SENATE

PROPOSAL SCC #99/00- 115

CURRICULUM PROPOSAL FORM 1999-2000

OCT 27

RECEIVED

NON-GENERAL EDUCATION PROCESS A

DEADLINES: Deadline dates for 1999/2000 submissions: Regular proposals: October 22, 1999 to be implemented in Fall 2000; Short-Term proposals: December 10, 1999 to be implemented in Fall, 2000; Regular proposals February 18, 2000 to be implemented in Spring 2001; March 24, 2000 for short-term courses to be implemented in Spring 2001

PROPOSAL TITLE: Introduction to Analytic Dynamics (0901 453) 0901.453

SPONSOR(S): Dr. Jennifer Kadlowec

DEPARTMENT: Mechanical Engineering

COLLEGE: Engineering

IF LAS CHECK ONE: _____History/Humanities _____Math/Science ____Social/Behavioral Sciences

Check one: __X__Undergraduate _____Graduate

THE ATTACHED ***NON-GEN-ED*** PROPOSAL IS BEST DESCRIBED BY THE ITEM(S) CHECKED.

__X__New non-gen-ed course
_____Short-term non-gen-ed course
_____Minor curricular changes (fewer than three) to:
_____existing non-gen-ed course
_____non-gen-ed degree requirements
_____major
_____minor, specialization, concentration, track certificate program

DEPARTMENT
(Signature indicates approval)

Ravi Ruth Ravichandran 10/20/99
Dept. Curriculum Chair/Date

TRChandrupatla 10/22/99.
Dept. Chairperson/Date

ACADEMIC DEAN

Approved L Not Approved____ Comments:

Dean's Signature/Date

COLLEGE CURRICULUM COMMITTEE

Date of open hearing (if necessary) 2/8/00 Approved ✓ Not Approved____
Comments:

Signature of College Chair/Date: Ravi Ruth Ramachandran

UNIVERSITY CURRICULUM COMMITTEE

Date Received/Processed 2/28/00
Comments:

Curriculum Chair Signature: [signature] Date Announced At Senate 2-28-00

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): _____ Executive VP/Proved Signature/Date [signature] 3/2/00

REGISTRAR

Date Approved Course Description Required_____
Hegis Taxonomy & Course Number Assigned CHCL 453

Registrar Signature/Date Robert A. Kubat 3/21/00

NOTIFICATION FORWARD

_____Senate Curriculum Committee Chairperson _____Academic Dean(s)

_____Department Chairpersons _____Registrar _____Sponsor(s)

Course Proposal

1. Details:

a) Course Title:	Introduction to Analytic Dynamics (0901.453)
b) Sponsor:	Dr. Jennifer Kadlowec and College of Engineering Curriculum Committee
c) Credit Hours:	3 credit hours
d) Course Level:	Senior undergraduate
e) Curricular Effect:	Senior elective course for mechanical engineering students
f) Prerequisites:	Engineering Analysis II or equivalent, dynamics, vibrations
g) Suggested Time/ Scale of Implementation	Fall or spring semesters One section
h) Resources:	Faculty: Existing faculty is in place to 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 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.

This course is an important elective for students who want to focus on mechanical systems. Analytical dynamics introduces students to the concept of 3-D particle and rigid body dynamics and its applications in mechanical engineering. Analytical dynamics develops the foundation for the study of rigid body dynamic and vibration systems. This course requires students to be knowledgeable in physics, mathematics and mechanics and is an extension of undergraduate coursework in this area.

3. Essence of the Course:

a) Objectives:

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

1. Formulate and solve problems involving the kinematics and dynamics of particles in two and three dimensions.

2. Formulate and solve problems using general vectorial development for dynamics of single particles and systems of particles.

3. Use Lagrange's equations to formulate the equations of motion for particles

and rigid bodies.

4. Formulate and solve problems of three-dimensional rotational dynamics of one or more rigid bodies.

5. Apply computer software to solve differential equations of motion for three dimensional dynamics/vibrations problems.

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.

Kinematics of a particle
- Position, velocity and acceleration (linear and angular)
- Rigid body motion about a fixed point
- Motion in a moving/rotating coordinate system

Dynamics of a particle and system of particles
- Work and energy
- Conservative forces
- Linear impulse and momentum
- Angular impulse and momentum

Lagrange's equations
- Degrees of freedom
- Generalized coordinates
- Generalized forces
- Constraints
- Virtual work
- Lagrange multipliers

Kinematics and dynamics of rigid body motion
- Degrees of freedom
- Moments of inertia
- Matrix and dyadic notation
- Translation and rotation of axes
- Euler angles
- Equations of motion
- D'Alembert's principle

Vibration theory

One and two degree of freedom systems
Free and forced vibrations

c) Evaluation and Grading Procedure of Students:

Student grades will be determined on the basis of examinations, homework and/or projects, computer 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 with Dr. Guerra in the Chemistry/Physics department indicates that this course would complement Classical Mechanics in the sense that this course will focus heavily on 3-D rigid body dynamics rather than particle dynamics.

Catalog Description:

Introduction to Analytic Dynamics (0901.453)
Prerequisites: Engineering Analysis II or equivalent, Dynamics, Vibrations

Newton/Euler and Lagrangian formulations for three-dimensional motion of particles and rigid bodies. Modern analytical rigid body dynamics equation formulation and computational solution techniques applied to mechanical multibody systems. Kinematics of motion generalized coordinates and speeds, analytical and computational determination of inertia properties, generalized forces, Lagrange's equations, holonomic and nonholonomic constraints, constraint processing, computational simulation.

ROWAN UNIVERSITY

Department of Chemistry and Physics

TO: **Senate Curriculum Committee**
FROM: **Eddie Guerra**
DATE: **October 20, 1999**
SUBJECT: **Introduction to Analytic Dynamics**

As a follow-up to the discussion with Dr. Jennifer Kadlowec, I have been charged by my department to write this memo concerning the proposed course, **Introduction to Analytic Dynamics**. We **support** this new course, although it does have some topics in common with the course Analytical Mechanics (1902.315) offered by our department. The key differences in these courses (outlined below) make it a much more suitable course for engineering students. Both courses complement each other nicely, and any student in physics and engineering would benefit from taking both courses.

Both courses present a formal treatment of Newtonian mechanics and introduce Lagragian mechanics. However, these courses diverge after introducing Lagrangian mechanics. **Introduction to Analytic Dynamics** covers rigid body motion, systems of particles, and vibrations in much more depth than Analytical Mechanics. Also, there is a stronger focus on numerical methods and engineering applications than in a traditional physics course.

Introduction to Analytic Dynamics does not treat gravity or Hamiltonian mechanics, and does not cover central force motion in as much depth as Analytical Mechanics. These topics make up a large portion of Analytical Mechanics.

Both classes offer students an opportunity to solve problems using common mathematical tools. The diversity of applications is the reason for offering both courses.