction |
| 05.26.16 – 05.31.16 | Vehicle fundamentals |
| 06.02.16 | Electrified vehicle topologies |
| 06.07.16 – 06.09.16 | Drive system components |
| 06.14.16 | Design examples |
| | ***Homework 1: Vehicle design*** |
| 06.16.16 - 06.21.16 | Electric machines in vehicle traction applications and fundamentals of electromagnetics and electric machinery |
| ***06.23.16*** | ***Midterm: Electrified vehicles: design, configurations and components*** |
| 06.28.16 | Rotating magnetic field theory |
| 06.30.16 - 07.12.16 | Permanent magnet synchronous machine drives |
| | ***Homework 2: Finite element analysis of Toyota/Prius electric machine*** |
| 07.14.16 - 07.21.16 | Induction machine drives |
| | ***Project: Comparisons of electrified drivetrains*** |
| 07.26.16 - 07.28.16 | Switched reluctance machine drives |
| 08.02.16 | Future trends |
| ***08.04.16*** | ***Project presentations*** |
| ***08.09.16 or 08.10.16*** | ***Final exam*** |

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**Grading Policy**

Midterm and final exams: 20% and 30%

Homework: 20%

Project: 30%

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**Course & Instructor Policies**

Special assignments to get extra credits are possible upon request of students.

Class attendance will not be graded.

Late assignments are not allowed unless the reason is stated and approved in advance.

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**Comet Creed**

"As a Comet, I pledge honesty, integrity, and service in all that I do."

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***The descriptions and timelines contained in this syllabus are subject to change at the discretion of the instructor.***