



The University of Georgia

Faculty of Engineering

MEMORANDUM

To: Fiona Liken
Office of Curriculum Systems
116-B Franklin House

From: E. Dale Threadgill *EDT*
Director, Faculty of Engineering

Date: September 14, 2007

RE: Proposal to add ENGG 2000 to the General Education Curriculum

The Faculty of Engineering requests that the University Curriculum Committee consider adding ENGG 2000, Solving Technical Problems Using Engineering Decision Making, to Area D of the General Education Curriculum. The course is designed to create broad hands-on learning experience related to reasoning and innovation as it relates to the development of technology and new products. Lectures and assignments focus on the use of the functional decomposition process as a means to integrate principles from the computational and the natural sciences, and on an understanding of how the constraints of environmental issues, societal issues and a global market place affect the development of technical solutions. To successfully complete this course, the student must demonstrate an understanding of how desires of the client (both human and non-human) affect the definition of a problem, must successfully employ creativity to generate unique conceptual solutions and must demonstrate an appreciation of how basic scientific principles affect the technologies that transform concepts to actual products. Overall, the learning objectives of ENGG 2000 match the objectives of the Core Curriculum Area D.III Quantitative Literacy.

**Council on General Education
Core Curriculum Course Proposal Form**

Note: Institutions submitting proposals for courses for the Core Curriculum should refer to the following information on the Board of Regents web site: Core Curriculum Principles and Framework, Areas A-E General Guidelines, and Common Course Prefixes, Numbers, and Descriptions all of which can be found at:
<http://www.usg.edu/admin/accaff/newcore/>

1. Institution: The University of Georgia- The Faculty of Engineering
2. This is a proposal for (check one):
√ (a) A new course, or

(b) A change in an existing course
If this is a change, please provide information on the current course, complete information on the new course, and a rationale for the change.
3. Requested to satisfy Core Area(s) Area D Quantitative Literacy (Quantitative Reasoning for the new General Education Curriculum Proposal)
4. Course Subject/Prefix General Engineering/ ENGG
5. Course Number 2000
6. Course Title Solving Technical Problems using Engineering Decision Making
7. Lecture Hours-Laboratory Hours-Credit Hours 2 hour lecture- 2 hours lab 3-credit hours
8. Course Prerequisites (if any) _____
9. Course Co-requisites (if any) _____
10. Explain how this course fits within the context of the institution's mission and general education program and advances the institution's general education learning outcomes. If this is a course proposal for Area B, explain how the course addresses the institution's philosophy, goals, and objectives for courses offered in Area B. Also note that courses specific to the major, skills-based courses and orientation courses are not appropriate for Area B of the Core.
The objective of the course is to create a broader learning experience related to reasoning and innovation as it relates to the development of technology and new products. The student's quantitative reasoning skills will be developed from the perspective of engineering and technology, in particular how quantitative reasoning is used in the development of innovative products. Students will utilize simple math tools to reason [to understand, interpret, critique, debunk, challenge, explicate, and draw conclusions] as it is related to the innovative development of new technologies. Lectures and assignments will focus on the use of the functional decomposition process as a means to integrate principles from the computational and the natural sciences, and on an understanding of how the constraints of environmental issues, societal issues and a global market place affect the development of technical solutions. Students will employ methods of simplistic engineering [mathematical and scientific] analysis. Course activities will focus on a systematic process used in engineering to develop logical solutions within the constraints of the environment, society and global-marketplace.

11. Attach a catalog description and a **syllabus** with detailed information regarding the content of the course (and laboratory, if applicable), required reading, grading requirements, and course objectives.
12. Has this course been reviewed and approved by the institution's curriculum committee and/or other appropriate campus committees that oversee the core curriculum?

No; course proposal still in the CAPA system awaiting UCC approval

13. Provide any additional information you want considered in support of the Council's consideration of the proposed course.

Oftentimes, engineering is assumed to be simply the use of mathematics to analyze the function or physical attributes of a device, product or process. However, mathematical analysis is only a small component of engineering activities. An engineer must be able to identify not only the functional requirements of a problem, but must also understand the problem's constraints particularly those from social, environmental and market aspects; must be able to understand the desires and needs of the client (both human and non-human) and how these affect the definition of a problem; must employ creativity to generate unique conceptual solutions; must understand the scientific principles that enable the concept to be transformed from solutions to reality; and must be able to evaluate critically the solution to determine if it will fulfill the needs of the client. Thus, many of the attributes found in an engineering education fulfill the definition of quantitative reasoning.

Almost all colleges of engineering offer a sophomore engineering course similar to the one presented here where the course is used to meet the ABET* accreditation goals related to quantitative reasoning. Engineering and pre-engineering programs found at other universities and colleges in the State of Georgia offer the sophomore course herein or a similar course.

