GRADUATE SCHOOL PROPOSAL COVER SHEET

All curriculum proposals should be sent to the Graduate School office for review. Minor changes will be handled administratively. Substantive changes and new proposals require the action of both Graduate Council and Faculty Senate. When all signatures have been obtained, the Graduate School will notify the originator of the proposal to send an electronic version of the proposal to the Graduate School dean for placement on the Graduate Council agenda.

Note: All changes that affect course numbers or titles do not require action by the Graduate Council but must be submitted to the Dean of Graduate School for transmission. All other curricular proposals require the action of both Graduate Council and Faculty Senate. After the required signatures have been obtained, return the proposal to the Dean of Graduate School, who will notify the proposal originator to send an electronic version of the proposal to the Graduate School office.

From: Timothy W. Swafford Date: 6 June 2006

Title of Proposal: Addition of Two Courses to Computational Engineering Curriculum

Proposed Starting Date: Fall 2006 ~~Probably Fall 2007 These are new courses, really~~ Fall 2007

UTC REC

JUN 09 2

REGISTRA

REVIEWED BY:				
David Whitaker	06/06/06	✓		
Department Head	Date	approve	neutral	disapprove*
J. Ron Veale	6/06/06	✓		
Dean	Date	approve	neutral	disapprove*
Gyvonne Kilpatrick	6/14/06	✓		
Director, The Graduate School	Date	approve	neutral	disapprove*
Deborah Arthur	6.14.06	✓		
Dean, The Graduate School	Date	approve	neutral	disapprove*
Linda Dutton	9.23.06			
Registrar	Date	approve	neutral	disapprove*
Theresa Liddle	8/25/06			
Dean of Lupton Library	Date	approve	neutral	disapprove*
H Berkman	10/2/06	✓		
Provost	Date	approve	neutral	disapprove*
REVIEWED BY OTHER UNITS IMPACTED:				
Reviewer	Date	approve	neutral	disapprove*
Reviewer	Date	approve	neutral	disapprove*
Reviewer	Date	approve	neutral	disapprove*

* Those who disapprove must attach an explanation.

SUMMARY OF ACTION BY GRADUATE COUNCIL

_____ Approved as submitted

_____ Approved with amendments (amendments indicated and transmitted to originator to revise and submit electronical for Faculty Senate)

_____ Forwarded to Faculty Senate

_____ _____
Graduate Council Chair Date

SUMMARY OF ACTION BY FACULTY SENATE

_____ Approved as submitted and sent to originator and Registrar

_____ Approved with amendments (amendments indicated) and sent to originator and Registrar

_____ _____
President, Faculty Senate Date

Revised 11/05

Curriculum Proposal

Addition of Two (2) Courses to the Computational Engineering Curriculum
June 2006

Rationale for the Courses

Computational Engineering encompasses both development and application of software tools and systems, including physical, mathematical, and geometric modeling, solution algorithms, computer simulations, and visualization, analysis, interpretation, synthesis and use of computed results to solve practical problems. These courses address both theoretical and practical aspects relative to the topical areas of physical and geometric modeling within the Computational Engineering curriculum. The first course (ENCM 534 Viscous Flow Theory) provides students with a fundamental background in physical and theoretical aspects of viscous flow and provides an appropriate background for study of computational simulation of viscous flows. The second course (ENCM 716 Adaptive and Dynamic Grid Generation) is the second course in a two-course sequence and provides the student with exposure to the various methods used to dynamically change computational grids as the solution progresses. Both courses have been taught for two semesters as "Special Topics in Engineering" and are now considered an important part of a student's coursework in Computational Engineering, thus prompting the present proposal.

Impact on Computational Engineering

As already stated, these courses have been taught for two semesters as "Special Topics" courses and are now considered an integral part of the overall curriculum. The addition of these two courses adds considerably to the material students need as they graduate from the program and enter the workforce to function as practicing computational engineers.

Catalog Information

Viscous Flow Theory (ENCM 534) provides students with a fundamental background in physical and theoretical aspects of viscous flow and provides an appropriate background for study of computational simulation of viscous flows (ENCM 734 Viscous Flow Computation). Adaptive and Dynamic Grid Generation, ENCM 716, is the second course in a two-course sequence (the first being ENCM 516, Grid Generation) and exposes students to advanced methods used to dynamically change computational grids as the solution progresses.

Course Titles and Descriptions

(1) Viscous Flow Theory (3)

Description: Physical and theoretical aspects of viscous fluid flow, from a perspective that provides fundamental background for computational simulation of viscous flows; development of mass, momentum and energy conservation equations for a Newtonian fluid; introduction to Cartesian tensors; development of boundary-layer theory; introduction to inviscid flow analysis; classical analytical solutions and experimental

measurements for fluid flow problems; three-dimensional primary and secondary flows.

(2) Adaptive and Dynamic Grid Generation (3)
Description: Introduction to the concepts and methodologies of adaptive and dynamic meshing as applied to unstructured meshes; use of mesh movement and mesh refinement for adaptation; use of Linear-Elastic relations for dynamic meshing in conjunction with moving boundary problems (course will work exclusively with two-dimensional triangular meshes).

Syllabi
See attached sheets.

