PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title:	**Control Engineering A**	Level:	**5**	Cedit Value:	**10**

Module code: (if known)	**ENG512**	Cost Centre:	**GAME**	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): N/A

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **Z Chen**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising second half of ENG547 (Avionics, Flight Dynamics and Control).**
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 concepts of mathematical modelling in the area of control engineering and to extend established mathematical skills and thus to apply analytical methods to control analysis, system design, implementation and modification.

Expected Learning Outcomes

Knowledge and Understanding:

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

1. Understand and use correct mathematical techniques to analyse control systems and their application to aircraft systems.
2. Design and/or modify a control system to meet a specified performance in the time domain using analytic, graphical, empirical and computer methods. *(KS 3, 4)*
3. Design and/or modify a control system to meet a specified performance in the frequency domain using analytic, graphical, empirical and computer methods. *(KS 3, 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 (%). ***Details of indicative assessment should also be included****.*

All learning outcomes will be assessed by means of a formal examination.
(This corresponds to 'Assessment 2' of ENG547.)

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 hrs	

Learning and Teaching Strategies:

The module will be delivered by a set of structured lectures backed up by tutorials, practical and computer-based Laboratory work and assignments, including use of videos. Approximately 30% of module time will be spent on practical investigations and will include the use of computer simulation software.

Syllabus outline:

Modelling and Analytical Techniques: System models of physical/electrical systems; open and closed loop systems; similarities of models from different physical systems; differences between servosystems, regulators and process control systems; steady state and transient response; Laplace transform solutions for step, ramp and sinusoidal inputs; final value theorem; transfer functions and characteristic equations; block diagram algebra; poles and zeros; stability; Routh Hurwitz stability criterion; use of computer software for correlation of open and closed loop transient responses.

Time Domain Analysis: Performance criteria: damping ratio, natural frequency, rise time, overshoot, settling time, logarithmic decrement; system lags and time constants; system class and steady state errors for standard input functions; proportional, integral and derivative control. Empirical methods for determining controller parameters: Zeigler and Nicholls, quarter decrement and continuous cycling approaches; variations in system response for controller settings.

Frequency Domain Analysis: Bode and Nyquist diagrams; stability criteria; relative stability; gain and phase margins; correlation between frequency response and transient response parameters; derivation of transfer function from Bode diagram. Compensation techniques: lag and/or lead networks; design for a specified performance; use of computer software for the above.

Bibliography:

Essential Reading:

Bishop, R.D. & Dorf, R.C. (2010) *Modern Control Systems*, 12th Edn., London: Prentice-Hall.

Recommended reading:

Ogata, K. (2008) *Modern Control Engineering*, 5th Edn., London: Prentice-Hall.

Attaway, S. (2011) *Matlab: A Practical Introduction to Programming and Problem Solving*, 2nd Edn., Butterworth-Heinemann.