In 2000, the University of Georgia completed its ten-year strategic plan for the 21st century, identifying comprehensive engineering as a priority initiative. In the fall of 2006, the University System of Georgia Board of Regents approved the expansion of undergraduate engineering education at the University by approving degrees in biochemical engineering, environmental engineering and computer systems engineering. Given the expansion of engineering education at the University and the fact that the course proposed herein can be found at other colleges and universities, ENGG 2000 would provide the University with a core curriculum course for quantitative reasoning, provide the general student body an opportunity to experience engineering and applied technologies subject matter, and provide a unique experience to enrolled students.

*The Accreditation Board of Engineering and Technology (ABET) requires that engineering BS degrees demonstrate critical thinking skills throughout the curriculum.

All work is to be done individually unless otherwise specified by the instructor(s). At the discretion of the instructors, late work will not be graded or may receive a reduced grade. As a rule of thumb, the grade will be, immediately, reduced one letter grade and will be reduced another letter grade for every 12 hours past the deadline.

If the assignment is a group/team project, it is the responsibility of each student in the group/team to make sure the assignment is submitted on time. Therefore, any reduction in grade due to missing a deadline will affect all student members of a group/team.

There is **no exception** for not meeting a deadline for assignments (malfunctions of computers, printers, photocopiers are common excuses given by students, but are not acceptable excuses). If you anticipate conflicts for meeting a deadline, you should arrange to turn in the work early. Unless announced otherwise, work will be due at the beginning of the class period.

All reports should be neat, logical and concise. The format of the reports will be provided in class. Unless otherwise specified in lecture, all reports must be typed, limited to one inch margins with 1.5 line spacing. A font size no smaller than Arial Narrow 12 point must be used.

Class Attendance:

Please read the UGA Bulletin statement on “Class Attendance” and “Withdrawal from Courses.” If the instructor determines that you have missed a significant number of class lectures, an administrative withdrawal will be issued. Significant number of class lectures is defined herein as

- missing the two class lectures before the end of the Drop/Add Period for this semester, or
- missing three or more class lectures without an official UGA excuse, or
- missing five or more class lectures. (Only two Official UGA excused absences will be allowed).

Attendance is EXPECTED and will be recorded. Materials presented or distributed **will not be repeated or redistributed** for the benefit of absentees.

Be on time and do not start to “pack up” to leave early. If either situation becomes a problem and can not be resolved, the instructor will remove the student from the class rolls using an administrative withdrawal.

Please do not read newspapers in class, study for another course or exhibit similar behavior (It would be better if you skipped the class period and give the other activity your full attention). **Turn off all cell phones and pagers upon entering class.** Do not answer or make calls on a cell phone during class time. Disruption will result in the student being asked to leave the class lecture and at the discretion of the instructor, may result in the issuing an administrative withdrawal.

Term Project

A term project will be assigned during the semester. Teams of students will work together on the assigned project. Each team member’s performance on project presentations and written reports will be assessed based on overall performance of the team (that is, each team member will be assigned the same grade for project presentations and project written reports). An engineering notebook (will be discussed in lecture) must be used to record all work associated with the project. Individual team member performance will be assessed using the engineering notebook (that is, the performance of an individual will be assessed using the grade assigned to that individual’s engineering notebook). The notebook must show the individual student’s contribution to a project. Individual contribution is considered to be independent work that has been shown through proper documentation.

A letter of transmittal is to accompany all reports associated with the project and is to be signed by each team member. The lack of a signature will be interpreted as

- A team member does not approve of the report and will be providing a separate report, or
- A team member did not contribute to the report, is not being given credit by fellow team members and will be providing a separate report. (if the team deciding that an individual not

allowed to sign a report and this decision is less than 3 days prior to a deadline, the instructor will meet with team members and determine if an extension should be granted to the individual)

Details of these reports will be given later during lecture. The first two reports will be assessed and graded by the instructors and then returned to the team. The team can resubmit these two reports within three days for re-assessment and re-grading.

Team Member Assessments

A team member assessment form is attached to this syllabus. Each student is required to complete this assessment form and turn it in to the instructor. These assessment forms should be used to indicate the performance of your team mates. The instructor will use this form to determine if problems exist within a particular team and the instructors fully expect each student enrolled in ENGR 2920 to utilize this assessment form to indicate difficulties that exist within a team. Lack of participation may result in an instructor initiated course withdrawal. This assessment form is the primary method to identify students who are not contributing to the term project.

GRADE DETERMINATION

This course will consist of homework and in-class assignments, pop-quizzes, and a term project. Students will be graded on their professional attitude, knowledge of design methodology, written and oral communication skills.

The grades are based on the following scale.

