# 2012-2013 SHORT SIGNATURE SHEET

**Date:** January 16, 2013  

**Subject:** SEEM Curriculum Revision  

**Originating Department:** Systems Engineering & Engineering Management Program  

**TYPE OF PROPOSAL:** UNDERGRADUATE **X** GRADUATE UNDERGRADUATE & GRADUATE  

(Separate proposals sent to UCCC and Grad. Council)

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<th>DATE RECEIVED</th>
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<th>COMMENTS: APPROVED, APPROVED WITH REVISIONS, ETC.</th>
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| 11/27/2012    |                |                                                 | PERSON ORIGINATING PROPOSAL  
Dr. Churizu Lim |
| 1/16/2013     |                | **Approved**                                    | DEPARTMENT CHAIR  
Dr. Ertunga C. Ozelkan |
| **23-Jan 2013** |                | **Approved**                                    | COLLEGE CURRICULUM COMMITTEE CHAIR  
Dr. Wesley Williams |
| **1/23/13**   |                | **Approved**                                    | COLLEGE DEAN  
Dr. Robert Johnson |
|               |                |                                                 | GENERAL EDUCATION  
(if applicable; for General Education courses only)  
[print name here:] |
|               |                |                                                 | UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR  
(for undergraduate courses only)  
Dr. Rick Lejk |
|               |                |                                                 | GRADUATE COUNCIL CHAIR  
(for graduate courses only) |
|               |                |                                                 | FACULTY GOVERNANCE ASSISTANT  
(received and processed in Academic Affairs) |

Revised 08/19/12  
OAA/iz
*To: Undergraduate Course and Curriculum Committee Chair

From: Dr. Ertunga C. Ozelkan

Date: January 16, 2013

Re: SEEM Curriculum Revision

The Short Form is used for minor curriculum changes. Minor changes may include:
- Changes to course numbering (note: must follow Course Numbering Policy)
- Editorial changes to current catalog copy
- Individual new courses (undergraduate only)
- Other small changes that have limited to no impact on other departments or units

Submission of this Short Form indicates review and assessment of the proposed curriculum changes at the department and collegiate level either separately or as part of ongoing assessment efforts.

*Proposals for undergraduate courses should be sent to the Undergraduate Course and Curriculum Committee Chair. Proposals related to both undergraduate and graduate courses, (e.g., courses co-listed at both levels) must be sent to both the Undergraduate Course and Curriculum Committee and the Graduate Council.
SUMMARY:

1. Compliance with ABET Requirements

Systems Engineering & Engineering Management (SEEM) proposes to add a mathematics course, MATH 2171 (Differential Equations), to the list of required courses in order to fulfill ABET Accreditation requirements for science and mathematics.

SEEM proposes to add a 3-credit hour science elective course (BIOL 1xxx, BIOL 2xxx, CHEM 120x, PHYS 1xxx) to the list of required courses in order to fulfill ABET Accreditation requirements for science and mathematics.

SEEM proposes to remove ENGL 2116 (Introduction to Technical Communication) from the list of required courses in order to accommodate ABET Accreditation requirements for science and mathematics. Note that Systems Engineering (SEGR) students’ need to complete a 3 credit hour SEGR 3111 Project Management, which is an “W” and “O” course in addition to the other “W” and “O” designated Senior Design Courses (SEGR 3290, SEGR 3291).

SEEM proposes to remove OPER 3100 (Operations Management) from the list of required courses in order to accommodate ABET Accreditation requirements for science and mathematics.

2. Establishment of Two Concentrations: Energy Systems and Engineering Management

SEEM proposes to replace two 9 credit hour tracks (Systems Engineering and Engineering Management) of the BSSE curriculum with two 12 credit hour concentrations (Engineering Management and Energy Systems). Accordingly, SEEM proposes the following changes in the curriculum in addition to the aforementioned changes.

1) Remove SEGR 4101 (Network Modeling & Analysis) from the list of required courses in the BSSE Plan of Study.

2) Add a new 3-credit hour Engineering Management concentration course
   a. SEGR 4150 Leadership Skills for Engineers

3) Make SEGR 2111, SEGR 3112, and SEGR 4150 required courses for the Engineering Management concentration, and list OPER 3100, OPER 3201 and OPER 3208 as elective courses.

4) Add four new 3-credit hour Energy Systems concentration courses.
   a. SEGR 4961: Introduction to Energy Systems
   b. SEGR 4962: Energy Markets
   c. SEGR 4963: Energy Systems Planning
   d. SEGR 4964: Case Studies in the Energy Industry

5) Require students pursuing BSSE without concentration to complete any 12-credit hour combination of the Energy Systems and the Engineering Management concentration courses.
3. Course Subject Code Change

SEEM proposes to change the subject code of ENGR 3670 (Total Quality Systems) to SEGR 3670 (Total Quality Systems) since the majority of students is from systems engineering.

