

City University of Hong Kong

**Information on a Course
offered by Department of Electronic Engineering
with effect from Semester A in 2011/12**

This form is for completion by the Course Co-ordinator/Examiner. The information provided on this form will be deemed to be the official record of the details of the course. It has multipurpose use: for the University's database, and for publishing in various University publications including the Blackboard, and documents for students and others as necessary.

Please refer to the Explanatory Notes attached to this Form on the various items of information required.

Part I

Course Title:	Linear Systems Theory and Design
Course Code:	EE5411
Course Duration:	One Semester (13 weeks)
No. of credits:	3
Level:	P5
Medium of Instruction:	English
Prerequisites (<i>Course Code and Title</i>):	Nil
Precursors (<i>Course Code and Title</i>):	MA2170 Linear Algebra and Multi-variable Calculus, or EE3210 Signals and Systems, or EE3118 Linear Systems and Signal Analysis
Equivalent Course (<i>Course Code and Title</i>):	Nil
Exclusive Courses: (<i>Course Code and Title</i>):	Nil

Part II

1. Course Aims:

This course aims to introduce to students fundamental concepts, techniques, and tools in linear system analysis and design, required for a broad range of engineering disciplines including systems and control, signal processing, and communications.

2. Course Intended Learning Outcomes (CILOs)

Upon successful completion of this course, students should be able to:

No.	CILOs
1.	Recognise and determine system characteristics
2.	Describe and apply state-space modelling
3.	Implement the solution/response of linear dynamical systems

4.	Describe and apply controllability and observability to linear systems
5.	Apply state feedback and state estimator to engineering design
6.	Apply stability of linear systems to modern engineering design

3. Teaching and Learning Activities (TLAs)

Indicative of the possible activities and tasks designed to facilitate students' achievement of the CILOs. Fine details will be provided for students upon the commencement of the course.

CILO 1, 2, 3, 4, 5, 6	Lectures, tutorials, written assignments
CILO 4, 5, 6	Case studies, presentation

Timetabling Information

Pattern	Hours
Lecture:	26
Tutorials:	13
Laboratory:	
Other activities:	

4. Assessment Tasks/Activities

	Type of assessment tasks	Weighting (if applicable)
Continuous Assessment	Written assignments, case studies, and presentation	50%
Examination	Written examination	50% 2 hours

Remarks: To pass the course, students are required to achieve at least 30% in the examination.

5. Grading of Student Achievement:

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1, 2	The course will provide fundamental concepts and techniques required in the modeling, analysis, and design of modern engineering systems in broad fields such as control technology, communication systems, and signal processing algorithms.
3, 4	Student will be able to analyze and design state feedback and state observers, and consequently to analyze and design feedback systems using numerically efficient state-space methods.
5	The lectures will provide the necessary tools for students to access contemporary research developments. The case studies will expose students to new research frontiers.
6,7	The case studies and presentation will provide students with the opportunity to work as a team and to develop their communication skills.

Part III

Keyword Syllabus:

Mathematical Systems Descriptions

Review of basic concepts, causality, stability, linearity, time-invariance, input-output description, state-space description, LTI systems, linearization.

Basic Mathematical Background

Linear space, vector norms, linear equations, linear transformation, eigenvalues and eigenvectors, canonical forms, matrix function, positive definite matrices, matrix induced norms.

Linear Dynamical Equations

Solution space, fundamental matrix, transition matrix, adjoint systems, equivalent systems.

Controllability and Observability

Controllability Gramian, rank test, PBH test, output controllability, observability Gramian, observability test, PBH test, duality, canonical forms, canonical decomposition, minimal realizations.

State Feedback and Observer

State feedback, pole placement, full-state observer, reduced state observer, separation principle, tracking and regulation.

Stability Analysis

Input-output stability, system induced norms, internal stability, Lyapunov stability, Lyapunov equation.

Recommended Reading:

C.T. Chen, Linear System theory and Design, 3rd Ed., Oxford Univ. Press, 1999

Online Resources (if any)

Returned by:

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