Course Title: Power Electronics  
Course code: 610581

Course Level: Fifth Year  
Course prerequisite(s) and/or corequisite(s): Electronics (2) 650321

Credit hours: Three

Academic Staff Specifics

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Office Number and Location</th>
<th>Office Hours</th>
<th>E-mail Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. M.T. Lazim</td>
<td>Associated professor</td>
<td>Electrical engineering – Room 822</td>
<td>10.00- 11.00(Sunday Tuesday and Thursday)</td>
<td><a href="mailto:drmohamadtofik@yahoo.com">drmohamadtofik@yahoo.com</a></td>
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</table>

Course module description:
Introduce the student to the principles, operation, and design of power electronics converter circuits.

Course module objectives:

1. Understand operating characteristics of power semiconductor devices.
2. Learn converter topologies, control techniques, and applications.
3. Learn analysis and design aspects of converters.
4. Understand losses and protection of power semiconductor devices.

Course/ module components

- Books (title, author(s), publisher, year of publication)
  
  Text Book:
• Support material (s) (vcs, acs, etc).
• Study guide (s) (if applicable)
• Homework and laboratory guide (s) (if applicable).

Teaching methods:

• Lectures (3 per week) are used to describe and develop the concepts listed above.
• Supervisions are used to solve problems set (tutorials) by various exercises.

Learning outcomes:

• Knowledge and understanding

Having successfully completed the course, the student will be able to demonstrate knowledge and understanding of:

• The various types of power semiconductor devices and their characteristics.
• The various types of power electronics circuits used in energy processing.
• Analysis and design of power converter circuits such as AC-DC, AC-AC, DC-DC and DC-AC converters.
• Applications of power electronics circuit in industry.
• Methods of protection of power semiconductor devices.
• Methods of calculation of power devices losses.

• Cognitive skills (thinking and analysis).
Students are allowed to make seminars on various subjects in power electronics.

• Communication skills (personal and academic).

Having successfully completed the module, student will be able to:

• Appreciate the importance of power electronics role in industry.
• Compare and contrast the operation of different types of power electronic circuits and devices.
• Derive equations related to the various converter circuits.
• Formulate relevant equivalent circuits for the different converters.
• Identify different types of power electronic circuits.
• Analyze simple problems related to energy processing using PE circuits.

• Practical and subject specific skills (Transferable Skills).

Having successfully completed the module, the student will be able to:

• Solve the problems of power electronics circuits .
• Explain the operation and performance of different types of energy converters
• Apply equivalent circuits to performance analysis .
• Interpret results and correlate them with theoretical predictions
• Write a technical reports.
**Assessment instruments**

- Short reports and/ or presentations, and/ or Short research projects
- Quizzes.
- Home works
- Final examination: 40 marks

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<tr>
<th>Allocation of Marks</th>
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<tbody>
<tr>
<td><strong>Assessment Instruments</strong></td>
</tr>
<tr>
<td>First Exam</td>
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<tr>
<td>Second Exam</td>
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<tr>
<td>Final examination: 50 marks</td>
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<tr>
<td>Reports, research projects, Quizzes, Home works, Projects</td>
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<td><strong>Total</strong></td>
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**Documentation and academic honesty**

- Documentation style (with illustrative examples)

Hand written and typed lecture notes including solved examples and tutorial problems are prepared from various references related to the topics. The student shall try to solve these tutorial problems by himself while answers are given individually. The solution of these problems is given to the student before the final examination.

- Protection by copyright
- Avoiding plagiarism.

**Course/module academic calendar**

<table>
<thead>
<tr>
<th>week</th>
<th>Basic and support material to be covered</th>
<th>Homework/reports and their due dates</th>
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<tbody>
<tr>
<td>(1)</td>
<td>Introduction to Power Semiconductors devices</td>
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<tr>
<td>(2)</td>
<td>Types and Applications of Power electronic converters.</td>
<td>Homework 1</td>
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<tr>
<td>(3)</td>
<td>AC-DC Converters: Single-Phase Half-Wave and full-wave Rectifiers (Uncontrolled).</td>
<td>Quiz 1</td>
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<td>(4)</td>
<td>Three-phase rectifier</td>
<td>Homework 2</td>
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<td>(5)</td>
<td>Controlled rectifications – single-phase half-wave and full-wave.</td>
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<tr>
<td>(6)</td>
<td>Controlled rectifications Three-phase Applications</td>
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<tr>
<td>(7)</td>
<td>First examination</td>
<td>Controlled rectification multi-phase Applications</td>
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<tr>
<td>(8)</td>
<td>AC-AC Converters: Single-Phase,</td>
<td>Homework 3</td>
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<tr>
<td>(9)</td>
<td>AC-AC Converters: Single-Phase</td>
<td></td>
</tr>
<tr>
<td>(10)</td>
<td>AC-AC Converters: Three-Phase</td>
<td>Homework 4</td>
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<td>Second examination</td>
<td>Cycloconverters.</td>
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<td>(12)</td>
<td>DC-AC Converters: 1-Phase invertors: (Single-Leg, H-Bridge); PWM Inverter;</td>
<td>Quiz 3</td>
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<tr>
<td>(13)</td>
<td>DC-DC Converters; Step-down; Step-Up; Applications</td>
<td>Homework 5</td>
</tr>
<tr>
<td>(14)</td>
<td>Three-Phase Inverter; Applications</td>
<td>Quiz 4</td>
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<tr>
<td>(16)</td>
<td>Final Examination</td>
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**Expected workload:**

On average students need to spend 2 hours of study and preparation for each 50-minute lecture/tutorial.

**Attendance policy:**

Absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

**Module references**

**Books**


**Journals**

IEEE Transactions on Power electronics, Pennsylvania, New York

**Websites**

www.wikipedia.org