ROWAN UNIVERSITY CURRICULUM PROPOSAL

PROPOSAL TITLE: ENGINEERING ELECTROMAGNETICS I

CHECK APPROPRIATE: ✓ UNDERGRADUATE ___ GRADUATE ___ SEMESTER HOURS 2

SPONSOR(S): DR SHREEKANTH MANDAYAM & DR JOHN L SCHMALZEL

DEPARTMENT/TELEPHONE # ELECTRICAL ENGINEERING / 4412

CHECK ONE: ✓ COURSE __MINOR PROGRAM __CONCENTRATION __SPECIALIZATION

__ACHIEVEMENT CERTIFICATE __CERTIFICATION PROGRAM __MAJOR PROGRAM

Step #1 (Department)	Step #2 (Receipt)	Step #3 (School)
22 OCT 97 Approved (Date) ___ Not Approved (Date) [signature] Dept. Curriculum Chr. 22 OCT 97 Reviewed (Date) [signature] Dept. Chr.	SCC# 97-98-179 10-24-97 Date Received Senate ____ Senate Curriculum Chr.	Reviewed Date: 22 OCT 97 ✓ 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 [signature] 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 If voted on: ✓ Approved ___NOT Approved

Date forwarded to Executive Vice President/Provost 3/5/98

Senate Curriculum Committee chair Signature/Date: [signature] 3/4/98

#7 (Executive Vice President/Provost): Date Received ________

Approved

NOT Approved If no, reasons are as follows:

:ent Credit Hours ________

:ty Load Hours ________

:lized Credit Hours ________

:ial Copy & Approval Sheet Filed (Date) 3/9/98

:cutive Vice President/Provost Signature [signature]

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istrar

: Approved Course Description Received 3/12/98

:s Taxonomy and Course Number Assigned 0909-301

:/Signature of Registrar [signature]

:fication Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Course Proposal

1. Details:

a) Course Title:	Engineering Electromagnetics I (0909.301)
b) Sponsor:	Dr. Shreekanth Mandayam and Dr. John L. Schmalzel, Electrical Engineering
c) Credit Hours:	2 credit hours
d) Course Level:	Junior
e) Curricular Effect:	Required course for electrical engineering majors
f) Prerequisites:	Math for Engineering Analysis II, Physics II
g) Suggested Time/ Scale of Implementation	Fall1998 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 of the Engineering Curriculum Proposal approved by the College Senate in December, 1994, and is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February, 1995. The proposed course is a core requirement for the Electrical Engineering discipline, contributing to the Engineering Topics requirements as defined by the Accreditation Board for Engineering and Technology (ABET).

Engineering electromagnetics lays the foundations for the analysis and design of the entire spectrum of electronic devices from the largest turboalternators to the smallest microcircuits. Electronic systems that require a working knowledge of electromagnetics include consumer electronics(TVs, microwave ovens, computers), microelectronics and communication systems (antennas and transmission lines). The theory of electromagnetic fields is a more general case of circuit theory (Networks I and II) and is required in the design and analysis of systems that incorporate very high signal frequencies and wireless signal transmission. Students gain familiarity with the development and application of the Maxwell's Equations for designing and analyzing electrostatic, magnetostatic and quasistatic systems. Students also acquire competence with the use of mathematical models for these systems, which are comprised of elliptic and parabolic partial differential equations.

3. Essence of the Course:

a) Objectives:

The proposed course has a number of objectives:

(i) Provide an overview of electromagnetic field theory, commencing from the Maxwell's equations.

(ii) Provide a working knowledge of electrostatic, magnetostatic and quasistatic principles.

(iii) Provide a knowledge of the mathematical tools (elliptic and parabolic differential equations) for the analysis and design of electrostatic, magnetostatic and quasistatic devices.

(iv) Provide a working knowledge of the appropriate software for analyzing and designing electrostatic, magnetostatic and quasistatic devices .

(v) Demonstrate the applications of electrostatic, magnetostatics and quasistatics in a variety of electronic systems (typical systems are: laser printers, photocopiers, electromagnetic Nondestructive evaluation systems, biolelectromagnetic systems, etc.)

b) Topical Outline:

The general topical outline is described below; however, prior to each semester's offering, the instructor will assess any technology advances in the course subject matter or in teaching resources prior to the course and make changes deemed appropriate to maintain requisite content and currency.

Complex vector analysis
Complex algebra
Complex representation of time-harmonic scalars
Real vectors
Complex vectors
Time averages

Maxwell's Equations
Constitutive Relations
Maxwell's Equations for time-harmonic fields
Lorentz force law
Poynting's theorem

Electrostatic fields
Electrostatic potential

Gauss' Law
Engineering applications

Electric fields in material space
Material properties
Convection, conduction and polarization
Linear, isotropic and homogeneous dielectrics
Engineering applications

Solution techniques
Electrostatic boundary value problems
Poisson's and Laplace's equations
Numerical modeling techniques
Engineering applications

Magnetostatic fields
Magnetic flux density
Magnetic scalar and vector potentials
Magnetic force and torque
Magnetic materials
Magnetic circuits
Engineering applications

Quasistatic fields
Electro-quasistattic fields
Magneto-quasistatic fields
Engineering applications

c) Evaluation and Grading Procedures:

Student grades will be based on projects, examinations, homework, 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.

4. Results of Consultations:

a) Consulted Departments: None
b) Consultants and Consultant Statements: (N/A)
c) Written Consultations: (N/A)

5. Additional Supporting Information:

Example textbooks that could serve as primary or supplemental references for this course:

1. L. C. Shen and J. A. Kong, *Applied Electromagnetism*, 3rd Edition, PWS Publishing, Boston, MA, 1995.
2. M. N. O. Sadiku, *Elements of Electromagnetics*, 2nd Edition, Oxford University Press, New York, NY, 1995.
3. D. K. Cheng, *Field and Wave Electromagnetics*, 2nd Edition, Addison-Wesley, Reading, MA, 1992.

Example software that could be used in conjunction with the course:

1. *Matlab Partial Differential Equation Toolbox*, The MathWorks Inc., Natick, MA.
2. *PC-Opera, Opera-2D*, Vector Fields, Inc., Aurora, IL.

6. Catalog Description:

The first course in engineering electromagnetics covering applications of electrostatics, magnetostatics and quasistatics in contemporary electrical engineering practice. The course also covers numerical modeling of electromagnetic devices using appropriate software.

Prerequisite of Physics II and Mathematics for Engineering Analysis II required.