PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM*

Module Title:	**Power Electronics**	Level:	**6**	Credit Value:	**10**

Module code: **ENG683** (if known)	Cost Centre: **GAEE**	JACS2 code: H650

Semester(s) in which to be offered: **1**	With effect from: **July 2015**

Office use only: To be completed by AQSU:	Date approved: **July 2015** Date revised: Version No: 1

Existing/New: **New**	Title of module being replaced (if any):

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **Y. Vagapov**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG645 (Power Electronics and Electric Drives).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop the understanding of power electronic devices into the control or provision of power supplies and in controlling electrical machinery and thus to design and prove electronics-based circuits for the control of electrical machines and power supplies.

Expected Learning Outcomes

Knowledge and Understanding:
At the completion of this module, the student should be able to:

1. Comprehensively understand the principles and operation of the electronic devices available for power applications;
2. Critically analyse and evaluate the effects of power electronics equipment on electrical supplies and loads;
3. Apply appropriate techniques in the design of different types of converters; *(KS 10)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of a written examination covering all outcomes. It is an unseen time-constrained exam.
(This corresponds to one-half (part A) of the examination of ENG645.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be delivered through lectures, tutorials and student-driven investigative work. A significant amount of the content is to be achieved through individual study. Approximately one third of the timetabled time will be devoted to formal lectures. The remainder of the time will be allocated to tutorials and to individual study but also with some programmed access to lab/computer facilities, for practical investigation and analysis activities.

Syllabus outline:

Power Semiconductor Devices: Operation, characteristics, ratings, applications of diodes, thyristors, MOSFETs, IGBTs. Darlington-pair configuration, transistor as a switch. Analysis and calculation of power losses in power semiconductors. Selection of devices for particular tasks.

Thermal Consideration: Cooling systems and heat sinks. Thermal resistances. Thermal equivalent circuits. Heat transfer coefficient. Analysis and calculation of heat sink parameters.

AC–DC Converters - Rectifiers: Principle of operation of controlled rectifiers. Thyristor firing methods. Phase control firing circuits. Natural and forced commutation circuits. Single-phase and three-phase bridge rectifiers operating under different load conditions. Harmonics and power factor improvement.

DC–DC Converters: Principle of operation and characteristics of step-down, step-up, inverting converters. Duty ratio and voltage control.

DC–AC Converters - Inverters: Principle of operation and characteristics of single-phase and three-phase inverters. Pulse width modulation. Voltage control and harmonics.

Power Electronic Applications: Switching mode power supplies, Uninterruptible power sources. Power factor correctors. Static voltage regulators.

Bibliography:

Essential reading:

Hart, D.W. (2011) *Power Electronics*, New York: McGraw-Hill.

Mohan, N. (2012) *Power Electronics: A First Course*, Hoboken: Wiley.

Recommended reading:

Wildi, T. (2005) *Electrical Machines, Drives and Power Systems*, 6th Edn., Englewood Cliffs: Prentice-Hall

Chapman, S. J. (2011) *Electric Machinery Fundamentals*, 5th Edn., New York: McGraw-Hill.

Hubert, C.I. (2002) *Electric Machines: Theory, Operating Applications and Control*, 2nd Edn., Englewood Cliffs: Prentice-Hall