PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM*

Module Title:	**Electronic Design and Test**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG617**	Cost Centre:	**GAEE**	JACS2 code:	H600

Semester(s) in which to be offered:	**2**	With effect from:	**July 2015**

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

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

Originating Academic area:	**Engineering and Applied Physics**	Module Leader:	**B. Klaveness**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG636 (Electronics, Design and Testing).**
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 extend the student to develop original test strategies and to consider the interrelationships of test and design within the design and manufacturing cycle for modern electrical and electronic products.

Expected Learning Outcomes

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

1. Originate electrical and electronic designs for a given specification;
2. Analyse test requirements during the design stages of an electrical or electronic circuit or system, and incorporate suitable improvements to enable flexible, cost effective automatic testing;
3. Analyse Hardware, specify, and design appropriate software algorithms and test equipment to implement accurate and cost effective tests by means of a minimal test programme; *(KS 5)*

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 major practical assignment. For example: individual design and implementation of test sequences using automated hardware programmed using industry leading software. The equipment can be used to control dc/ac sources, DMM/DSO etc to automatically characterise a given item under test. e.g.: Component / Analogue Amp / Digital logic PCB/PV panel etc. The evidence of the activity is produced as a portfolio of software, written report and a final practical demonstration of the solution. It covers all outcomes. (This corresponds to assessment 1 – portfolio - of ENG636.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Portfolio	100%		2000

Learning and Teaching Strategies:

The module will be delivered mainly through keynote lectures and student-driven development work, particularly using computer-based, automated test equipment. A significant amount of the work is carried out by students in a minimally supervised specialist lab accessed outside normal class times.

Detailed lecture notes provided for the student will allow the optimisation of lecture time, with good opportunity for self-study and occasional tutorials. Case studies may be used using examples of failure obtained from our commercial activities for industrial companies and are designed to broaden the range of students reading and may help with their practical work.

Syllabus outline:

Testing methodology: The Design cycle, test strategies and use of manual, automatic and semi automatic test implementations, analysis of design, manufacturing, random and end of life faults. Design of structured testing algorithms for circuits and systems, test pattern generation, minimal and fault location algorithms. Analogue/digital and power system techniques.

Designing for testability: Principles, integration of test considerations into the design cycle, reliability and maintainability considerations. Testability measures and good practices. Relevance to QA and QC. Costs and penalties. Feedback from manufacture, test and field failures, safety, costs, timescales, RoHS.

Parametric analysis: Derivation of design and test limits, use of tolerance tiering, statistical analysis of production data, trend analysis and monitoring techniques.

Signal Integrity: Signal monitoring and interfacing, noise, transients. Transmission line effects, mathematical and graphical analysis tools. Best practice PCB design for EMC compliance.

Advanced test features: Overview: Boundary Scan, BILBO, etc. Self-test features, and comparison of algorithmic-based techniques with knowledge-based systems; suitability for ATE.

Current developments and Applications: Investigation and review by, attendance at seminars, guest speakers (Researchers, KTP and placements, etc), review of manufacturers web based literature and software, Case studies, Identification of parametric, functional and test anomalies during complex system integration, etc.

Implementation: Design of ATE systems incorporating ergonomic considerations, safety, initialisation, fault handling, progress, display, data entry, analysis and results presentation.

Bibliography:

Essential reading:

Angus, R.B. and Hulbert, T.E. (2005) *VEE Pro Practical Graphical Programming*, London: Springer.

Recommended reading:

Simpson, A. (1981) *Testing Methods and Reliability (Elect)*, Palgrave Macmillan, London.
Crouch, A. (1999) *Design for Test*, London: Prentice-Hall.
O'Connor, P.D.T (2001) *Test Engineering,* New York: John Wiley and Sons.
Loveday, G.C. (1980) *Electronic Testing and Fault Diagnosis,* New York: Pitman.
Russel, G. and Sayers, I.L. (1989) *Advanced simulation and Test Methodologies for VLSI Design,* Van Nostrand Reinhold.