4. Senior Design Course Availability in both Fall and Spring

SEEM proposes to make SEGR 3290 (Systems Design Project I) and SEGR 3291 (Systems Design Project II) available in both Fall and Spring semesters which will decrease the time to degree completion of the students. This change will require in the catalog deleting of the semester designation for these courses.

5. Adding/Changing of Co/Pre-requisites

SEEM proposes to remove the co-requisite, SEGR 3111 (Project Management), for SEGR 3290 (Systems Design Project I) to accommodate Senior Design Projects beginning in Spring semesters.

SEEM proposes to change the prerequisite for SEGR 2105 (Computational Methods for Systems Engineering I) as “Sophomore Standing with a grade of C or above in ENGR 1202, MATH 1241 and MATH 1242” (which currently does not have any prerequisites).

SEEM proposes to change the prerequisite for ENGR3670 (SEGR 3670 - Total Quality Systems) as “STAT 3128 Prob. & Stat. for Engr. with a grade of C or above” as a pre-requisite since the course talks about statistical process control and experimental design (which currently says Junior or Senior status and permission of instructor).

SEEM proposes to change the prerequisite for SEGR 3101 (System Design and Deployment) as “SEGR 2101 System Design Concepts with a grade C or above” (which currently says SEGR 2105 with a grade of C or above or permission of the department) since SEGR 3101 builds on the concepts introduced in SEGR 2101.

SEEM proposes to change the prerequisite for SEGR 3107 (Decision and Risk Analysis) as “STAT 3128 Prob. & Stat. for Engr. with a grade of C or above” (which currently says SEGR 2105 with a grade of C or above or permission of the department) since SEGR 3107 utilizes probability and statistics concepts extensively in decision and risk models.

6. Further Changes in Plan of Study

SEEM proposes to rearrange the sequence of required courses in the BSSE Plan of Study in order to accommodate aforementioned changes and improve student learning outcomes as follows:

1) Add the science elective course to the first semester of the freshman year.
2) Move CHEM 1251, 1251L from the first semester of the freshman year to the second semester of the sophomore year.

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3) Move MATH 2164 from the second semester of the sophomore year to the first semester of the sophomore year.
4) Add MATH 2171 to the second semester of the junior year.
5) Move OPRS 3113 from the second semester of the junior year to the second semester of the senior year.
6) Move a technical elective course (formerly SEGR 4101, see above) from the second semester of the senior year to the first semester of the senior year.
7) Move SEGR 3107 from the first semester of the senior year to the first semester of the junior year.
8) Move SEGR 3111 from the first semester of the senior year to the second semester of the junior year.
9) Move ENGR 3670 (SEGR 3670) from the second semester of the junior year to the first semester of the senior year.
10) Replace track courses with concentration courses as described above
11) Switch the order of the concentration course (old track course) in Sophomore semester II with technical elective in senior semester II.

FOR CONSULTATION WITH OTHER DEPARTMENTS:
1. Does the proposed change affect other departments (including additions and/or changes to degree requirements or prerequisites offered in other departments)?
   X Yes   No

2. If Yes, please list the other departments affected by the proposed change:
   Biology
   Business Information Systems & Operations Management
   Chemistry
   English
   Mathematics & Statistics
   Physics

3. Have you consulted with each department listed in item 2 regarding the proposed change?
   X Yes   No

Result(s) of Consultation(s) (please attach documentation):

See Appendix: Consultation

For a new course or for major modification of an existing course, include Consultation on Library Holdings.
RESOURCES:
1. For a new course or revisions to an existing course, check all the statements that apply:
   - X This course will be cross listed with another course.
   - X There are prerequisites for this course.
   - X There are co-requisites for this course.
   - ___ This course is repeatable for credit.
   - ___ This course will affect the number of credits hours for its program.
   - ___ This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.
   - ___ This proposal will alter an agreement with a North Carolina community college.

For all items checked above, applicable statements and content must be reflected in the proposed catalog copy.

2. Indicate the additional resources required, if any, to implement and maintain the proposed change.

Energy concentration will require hiring several adjunct professors from the industry. Energy Production and Infrastructure Center (EPIC) has agreed to fund the related adjunct faculty. EPIC and SEEM Program have already identified several potential adjunct faculty, who are industry subject matter experts. These experts have been providing significant input for the development of the energy concentration related courses.

CREDIT HOUR: Review statement and check if applicable
   - X The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a credit hour.

