Course Outline (Higher Education)

School:	School of Engineering, Information Technology and Physical Sciences
Course Title:	ADVANCED CONTROL SYSTEMS ENGINEERING
Course ID:	ENGIN5405
Credit Points:	15.00
Prerequisite(s):	(ENGIN3404 or ENMTX3040)
Co-requisite(s):	Nil
Exclusion(s):	(ENMTX4020)
ASCED:	039999

Description of the Course:

This is a capstone course enhancing students knowledge and skills in the advanced topics of control system engineering. Through this course, students will appraise their understanding of the applications and importance of control system in mechatronic applications. Students will be able to interpret, analyse and exemplify different areas of automated control systems, digital control systems, predictive control systems and real time realisation using suitable control system software. Integrating this course with the knowledge and understanding obtained in previous courses, students will be able to distinguish between the principles of different control systems and will be able to apply them in developing and designing appropriate engineering processes. The theoretical knowledge will be complemented with projects and laboratory exercises. The activities will allow students to enhance their skills in designing software based models for controlling mechatronic systems. The students will also learn to appreciate applications of the developed knowledge and skills in industrial environment.

Grade Scheme: Graded (HD, D, C, P, MF, F, XF)

Work Experience:

No work experience: Student is not undertaking work experience in industry.

Placement Component: No

Supplementary Assessment: Yes

Where supplementary assessment is available a student must have failed overall in the course but gained a final mark of 45 per cent or above and submitted all major assessment tasks.

Program Level:

Level of course in Program	AQF Level of Program					
	5	6	7	8	9	10
Introductory						
Intermediate						
Advanced					✔	

Learning Outcomes:

On successful completion of the course the students are expected to be able to:

Knowledge:

K1. Demonstrate advanced understanding of the theory and applications of control systems and controllers.
K2. Analyse and interpret principles of digital control system.
K3. Demonstrate understanding of performing stability analysis of control systems.
K4. Explain and appraise different transformation techniques and methodologies.
K5. Demonstrate understanding of different control systems design.

Skills:

S1. Design, evaluate and critically analyse different control systems for stability and performance to ensure relevant criteria are met.
S2. Transform and evaluate different control systems.
S3. Design, analyse and perform real time realisation of different control systems using control software.

Application of knowledge and skills:

A1. Apply mathematical and theoretical knowledge to design and model an effective control system for a practical engineering process.
A2. Design and apply a suitable automatic control system in order to automate an industrial engineering process.

Course Content:

Topics may include:

- Review of control system engineering including stability and steady state errors.
- Design via root locus, frequency response and state response.
- Introduction to the advanced principles of digital control system.
- Digital control system stability; the z-transform and stability analysis in z-domain.
- Overview of tustin transform, w-transform and higher harmonic control.
- Discrete system design and analysis.

- Predictive control system: modelling and principles.
- Optimal control: principles, designing and modelling.
- Stochastic optimal control and nonlinear optimisation.
- Advanced applications of calculus of variations to optimal control.
- Computer / microprocessor based control, adaptive control and fuzzy logic control systems.
- Multivariable controllers based on fuzzy logic and neural network methods.
- Designing, modelling and real time realisation of different control systems using control software.

Values:

V1. Appreciate the importance of control system in a mechatronic engineering process.
V2. Acknowledge the importance of this subject in automating a mechatronic industrial process or system.

Graduate Attributes

The Federation University FedUni graduate attributes (GA) are entrenched in the Higher Education Graduate Attributes Policy (LT1228). FedUni graduates develop these graduate attributes through their engagement in explicit learning and teaching and assessment tasks that are embedded in all FedUni programs. Graduate attribute attainment typically follows an incremental development process mapped through program progression. **One or more graduate attributes must be evident in the specified learning outcomes and assessment for each FedUni course, and all attributes must be directly assessed in each program**

Graduate attribute and descriptor		**Development and acquisition of GAs in the course**	
		Learning Outcomes (KSA)	**Assessment task (AT#)**
GA 1 Thinkers	Our graduates are curious, reflective and critical. Able to analyse the world in a way that generates valued insights, they are change makers seeking and creating new solutions.	K1-K5 S1-S3 A1-A2	1-3
GA 2 Innovators	Our graduates have ideas and are able to realise their dreams. They think and act creatively to achieve and inspire positive change.	S1-S3 A1-A2	1-3
GA 3 Citizens	Our graduates engage in socially and culturally appropriate ways to advance individual, community and global well-being. They are socially and environmentally aware, acting ethically, equitably and compassionately.	A1-A2	1-3
GA 4 Communicators	Our graduates create, exchange, impart and convey information, ideas, and concepts effectively. They are respectful, inclusive and empathetic towards their audience, and express thoughts, feelings and information in ways that help others to understand.	K1-K5 S1-S3 A1-A2	1-3

Graduate attribute and descriptor		Development and acquisition of GAs in the course	
		Learning Outcomes (KSA)	Assessment task (AT#)
GA 5 Leaders	Our graduates display and promote positive behaviours, and aspire to make a difference. They act with integrity, are receptive to alternatives and foster sustainable and resilient practices.	K1-K5 S1-S3 A1-A2	1-3

Learning Task and Assessment:

Learning Outcomes Assessed	Learning Tasks	Assessment Type	Weighting
S1-S3, A1-A2	Experimental work and / or projects to verify students ability to apply knowledge and skills acquired in the course.	Reports, demonstrations	10-30%
K1-K5, S1-S3	Relevant tasks and problems to enforce understanding of the students and help in gradual development of knowledge and skills throughout the course.	Assignments, quizzes	10-30%
K1-K5	Questions and problems related to the course contents.	Exams / Tests	40-60%

Adopted Reference Style:

Other (IEEE-Refer to the library website for more information)

Refer to the library website for more information

Fed Cite - referencing tool