UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Control Engineering
Module Code	CPE6008-B
Academic Year	2021/2
Credits	20
School	Department of Chemical Engineering
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Laboratories	6
Lectures	24
Tutorials	10
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

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

- Terminology, basic elements in a simple control loop, process variables, closed loop vs. open loop system, impulse, step, ramp inputs.
- Control Loop Hardware: sensors, transmitters, control valves.
- Instrumentation for measurement of process variables.
- Mathematical models for dynamic processes, response of FOPDT, second-order dynamics, block diagram representation.
- Laplace/inverse transforms, partial fractions, transfer functions, poles and zeros, system response versus pole location.
- Rise time, settling time, overshoot, damping ratio, bandwidth.
- Stability: Routh-Hurwitz Criterion.
- System type, steady-state error, error constants, Final Value Theorem.
- Frequency response: Bode/Nyquist plots. Gain/phase margin.
- Root Locus Techniques: Root Locus design.
- Control Strategies: feed-forward, ratio, cascade, phase lead/lag.
- PID controller and tuning methods, Anti-windup.
- Process & Instrumentation Diagram (P&ID), standards and symbols.
- Control system simulation using MATLAB and Simulink.

Learning Outcomes

Outcome Number	Description
01	Use process control terminology and describe the instrumentation needed to implement process control.
02	Determine process dynamics from step response data and convert differential equations into transfer function and state space representation.
03	Analyse stability and performance of feedback loops using Laplace and frequency domain techniques.
04	Formulate design specifications for a control system and select appropriate compensator design strategies to achieve desired performance.
05	Identify and use material from a variety of references, such as books and web-based sources.
06	Solve problems and communicate effectively through writing reports.

Learning, Teaching and Assessment Strategy

The course material is delivered through a combination of interactive lectures supported by videos/animations, tutorials, and computer simulation. Lectures will explore principles of process control analysis and design (LOs 1, 2, 3, 4, 5). Case studies are presented to illustrate real-world applications of control and promote class discussion.
Formative assessment is through tutorial exercises and computer simulations which provide the opportunity for students to test their understanding and implement the techniques learned in the lectures (LOs 2, 3, 4, 5, 7). Directed reading will help deepen understanding of the lecture topics (LO6).

The coursework (LOs 1, 2, 3, 4, 5, 6, 7) and examination (LOs 1, 2, 3, 4) are used to assess understanding of the theory, use of the software tools, and analytical problem solving skills, developed during the course. Formative verbal feedback is given in the weekly tutorials. Written feedback on the coursework is provided after marking of the submitted reports (LO7).

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Examination - Open Book	Online Open Book Examination (2 Hrs)	50%
Summative	Coursework	Coursework (0-3000 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.

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