ROWAN UNIVERSITY CURRICULUM PROPOSAL

(12)

PROPOSAL TITLE: SYSTEMS AND CONTROL I

0909.321

CHECK APPROPRIATE: ✓ UNDERGRADUATE ___ GRADUATE 3 SEMESTER HOURS

SPONSOR(S): RAVI P RAMACHANDRAN
JOHN J SCHMALZEL

DEPARTMENT/TELEPHONE # ELECTRICAL ENGINEERING / x4643

CHECK ONE: ✓ COURSE ___ MINOR PROGRAM ___ CONCENTRATION ___ SPECIALIZATION
___ ACHIEVEMENT CERTIFICATE ___ CERTIFICATION PROGRAM ___ MAJOR PROGRAM

Step #1 (Department)

22OCT97 Approved (Date)

___ Not Approved (Date)

John Schaff
Dept. Curriculum Chr.

22OCT97
Reviewed (Date)

John Schaff
Dept. Chr.

Step #2 (Receipt)

SCC# 97-98-181

10-24-97
Date Received Senate

Senate Curriculum Chr.

Step #3 (School)

Reviewed Date: 22OCT97

✓ Recommend to Approved

___ Recommend NOT to Approve

Forward for Open Hearing:

✓ WITHOUT Reservations

___ WITH Reservations:

Comments:

Robert P. Hesketh
School Committee Chr.

Step #4 (Academic Dean): ✓ Recommended ___ NOT Recommended ___ Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date J. Stracey 10/28/97

Step #5 (Senate Curriculum Committee): Open Hearing Date: _____ Approved by Curriculum Committee Date_____

Returned to Sponsor(s) for the following reason:

Step # 6 (Senate) Date announced/voted on at Senate 12/16/97 If voted on: ___Approved ___NOT Approved

Date forwarded to Executive Vice President/Provost _____

Senate Curriculum Committee chair Signature/Date: Janette Reeves 12/16/97

Step #7 (Executive Vice President/Provost): Date Received JAN 2 1 1998

_x_ Approved

___ NOT Approved If no, reasons are as follows:

Student Credit Hours _____

Faculty Load Hours _____

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) 1/21/98

Executive Vice President/Provost Signature C J Mottoon

Registrar

Date Approved Course Description Received 28 Jan 98

Regis Taxonomy and Course Number Assigned 0909.321

Date/Signature of Registrar B Z Kelsey

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Course Proposal

1. Details:

a) Course Title:	Systems and Control I (0909.321)
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 1
e) Curricular Effect:	Required course for electrical engineering majors
f) Prerequisites:	Networks II and Mathematics for Engineering Analysis II
g) Suggested Time/ Scale of Implementation	Fall 1998 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 can be applied to many broad fields like engineering, medicine and economics. For example, the tracking of a human pulse or respiration rate in an operating room to see if any device is needed to keep the these rates under control is highly useful. Also, controlling the rate of supply to adjust equilibrium price and quantity to respond to fluctutations in demand is very imprtant for economic market analysis. Due to the widespread application of control theory, basic concepts of mathematical modeling and analysis of different types of systems is introduced in this course. Also, this course concentrates on single-input, single-output systems. Students must gain a sound theoretical and practical knowledge of the building blocks of control 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 single-input, single-ouput control systems by first introducing basic concepts like linearity, time-invariance, transfer function and stability.

(ii) Provide an understanding of the mathematical equivalence of different engineering systems like electrical, mechanical, fluidic and thermal by a common differential equation formulation achieved by a circuit equivalence.

(iii) Provide an understanding of feedback and how it can be used to obtain desired pole placement.

(iv) Provide an understanding of stability and frequency response analysis of control systems.

b) Topical Outline:

- Basic system concepts: linearity, time-invariance, stability, frequency response, causality, realizability and transfer function (poles and zeros).
- Mathematical modeling of physical systems: analogs between electrical, mechanical, fluidic and thermal systems and their circuit equivalence; differential equation description of such systems and their analysis; block diagram algebra; signal flow graphs.
- Feedback: open loop and closed loop systems; pole placement; compensator design; PID controllers.
- Stability Analysis: Routh-Hurwitz criterion; root locus method; Nyquist crietrion.
- Frequency response analysis: Bode plots; gain and phase margins.

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:

Z. Gajic and M. Lezic, *Modern Control System Engineering*. Prentice-Hall: New Jersey, 1995.

P. H. Lewis, *Basic Control Systems Engineering*. Prentice-Hall: New Jersey, 1997.

K. Ogata, *Modern Control Engineering*. Prentice-Hall: New Jersey, 1996.

B. C. Kuo, *Automatic Control Systems*. Prentice-Hall: New Jersey, 1994.

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

6. Catalog Description:

The first course in control systems introduces the fundamental concepts of linearity, time-invariance, stability and the transfer function. Mathematical and circuit equivalence of different systems (electrical, mechanical, fluidic and thermal) is established. A thorough treatment of stability through the Routh-Hurwitz, root locus and Nyquist criterion is given. Frequency response analysis by means of the Bode plot is also covered. Software simulation primarily with MATLAB and laboratory experiments will complement and supplement the theory.

Prerequisites of Networks II and Mathematics for Engineering Analysis II.