

PROPOSAL NUMBER: 99- 436

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### CURRICULUM PROPOSAL FORM

**\*DEADLINES:**

REGULAR COURSE PROPOSALS: OCTOBER 23, 1998 FOR FALL, 1999 AND FEBRUARY 19, 1999 FOR SPRING, 2000  
SHORT-TERM COURSE PROPOSALS: DECEMBER 11, 1998 FOR FALL, 1999 AND MARCH 26, 1998 FOR SPRING 2000

PROPOSAL TITLE: Systems and Controls II (0909.322)

SPONSOR/S: R. Ramachandran, J. Schmalzel  
DEPARTMENT: Electrical Engineering

0909.322

**CHECK ALL THAT APPLY:**

UNDERGRADUATE  GRADUATE

COLLEGE: \_\_\_\_\_

If LAS:  History/Humanities  
 Math/Sciences  
 Social/Behavioral Sciences

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**TYPE OF PROPOSAL (Check ALL that Apply)**

<input type="checkbox"/> General Education	<input checked="" type="checkbox"/> New Course (NOT Gen. Ed.)
<input type="checkbox"/> New Course in _____ Bank	<input type="checkbox"/> Name Change (Dept., School, Major)
<input type="checkbox"/> Existing course, Add To _____ Bank	<input type="checkbox"/> Changes in Degree Requirements
<input type="checkbox"/> Multicultural/Global Designation	<input type="checkbox"/> Changes Involve Gen. Ed. requirements
<input type="checkbox"/> Writing Intensive Designation	<input type="checkbox"/> Minor Changes to Existing Courses
<input type="checkbox"/> New Minor/Concentration/Specialization	<input type="checkbox"/> Course is NOT General Education
<input type="checkbox"/> New Major/Degree Program	<input type="checkbox"/> Course IS General Education
<input type="checkbox"/> Short Term Course Proposal	

**DEPARTMENT**

(SIGNATURE INDICATES APPROVAL)

Ravi Ravi Ramachandran 10/23/98

DEPT. CURRICULUM CHAIR / DATE

*[Signature]*

DEPT. CHAIRPERSON / DATE

**COLLEGE CURRICULUM COMMITTEE**

DATE OF OPEN HEARING (if necessary) \_\_\_\_\_

APPROVED

NOT APPROVED

Comments:

*[Signature]* 11/5/98

SIGNATURE DATE

**ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)**

APPROVED

NOT APPROVED

Comments:

*[Signature]* 10/23/98

SIGNATURE (Academic Dean) DATE

SIGNATURE (Graduate Dean) DATE

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary) College Level 2007

----- APPROVED  
----- NOT APPROVED

Comments:

Transmittal 11/1/98

SIGNATURE DATE

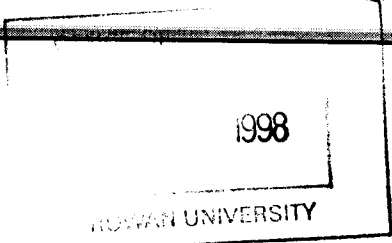
SENATE

Date announced at Senate 11/1/98

Voted upon at Senate: \_\_\_\_\_ Approved \_\_\_\_\_ Not Approved \_\_\_\_\_ Date: \_\_\_\_\_

EXECUTIVE VICE PRESIDENT/PROVOST

\_\_\_\_ APPROVED  
\_\_\_\_ NOT APPROVED If no, reasons are as follows:



STUDENT CREDIT HOURS \_\_\_\_\_ FACULTY LOAD HOURS \_\_\_\_\_ EQUALIZED CREDIT HOURS \_\_\_\_\_

OFFICIAL COPY & APPROVAL SHEET FILED (DATE): \_\_\_\_\_

DATE/SIGNATURE EXECUTIVE VICE PRESIDENT/PROVOST [Signature]

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED \_\_\_\_\_

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED 0909. 322

DATE/SIGNATURE OF REGISTRAR Robert A. Kubat 12/1/98

NOTIFICATION FORWARD:

