EECS

ECS643U/ECS720P Power Electronics



Aims:

• To enhance the knowledge and understanding of power electronic converters and their application in power electronic systems.

• To enhance knowledge and understanding of power electronic devices and their application in power electronic converters.

Key syllabus:

Fundamentals of power electronics

Circuit theory
Electronics
Power components
Digital systems
EMC/EMI
Simulation and hardware
Pulse width modulation

Applications of Power Electronics

- Electric Vehicles
- Renewable energy System (Solar Photovoltaics and Wind Turbines)
- Main electrical grid systems and smart grid
- AC/DC electric motor drives

• To provide students with the skills and techniques necessary to analyse and synthesise power electronic circuits utilising modern power electronic device

Prerequisites:

- Basic circuit theory
- Ordinary differential equations

Assessment:

- Exam: 80%
- Lab 1 (Active Power Factor Correction – Part 1): 3%
- Lab 2 (Active Power Factor Correction – Part 2): 3%
- Lab 3 (Line Commutated
- Converters): 3%
- Lab 4 (Modelling of dc-dc converters): 3%
- Lab 5 (dc-dc converter practical implementation): 4%

Power Switches

- Power switches: Diode, MOSFET, IGBT, Thyristor (SCR), BJT, GTO
- Bidirectional and bipolar switches,
- Gate drives
- Modern SiC and GaN-based power switches
- Design issues: losses, harmonics, EMI
- Switching losses and conduction losses

Power Rectifiers

- Single-phase and three-phase diode and thyristor rectifiers
- Modern H-bridge rectifiers

Power Converters

- Pulse-width Modulation
- Non-isolated and isolated dc-dc converters
- Dc-dc converter analysis in steady-state
- Continuous and Discontinuous Conduction Mode (CCM, DCM)
- Average Modelling of the dc-dc converter
- Lab 6 (Photovoltaics): 4%

Power Inverters

Single-phase inverters

All topics above will be presented with supplementary MATLAB/Simulink models

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