

Module Title:	Power Electronics for Biomedical Systems
Language of Instruction:	English
Credits:	5
NFQ Level:	8
Module Delivered In	1 programme(s)
Teaching & Learning Strategies:	(a) Teaching will be conducted using lectures, tutorials and practical laboratory sessions. (b) The Institute's VLE will be used to evaluate the students' understanding of the basic concepts during each section using online quizzes. (c) At the end of each section, self-test tutorial question sheets will be issued to the students. They will have one week to complete these questions. Any difficulties arising from the self-test question sheets will be addressed in class or laboratory sessions. (d) At various stages of the module, students will be directed to online materials and resources and will also have to conduct independent research on specific topics for purpose of completing practical exercises and assignments. (e) The practical laboratory sessions will offer the students hands-on laboratory experience using real measurement and test equipment, experimental instruments, and apparatus along with computational software environments. These applied experiments will serve to reinforce the theoretical knowledge and understanding of real-world systems.
Module Aim:	The aim of this module is to provide the student with knowledge and understanding in relation to power electronics for biomedical applications, circuits, and systems. The module focuses on the operation of power semiconductor switches, line frequency rectification of ac to dc, analysis of switch-mode converters dc to dc, finally, covering different power sources, energy harvesting principles, and associated circuits for medical devices.
Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Demonstrate the operation of different power semiconductor switches.
LO2	Examine line frequency rectification of ac to dc.
LO3	Analyse switch mode converters dc to dc.
LO4	Categorise the different power sources, energy harvesting principles, and associated circuits for medical devices.
Pre-requisite learning	
Module Recommendations <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Power semiconductor switches:

(i) Diodes, (ii) Thyristors, (iii) Bipolar Junction Transistors, (iv) Metal-Oxide Semiconductor Field Effect Transistors, (v) Gate-Turn-Off Thyristors, (vi) Insulated Gate Bipolar Transistors, (vii) MOS-controlled Thyristors, (viii) Drive and Snubber circuits, (ix) SiC and GaN wide-bandgap (WBG) semiconductor technologies.

Line frequency rectification of ac to dc:

(i) Diode rectifiers (uncontrolled dc), (ii) Phase-controlled rectifiers and inverters (controlled dc).

Switch-mode converters dc to dc:

(i) Control of dc-dc converters, (ii) Step-down (Buck) converter, (iii) Step-up (Boost) converter, (iv) Cúk dc-dc converter, (v) Full bridge dc-dc converter, (vi) Comparison of dc-dc converters.

Power sources and harvesting principles and circuits:

(i) Battery types, chemistries, performance characteristics, (ii) Battery management systems and recharger circuits, (iii) Energy harvesting principles and circuits for medical devices.

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Examination	Class Assessment.	1,2	10.00	Week 7
Project	Research Assignment/Exercise.	2,3,4	10.00	Week 14

No Project

Practical

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Lab Reports – Formative Assessments	1,2,3,4	20.00	Week 14

End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	Summative Assessment – Formal Examination.	1,2,3,4	60.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Every Week	3.00
Laboratory	Every Week	2.00
Independent Learning	Every Week	3.00
Total Hours		8.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEBEE_B	Bachelor of Engineering (Honours) in Biomedical Electronics	7	Mandatory