- 1) A shows maximum effort and high level of design skills for a sophomore
- 2) B shows very high level of effort and above average skills for a sophomore
- 3) C shows a good effort and average for a sophomore
- 4) D shows below average effort and below average skills for a sophomore
- 5) F unacceptable work

Grading

The following is the grade distribution for the course:

20 pts – Average of grades of laboratory assignments	20 pts – Average of report excluding report for the term project
20 pts- Average of homework and short term quizzes	20 pts- Term project report
	20 pts – Average of engineering notebook grades

- Laboratory assignments will be used to demonstrate lecture material and allow students to accomplish task under instructor supervision.
- Homework will be assigned to supplement lecture material. While this course is structured such that hours exams are not useful in assessing student performance, short quizzes may be used to insure students are making progress in the course and to help the instructor to assess problem areas.
- Reports will be used demonstrate student's mastery of the material
- The term project will require the student to integrate all lecture material and to demonstrate an understanding of the engineering problem solving process
- The notebooks will be used as a record of the students critical thinking skills and use of quantitative reasoning for developing logical solutions. It will also be used as a demonstration of the student's ability to integrate social, environmental, etc. constraints into the development of those solutions.

Withdrawal Policy: the student must demonstrate (provide evidence) of significant effort toward meeting the course requirements before a grade of W will be issued, otherwise a grade of WF will be issued.

- Any grading dispute should be put in writing with an appointment, with both instructors, scheduled to discuss the dispute.
- It is your responsibility to keep all graded material as proof of completed work. Only after final grades are assigned can you do with that material as you please.

Course Learning Objectives

Upon successful completion of this course the student will:

- be able to conduct the functional decomposition process of product development
- learn how to find the functional requirements of a problem
- learn the interactions of functional requirements as related to the computational and the natural sciences and to technology
- develop an understanding how constraints of environmental issues, societal issues and a global market place affect the development of a technical solutions and the functional aspects of a solution
- employ critical thinking skills to formulate conceptual solutions and to transform those concepts to reality
- learn how to employ methods of simplistic engineering [mathematical and scientific] analysis
- reinforce the value of integrating the communication skills from the arts, humanities, science and engineering.

Lecture Outline

- Approaches/steps to problem solving
 - Types of problems
 - Identifying a problem
 - Defining a problem
 - Constraints
 - a Social
 - b Environmental
 - c Scientific principles
 - Functional Requirements
- Formulating a solution
 - Use of computational methods and scientific principles to transform an idea to reality
- Functional Decomposition (FD)
 - Role of FD to product development
 - Defining a problem using the FD process
 - The role of computational science, the natural sciences and technology to transform an idea to reality
- Logical steps of developing a conceptual solution
 - Transforming ideas to realities and how this transformation is affected by constraints
 - Generation of conceptual solutions
 - Logical evaluation of concepts
 - Feasibility analysis
 - Technology readiness analysis
 - Decision matrix
 - Use of the axiomatic design technique to modify conceptual solutions for

robustness

- Conceptual solution to Detailed Solution
 - Application of computational sciences and scientific principles
 - The iterative nature of generating a final solution
- Field testing of a solution
 - How to determine technical problems
 - What are prototypes and simulation
 - How to use prototypes and simulations
 - Does a simulation have to be complex to be useful
 - Overview of simple equation simulations

Laboratory Assignments

1. Design a chair for a dormitory
Objective: Demonstrate how different people interpret the stated problem differently
2. Design a container to hold liquid to re-hydrate the human body
Objective: Demonstrate to collect data in order to better define the problem
3. Reverse Functional decomposition of a soda can
Objective: Demonstrate how to determine functions
Objective: Demonstrate the 12 functions of a soda can
Objective: Demonstrate how these functions can be accomplished by different can designs.
4. Conduct a functional decomposition of the problem “how to stand up”
Objective: Perform a functional decomposition of a simple task.
Objective: Demonstrate how the same set of functions can be used to design a robot
5. Use axiomatic design techniques to generate conceptual solutions to the following problem
“Develop a system to re-hydrate a person during liftoff of a space craft”
Objective: Demonstrate how a functional decomposition can be used to make a complex problem into a simple problem and how to develop conceptual solutions in a logical manner.
6. Initiate the term project: Design a bamboo bridge that spans over a 10 foot hole and can be used by hikers.
Objective: To generate a true problem statement, identify potential constraints and to develop a plan of action for completion of the project
7. Conduct a functional decomposition of the term project
Objective: To identify functional requirements and to identify needed data
8. Experimentation of properties of bamboo
Objective: to collect data needed as constraints and functional requirements
9. Repeat of labs 7 and 8 as needed
10. Generation of potential conceptual solutions for term project
Objective: to employ techniques taught in lecture
11. Employ simple mathematical techniques (taught in lecture) to size bridge components
Objective: to demonstrate the application to computational methods and scientific principles to develop a useful product
12. Repeat Lab 9 and 10 as needed
13. Construction of bamboo bridge
Objective: demonstrate the usefulness of accomplishments of previous labs

14. Demonstration of term project

Objective: the field testing of the solution.

Objective: determine where computational methods and scientific principles worked and failed

Objective: to critically evaluate if the problem was properly defined and constraints found