Module Specification

Module Summary Information

1	**Module Title**	Control Engineering
2	**Module Credits**	20
3	**Module Level**	7
4	**Module Code**	ENG7148

5	**Module Overview**

The module utilises the mathematical concepts such as transform calculus and matrix theory used to model systems using both the transfer function and state-space paradigms. You will then be able to design controllers for linear systems using time and frequency response methods, in particular, pole placement techniques will be applied using both input-output and state-feedback approaches. These will then be extended to observer design and LQR optimization.

Teaching and assessment will comprise not only of traditional lectures and tutorials, but also the use of industry standard software for problem solving.

6	**Indicative Content**

Lecture Topics	Tutorial and Post-session Activities
Linear System Modelling	Mathematical software
The Root-Locus Method	Numerical Root Locus methods
Lag-Lead and PID Controllers	Solution with Bode/Nyquist Plots
State-Feedback Control Design	Pole Placement Solution
State-Observer Design	Luenberger Solution
Optimal Control	Solution using LQR Methods
Optimal Observers	Kalman Filter Solution
ON-OFF Control	Describing Functions
Sliding Mode Control	Lyapunov Functions
Optimal Seeking Controllers	Optimal Perturbation

7	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Design classical controllers using Laplace, Fourier or Z-Transfer Function techniques.
	2	Implement pole placement controllers using state-feedback and modern control approaches.
	3	Formulate observers or Kalman filters.
	4	Apply modelling, simulation and control techniques using industry standard software to solve typical engineering problems.

8	Module Assessment		
Learning Outcome			
	Coursework	Exam	In-Person
1-4		X	

9	Breakdown Learning and Teaching Activities
Learning Activities	Hours
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable	36
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE	N/A
Private Study (PS) includes preparation for exams	164
Total Study Hours:	200