

University of Puerto Rico
 Mayagüez Campus
 College of Engineering
 Department of Electrical and Computer Engineering
 Bachelor of Science in Electrical Engineering

Course Syllabus

1. General Information:	
Alpha-numeric codification: INEL 5505 Course Title: Linear System Analysis Number of credits: 3 Contact Period: 3 hours of lecture per week Elective in INEL	
2. Course Description:	
English: Linear spaces and matrices; state variables representations for linear continuous and discrete time systems; the Z-transform and its applications; stability; controllability and observability; state estimators. Spanish: Espacios lineales y matrices, representación de sistemas lineales de tiempo continuo y discreto mediante variables de estado, la Transformada Z y sus aplicaciones, estabilidad, controlabilidad y observabilidad, estimadores de estado.	
3. Pre/Co-requisites and other requirements:	
INEL 4505.	
4. Course Objectives:	
Analyze linear systems and design of state-feedback controllers. Develop dynamical models for simple linear systems using state-space representation. Evaluate and interpret properties of linear systems such as stability, controllability, and observability. Design state-feedback controllers for single-input single-output linear systems. Implement the controllers using digital computers and validate its performance.	
5. Instructional Strategies:	
<input checked="" type="checkbox"/> conference <input checked="" type="checkbox"/> discussion <input checked="" type="checkbox"/> computation <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:	
6. Minimum or Required Resources Available:	
Eight workstations equipped with mechanical systems to be controlled, electrical measurements equipment, personal computers with data acquisition boards and software (Matlab, Simulink, RTW, and LabVIEW).	
7. Course time frame and thematic outline	
Outline	Contact Hours
System classification and structures	2
Introduction to linear algebra	8
Mathematical description of systems and examples of physical systems	3
The solution of the state equation	5
Linearization of dynamical systems	2
Discrete time systems, difference equations, and the Z-transform and its application	4
Discretization of continuous time systems	2
Stability of continuous and discrete time linear systems	4
Controllability and Observability	7
State feedback an pole placement	4
State estimators	2
Exams	2
Total hours: (equivalent to contact period)	45
8. Grading System	
<input checked="" type="checkbox"/> Quantifiable (letters) <input type="checkbox"/> Not Quantifiable	
9. Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.	

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2	50
<input checked="" type="checkbox"/> Final Exam	1	20
<input type="checkbox"/> Short Quizzes		
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	1	20
<input type="checkbox"/> Journals		
<input checked="" type="checkbox"/> Other, specify: Homework Sets	4	10
TOTAL:		100%

10. Bibliography:

Williams, R.L. Lawrence, D.A. Linear State Space Control Systems, 2007, John Wiley.
 C.T. Chen, Linear System Theory and Design, 3rd Ed., Oxford University Press, New York, 1999.

11. According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

12. Contribution of Course to meeting the requirements of Criterion 5:

Math	Basic Science	General	Engineering Topic
			✓

13. Course Outcomes

Map to Program Outcomes

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|---|-----|
| 1. Analyze linear systems and design of state-feedback controllers. | (a) |
| 2. Develop dynamical models for simple linear systems using state-space representation. | (a) |
| 3. Evaluate and interpret properties of linear systems such as stability, controllability, and observability. | (a) |
| 4. Design state-feedback controllers for single-input single-output linear systems. | (c) |
| 5. Implement the controllers using digital computers and validate its performance. | (b) |
| 6. Use modern engineering tools (MATLAB, LabVIEW, PSPICE...) for the design and implementation of a control system. | (k) |
| 7. Work as part of a team. | (d) |
| 8. Preparation of a written report about the final project. | (g) |

Person(s) who prepared this description and date of preparation: Gerson Beauchamp,
 Submitted by: Eduardo J. Juan Feb 2007