ROWAN UNIVERSITY CURRICULUM PROPOSAL

PROPOSAL TITLE: Finite Element Analysis

C 91 : 502

CHECK APPROPRIATE: ___ UNDERGRADUATE ✓ GRADUATE 3 SEMESTER HOURS

SPONSOR(S): Tirupathi R. Chandrupatla and Dept. of Mechanical Engineering Curriculum Committee

DEPARTMENT/TELEPHONE # 4632

CHECK ONE: ✓ COURSE ___ MINOR PROGRAM ___ CONCENTRATION ___ SPECIALIZATION

___ ACHIEVEMENT CERTIFICATE ___ CERTIFICATION PROGRAM ___ MAJOR PROGRAM

Step #1 (Department)

✓ Approved (Date) 10/21/97

___ Not Approved (Date)

Dept. Curriculum Chr.

10/21/97
Reviewed (Date)

TRChandrupatla
Dept. Chr.

Step #2 (Receipt)

SCC# 97-98-81

10-22-97
Date Received Senate

Senate Curriculum Chr.

Step #3 (School)

Reviewed Date:_____

✓ Recommend to Approved RAD

___ 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 10/23/97

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

Returned to Sponsor(s) for the following reason:

) # 6 (Senate) Date announced/voted on at Senate 12/4/97 If voted on: ___Approved ___NOT Approved

D warded to Executive Vice President/Provost _____

Senate Curriculum Committee chair Signature/Date: 12/11/97

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

\ Approved

___ NOT Approved If no, reasons are as follows:

Student Credit Hours _____

Faculty Load Hours _____

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) _____

Executive Vice President/Provost Signature _____

Registrar

Date Approved Course Description Received 28 jan 98

Hegis Taxonomy and Course Number Assigned 0401.501

Date/Signature of Registrar _____

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Course Proposal

1. Details:

a) Course Title:	Finite Element Analysis
b) Sponsor:	Dr. Tirupathi R. Chandrupatla and College of Engineering Curriculum Committee
c) Credit Hours:	3 credit hours
d) Course Level:	Graduate (0901. 502)
e) Curricular Effect:	Elective course for engineering graduate students
f) Prerequisites:	Engineering Analysis II or equivalent
g) Suggested Time/ Scale of Implementation	One section during spring semesters
h) Resources:	Faculty: Existing faculty can teach this course Library: No library acquisitions will be required Equipment: No laboratory equipment will be required Computers: Computer laboratory access will be required and additional software may be acquired.

2. Rationale:

The proposed course is an additional graduate engineering elective that would supplement 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 course introduces students to the concept of finite element analysis and its applications to various fields of engineering. Structural deformation and stress analysis are covered. The course deals with engineering problems in design and analysis.

3. Essence of the Course:

a) Objectives:

Upon completion of the course, the students will be able to

1. Formulate and model structural design problems and solve them using finite elements.

2. Formulate and solve field problems in the areas of potential flow, seepage flow, duct flow, heat transfer, and electrical and magnetic fields.

3. Create finite element meshes, determine nodal loads, and define the boundary conditions.

4. Apply basic computer software to solve stress and deformation analysis problems.

5. Develop stiffness matrices for various finite elements extending the capabilities of existing software.

b) Topical Outline:

The topics to be covered are listed below. The instructor will supply the students with a syllabus during the first week of classes. The instructor will assess any technology advances in the subject matter prior to the course and make topic changes deemed to be appropriate to maintain the level and currency of instruction.

Fundamental concepts
- Stresses and equilibrium
- Strain-displacement relations
- Stress-strain relations
- Temperature effects
- Potential energy and equilirium
- Galerkin's method

One dimensional problems
- Finite element modeling
- Coordinates and shape functions
- Element stiffness for bar element
- Global stiffness
- Treatment of boundary conditions

Trusses
- Plane trusses
- Space trusses

Two dimensional problems
- Finite element modeling
- Constant strain triangle (CST)
- Quadrilateral elements
- Orthotropic materials

Axisymmetric solids
- Triangular quadrilateral elements
- Quadrilateral elements
- Problem modeling

Beams and frames
- Beam element
- Two dimensional and three dimensional frames
- Elastic supports
- Problem modeling

Three dimensional problems
- Tetrahedral element
- Hexahedral element
- Frontal method

Scalar field problems
- Steady state heat transfer
- Torsion
- Potential flow, seepage flow, duct flow
- Electric and magnetic fields

Dynamics of structures
- Mass matrices for various elements
- Natural frequency analysis

c) Evaluation and Grading Procedure of Students:

Student grades will be determined on the basis of examinations, homework and/or projects, laboratory projects and reports. A course syllabus with stated method of arriving at the final grade, e.g., number of exams, projects homework, percentage of grade, will be distributed to the students during the first week of classes.

d) Course Evaluation:

The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:

The proposed course is an additional elective that would supplement the Engineering Curriculum Proposal approved by the Faculty Senate in December 1994. Consultations were submitted with original proposal as specified by the Curriculum Committee. The course ran under the special topics category in Fall 1997.

Catalog Description:

Finite Element Analysis (0901.502)
Prerequisites: Engineering Analysis II or equivalent, Solid Mechanics

Fundamental concepts for the development of finite element analysis are introduced. The element stiffness matrices are developed using shape functions defined on the elements. Aspects of global stiffness formation, consideration of boundary conditions, and nodal load calculations are presented. Mesh division and problem modeling considerations are discussed in detail. Topics of scalar field problems and natural frequency analysis are covered. Computer applications are included.