UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Control Engineering
Module Code:	MAE5010-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Mechanical and Automotive Engineering
FHEQ Level:	FHEQ Level 5
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	**Hours**
Lectures	24
Tutorials	12
Laboratory	12
Directed Study	152

Availability	
Occurrence	**Location / Period**
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims

Control Engineering is applied across all areas of engineering to develop safe and sustainable solutions. This module provides a solid theoretical foundation for understanding feedback control system analysis and design in both the time and frequency domains.

Outline Syllabus

Introduction: terminology, concept of control, closed loop vs. open loop systems; Dynamic models of mechanical, electrical and process systems; Block diagram representation; Standard time-domain test inputs; impulse, step, ramp; Laplace transforms, transfer functions, poles and zeros, characteristic equation; First and 2nd order systems; transient, rise/settling time,

overshoot/damping ratio, time delay ; Stability: Routh-Hurwitz Criterion; System type, steady-state error, error constants, Final Value Theorem; Root Locus Techniques; Nyquist stability criterion; Gain & phase margins; Bode diagrams, Time delays; PID controller and tuning methods; Lead/Lag compensation; Sensitivity, disturbance rejection; State space modelling, Multivariable systems; Digital controllers; Computer control, PLCs ; Control system simulation using Matlab and Simulink ; Control Engineering applications and context will be explored at every opportunity.

Reading List

Dorf, R. C., & Bishop, R. H. (2011). Modern control systems (12th ed.). Prentice Hall, Pearson.
Franklin, G. F., Powell, J. D., & Emami-Naeini, A. (2015). Feedback Control of Dynamic Systems. Global Edition.
Kuo, B. C., & Golnaraghi, F. (2003). Automatic Control Systems (8th ed.). Prentice-Hall.
Nise, N. S. (2011). Control systems engineering (6th ed.). Wiley.
Ogata, K. (2002). Modern control engineering (4th ed.). London: Prentice-Hall International.

Learning Outcomes

1	LO1. Develop knowledge of theoretical tools required for control system analysis and design and LO2. Apply the tools for solving control problems
2	LO3. Convert differential equations of a dynamical system into transfer function and state space form LO4. Critically assess absolute and relative stability of feedback systems LO5. Formulate design specifications for a control system and select appropriate compensator design strategies to achieve desired performance LO6. Use industry standard software, such as Matlab and Simulink, for control system analysis and design
3	LO7. Locate and study additional material from sources such as books, journals and Internet. LO8. Develop problem-solving skills LO9. Communicate effectively through writing two technical reports

Learning, Teaching and Assessment Strategy

The course material is delivered by lectures supported by tutorials, computer simulation, videos and animation. Lectures will explore principles of control systems analysis and design (LO1, LO2, LO3, LO4, LO5). Case studies are presented to illustrate real-world applications of control and promote class discussion.
Tutorial exercises and computer simulation provide the opportunity for students to test their understanding and implement the techniques learned in the lectures (LO2, LO6, L08). Directed reading will help deepen understanding of the lecture topics (LO7).
The coursework and examination are used to assess understanding of the theory and analytical problem solving skills developed during the course (LO3, LO4, LO5, LO8). Formative verbal feedback is given in the weekly tutorials. Feedback on the coursework is provided after marking of the submitted reports (LO9). Supplementary assessment: is a 2-hour exam worth 100%.

Mode of Assessment				
Type	**Method**	**Description**	**Length**	**Weighting**
Referral	Examination - closed book	Supplementary Assessment: Examination - closed book (2hrs)	2 hours	100%
Summative	Examination - closed book	Examination - closed book (1.5 hours)	90 minutes	50%
Summative	Coursework	2 reports in S1 and S2 (1000 words each) 1-System Response Simulation 2-Design of PID Controller	-2000 words	50%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.