PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM*

Module Title:	**Control Engineering B**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG618**	Cost Centre:	**GAEE**	JACS2 code:	H660

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:**	**Free-standing 10-credit component comprising half of ENG639 (Signal Processing and digital Control).**
Scheduled learning and teaching hours	36	core/option/elective (identify programme where appropriate):	
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 mathematical modelling to predict and modify control system behaviour by extending established analytical skills and applying computer-based methods to control-system design, implementation and modification.

Expected Learning Outcomes

Knowledge and Understanding:

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

1. Analyse and predict the performance of a computer controlled system;
2. Design and/or modify, using computer aided techniques, a control system to a specified performance using the state space approach. *(KS 4)*

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 B) of the examination of ENG639.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2	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. The application part of the module is done via laboratory work which uses MATLAB/Simulink for control system design, simulation and system identification. The students will be encouraged to further investigate the topics as directed learning.

Syllabus outline:

Computer-Based Control Systems: Signal patterns in computer controlled system; Modelling and mathematical representation of computer-based closed-loop control system. z-transfer function for a computer control system. Computer control system stability. Jury's stability criteria. System classification and frequency response. Computer control system performance. Time domain responses. Digital implementation of analogue controllers.

Multivariable Systems: State-space equations. State-space representations from transfer functions. State-space representations from difference equation. System controllability. System observability. Solution of state equation. State feedback control design. Full state observer design.

System Identification: White-box, black-box and grey-box model. Model structure identification. Model parameter identification. Autoregressive–moving-average (ARMA) models. Least-square regression method.

Linear Optimal Control: Criteria for optimal control; General optimal control formulation; Linear quadratic regulator.

Bibliography:

Essential reading:

Landau, I.D. and Zito, G. (2010) *Digital Control Systems: Design, Identification and Implementation (Communications and Control Engineering)*, Springer.

Recommended reading:

Tewari, A. (2003) *Modern Control Design with MATLAB and SIMULINK*, London: John Wiley and Sons.
Nise, N.S. (2003) *Control Systems Engineering*, 4th Edn., London: John Wiley and Sons.
Golten, J and Verwer, A. (2003) *Control System Design and Simulation*, London: McGraw-Hill
Free downloaded student edition of CODAS on web site: GoltenVerwer.com
Dorf, R.C. (2000) *Modern Control Systems*, 7th Edn., London: Addison Wesley.

Additional Reading:

http://www.mathworks.com/ (Guides for MATLAB software)
http://www.gnu.org/software/octave/ (Guides for Octave software)
http://www.theiet.org/ (Online resources from the IET)
http://www.ieee.org/index.html (Online resources from the IEEE)