Syllabus for:
ENCM 534 - Viscous Flow Theory

Instructor: Dr. W. R. Briley
UT SimCenter at Chattanooga, 701 E. M.L. King Blvd
Telephone: 425-5407, Email: roger-briley@utc.edu

Description: This is an introductory graduate-level course covering physical and theoretical aspects of the flow of viscous fluids. The course is designed to convey a perspective on viscous flow theory that is heavily weighted in topics that provide fundamental background for computational simulations of viscous flows. PREREQ: APPROVAL of INSTRUCTOR

Credit Hours: 3

Outline:

- Physical concepts and behavior of viscous flows
- Lagrangian and Eulerian descriptions of fluid motion
- Fluid properties, kinematics, deformation, boundary conditions
- Derivation of Eulerian conservation equations for mass, momentum and energy
- Cartesian vector and tensor notation, Newtonian stress-strain relationship
- Problem formulation, dimensional similarity, nondimensional formulations
- Vorticity and related considerations
- Integral form of conservation laws
- Classical analytical solutions for steady and unsteady laminar flows
- Two-dimensional boundary layer theory and classical solutions
- Introduction to inviscid flow theory
- Relevance of inviscid and boundary layer theories to viscous flow computation
- Three-dimensional viscous flow behavior: primary and secondary flows

Prerequisites: Consent of Instructor

Text: White, F. M., Viscous Fluid Flow, ***3rd Edition***, McGraw-Hill, 2006
(ISBN # 0-07-240231-8), 640 pages

Course Administration:

Grading:

Midterm Exam	35%
Final Exam	35%
Homework	30%

ATTENTION: If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think that you might need special assistance or special accommodations in this class or in any other class, call the Office for Students with Disabilities at 425-4006 or come by the office – 110 Frist Hall.

Syllabus for:
ENCM 716 – Adaptive & Dynamic Grid Generation

Instructor: Dr. Steve L. Karman
UT SimCenter at Chattanooga, 701 E. M.L. King Blvd
Telephone: 425-5492, Email: Steve-Karman@utc.edu

Description: Advanced concepts and methodologies of adaptive and dynamic meshing applied to unstructured grids. The adaptive mesh generation will be carried out via mesh movement and mesh refinement. The dynamic meshing will be in conjunction with moving boundary problems and will be addressed using optimization and smoothing ensuing from solving elliptic partial differential equations. All work will be performed on two-dimensional triangular meshes. PRE-REQUISITE: ENCM 510 OR APPROVAL OF INSTRUCTOR. See note 9.27.06

Credit Hours: 3

Outline:

- Introduction
- Mesh Smoothing & Optimization
- Elliptic Mesh Movement
- Linear-Elasticity Mesh Movement
- Feature-based Adaptive Refinement
- Adjoint-based Adaptive Refinement

Prerequisites: Consent of Instructor

Text: None.

Course Administration:

Grading:	Computer-based projects	100%

ATTENTION: If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think that you might need special assistance or special accommodations in this class or in any other class, call the Office for Students with Disabilities at 425-4006 or come by the office – 110 Frist Hall.

9-27-2006

Responses follow, but first some context:

Since our graduate program is multidisciplinary, we are generally flexible in setting prerequisites and in distinguishing required and elective courses (we accept students from several different undergraduate majors).

1. Is ENCM 534 a prerequisite to ENCM 716.....if so then you need to revise the course description for ENCM 716 to include ENCM 534 as a pre-requisite. If that is the case...that should be part of this proposal.

These courses are essentially unrelated and are not a two-course sequence. ENCM 534 should not be listed as a prerequisite for ENCM 716.

2. Page 1 – Catalog Information lists ENCM 716 as the second course in a two-course sequence (the fist being ENCM 516, Grid Generation) and exposes.... If ENCM 716 is the second course in the sequence why isn't ENCM 516 listed as a pre-requisite to ENCM 716. Are you allowing students to take ENCM 716 without having ENCM 516?

Although we would not typically allow a student to take ENCM 716 without ENCM 516, we would allow it if the instructor approves. Such exceptions might occur, for example, when a student received a MS degree at another institution or has work-related experience in grid generation. Although we do list prerequisites in other two-course sequences (ENCM 510 prerequisite for ENCM 710; ENCM 521 for ENCM 723), in this case we would prefer Consent of Instructor. A second alternative would be to list "ENCM 516, or Consent of Instructor".

3. How do these courses fit into the curriculum.....are they required courses or electives.....either way shouldn't there be some revision attached to the curriculum to show that students are either required to take these courses or that they are options as electives? If your program has a selection of electives defined and these courses are part of that selection....a program revision will need to be included to revise the catalog. Ditto if the courses are required.

Our MS and PhD programs do not require any individual courses; each student's Graduate Committee defines the courses required in each individual Program of Study. Our MS in Engineering Concentration provides a guideline of 12-16 hours of ENCM courses, and 6-9 hours of approved electives, but no individual course is required. Our MS catalog listing gives specialty and elective courses as a descriptive example, but not as a specific requirement.

Our catalog listing for the MS concentration will need to be updated at the next opportunity, to reflect the addition of these new courses. We attempted to include these changes as part of the latest catalog but missed the deadline because the course proposal had not yet been approved.

4. And finally.....are these courses part of the curriculum in the Master's program and/or PhD? Can students in both programs take these courses? Or are the 500 level courses part of the master's and the 700 level part of the PhD?

All of our ENCM 500 and 700 level courses including these are open to both MS and PhD students. Our 500 numbered courses are developed at an introductory graduate level typical of a MS student, and our 700 numbered courses are developed at an advanced graduate level typical of a PhD student. Our MS Programs of Study are strongly weighted toward but not restricted to 500-level courses.