- SENATE CURRICULUM COMMITTEE CHAIRPERSON
- DEPARTMENT CHAIRPERSONS
- ACADEMIC DEAN(S)
- REGISTRAR
- SPONSOR(S)

Transmittal 1/1/99

**1. Details:**

a) Course Title:	Systems and Control II (0909.322)
b) Sponsor:	Dr. Ravi P. Ramachandran, Dr. John L. Schmalzel and Electrical Engineering Curriculum Committee
c) Credit Hours:	3 credit hours
d) Course Level:	Junior 2
e) Curricular Effect:	Elective course for electrical engineering majors
f) Prerequisites:	Systems and Control I (0909 321)
g) Suggested Time/ Scale of Implementation	Spring 1999 One section
h) Resources	Faculty will be hired and laboratory equipment obtained consistent with Engineering School multi-year budget. Library acquisitions will be required.

**2. Rationale:**

The proposed course is a revision to part of the Engineering Curriculum Proposal approved by the College Senate in December, 1994. The proposed course is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February, 1995.

The concept of control system design can be applied to any real world system in which one seeks to get a desired output from the knowledge of internal variables. This course is a continuation of Systems and Control I with the focus being on multi-input, multi-output systems. Many of the concepts gained in Systems and Control I are extended to the multi-input, multi-output case. Students must gain a sound theoretical and practical knowledge of the building blocks of such systems by using mathematical background already obtained, simulation experiences and laboratory experiments.

**3. Essence of the Course:****a) Objectives:**

The proposed course has a number of objectives:

- (i) Provide an overview of multi-input, multi-output control systems by first introducing basic concepts like linearity, time-invariance, and state-space description.
- (ii) Provide an understanding of the matrix transfer function and its relationship to the fundamental concepts of the state-space description and stability.
- (iii) Introduce the fundamental concepts of controllability, observability, minimal realizations and controller and observer canonical form realizations.
- (iv) Provide an understanding of state feedback and how it can be used to obtain desired pole placement
- (v) Introduce optimal control and nonlinear systems.
- (vi) Expose different numerical techniques to solve control problems.

**b) Topical Outline:**

- Basic system concepts: linearity, time-invariance, and state-space description.
- State-space solution and concept of matrix transfer function: Numerical techniques to obtain transfer function.
- Controllability, observability and stability of multi-input, multi-output systems: Numerical methods to check stability; state feedback and pole placement.
- Transfer function description versus realization: Controller and observer canonical form, minimal realization.
- Introduction to optimal control: Parameter optimization techniques
- Introduction to nonlinear systems: Common physical nonlinearities, linearization, stability.

**c) Evaluation and Grading Procedures:**

Student grades will be based on projects, examinations, homework, laboratory reports and written and oral technical communication.

**d) Course Evaluation:**

The proposed course will be evaluated based on student evaluations and critical review by engineering faculty.

**e) Texts:**

T. Kailath, *Linear Systems*. Prentice-Hall: New Jersey, 1980.

W. L. Brogan, *Modern Control Theory*. Prentice-Hall: New Jersey, 1990.

W. J. Rugh, *Linear System Theory*. Prentice-Hall: New Jersey, 1995.

**4. Results of Consultations:**

**a) Consulted Departments:** None

**b) Consultants and Consultant Statements:** N/A

**c) Written Consultations:** N/A

**5. Additional Supporting Information:** N/A

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## **6. Catalog Description:**

Systems and Control II (0909.322): 3 credits

This course is a continuation of Systems and Control I with the focus on multi-input, multi-output systems. The fundamental concepts of linearity and time-invariance are introduced. The state-space description and the concept of a matrix transfer function are studied in depth especially with respect to stability. The concepts of controllability, observability, and realizations are covered. Numerical techniques are continuously emphasized. Optimal control and nonlinear systems are also discussed. Software simulation, primarily with MATLAB and laboratory experiments, will complement and supplement the theory.

Prerequisites of Systems and Control I (0909 321)