Subject Description Form

Subject Code	EE528
Subject Title	System Modelling and Optimal Control
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with a sound knowledge of system identification and modelling techniques in areas of prediction and control. 2. To introduce modern control design techniques.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Model systems using State Variable and Transfer Functions. b. Design optimal controllers for system models. c. Apply computer packages for control system modelling and design. d. Apply control system in practical applications.
Subject Synopsis/ Indicative Syllabus	1. ***System models*****:** functions, transformations and mapping, Laplace transformation and z-transformation, state variables and state space models of dynamic systems, relations between state space models and transfer function models, solutions of unforced linear state equations, matrix exponential, eigenvalues and eigenvectors, Jordan form, solutions of linear state equations, transition matrix. 2. ***Stability, controllability, and observability*****:** stability, Lyapunov stability, Lyapunov function, controllability and observability, definition and criteria, stabilizability and detectability, feedback control. 3. ***Optimal control*****:** Calculus of variations, formulation of optimal control problems, Pontryagin maximum principle, Riccati equation, application to linear regulator.
Teaching/Learning Methodology	Basic concepts and theories are taught in lectures and tutorials. Computer experiments will be assigned as part of the interactive assignments, where the students are expected to solve theoretical and practical control problems with critical and analytical thinking.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	✓	✓	✓	
Tutorials	✓	✓	✓	
Assignments			✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	
2. Assignments	40%	✓	✓	✓	✓
Total	100%				

The outcomes on concepts, analytical skills, problem-solving techniques, design and applications, and practical considerations of designing control systems are assessed by the usual means of examination and assignments, including computer-package-based assignments.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	39 Hrs.
Other student study effort:	
▪ Reading and studying	43 Hrs.
▪ Completing assignments	23 Hrs.
Total student study effort	105 Hrs.

Reading List and References

1. L. Ljung, System Identification: Theory for the User (2nd Edition), Prentice Hall.
2. C.C. Hang, T.H. Lee and W.K. Ho, Adaptive Control, Instrument Society of America.
3. N. Nise, Control Systems Engineering, Wiley.
4. P. J. Antsaklis and A. N. Michel, Linear Systems, McGraw Hill.

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