PROPOSED CATALOG COPY:

SEGR 2105. Computational Methods for Systems Engineering I. (3) Prerequisite: Sophomore Standing with a grade of C or better in ENGR 1202, MATH 1241 and MATH 1242. Introduces programming languages and computational tools that are often used by Systems Engineers. Programming in C and Matlab will be emphasized. Spreadsheet-based modeling will be introduced. (Spring)

SEGR 3101. System Design and Deployment. (3) Prerequisite: SEGR 21052101 with a grade of C or above or permission of the department. Focuses on the basics of systems design, analysis, and implementation. It covers system design elements, system interface issues, system decomposition, and system integration. The emphasis is on the effective design and integration of system operations and successful deployment of systems design results. (Fall)

SEGR 3107. Decision and Risk Analysis. (3) Prerequisite: SEGR 24105 STAT 3128 with a grade of C or above or permission of the department. This course aims to provide some useful tools for
analyzing difficult decisions and making the right choice. After introducing components and challenges of decision making, the course will proceed with the discussion of structuring decisions using decision trees and influence diagrams. Decisions under conflicting objectives and multiple criteria will be covered as well as sensitivity and risk analysis. *(Fall)*

SEGR 3111. Project Management. *(3) (O, W)* Prerequisite: STAT 3128 with a grade of C or above. Focuses on the study of various aspects of project management techniques and issues, and the use of conceptual, analytical, and systems approaches in managing engineering projects and activities. It includes the development and writing of project plans and reports for engineering and business operations. *(Fall)*

SEGR 3290. Systems Design Project I. *(1) (O, W)* Prerequisite: SE Senior standing; corequisite: SEGR 341H. First of a two-semester sequence leading to a major integrative system design experience in applying the principles of systems design and analysis and project management to the design of a system. Teamwork and communication skills are emphasized. It focuses on the development of the project plan and proposal for the capstone systems design project. Each student develops a complete systems design project plan and proposal and makes an oral presentation of the proposal to the faculty. It runs in conjunction with the project management course. *(Fall)*

SEGR 3291. Systems Design Project II. *(3) (O, W)* Prerequisite: SEGR 3290 with a grade of C or above. A continuation of SEGR 3290 for the execution of the proposed systems design project. This course includes a mid-term written progress report with an oral presentation and a final written report plus the final oral presentation to demonstrate project results. *(Spring)*

ENGRSEGR 3670. Total Quality Systems. *(3) Prerequisite: STAT 3128 with a grade of C or above Junior or Senior status and permission of instructor.* An interdisciplinary approach to principles and practice in the applications of continuous quality improvement (CQI) and Total Quality Management (TQM). Classroom work on major applications, reengineering processes; process mapping, personal effectiveness and time management; technical presentations; CQI tools, statistical process control, designed experimentation; management and planning tools, engineering economy, and case studies; assignments and projects in team building, communication, and group problem solving.

SEGR 4150: Leadership Skills for Engineers *(3)* Prerequisite: Junior standing. Overview of the skills needed to practice the most popular leadership styles in industry today. The first half of the course covers an introduction to the different styles of leadership and how they are applied by engineers within an organization. The second half of the course covers the critical leadership skills and competencies needed to build and lead powerful teams in a global environment.

SEGR 4961: Introduction to Energy Systems *(3)* Prerequisite: Junior standing, Basic math, economics, or consent of instructor. Overview of energy systems: energy types, generation, conversion, storage, transportation/transmission, and utilization. Principles, physical structure, processes, and utilization of fossil fuel, nuclear, and renewables for transportation, thermal, and electrical energy generation are discussed along with associated performance metrics. The course

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also provides an introduction to environmental impacts of energy production, life-cycle analysis, energy efficiency concepts and metrics, transmission systems, grid reliability, and the impact of smart grid technologies. All topics are presented in the context of industry standards as well as federal and state regulations.

**SEGR 4962: Energy Markets (3)** Pre/Co-requisite: SEGR 4961 Introduction to Energy Systems, Prerequisite: Junior standing, Basic math, economics, or consent of instructor. Energy and power systems in regulated and competitive environments and implications on business decisions for firms in these industries. Topics include: mechanism of energy markets; comparative market systems; determination of prices under different market structures; gas, oil, coal, and electricity market architecture; electricity market design; dispatch and new build decisions; smart grid and renewable energy in electricity markets; risk and risk management in energy including demand and price volatility and use of financial derivatives; and the impact of financial market trends and current and proposed policies on the energy industry.

**SEGR 4963: Energy Systems Planning (3)** Pre/Co-requisite: Junior standing, SEGR 4961 Introduction to Energy Systems, Prerequisite: Basic math, economics, or consent of instructor. Optimal planning of resources, logistics, distribution and storage in the end to end energy value chain from upstream natural gas production through mid-stream transportation & storage to downstream power generation, utility distribution and consumption. Smart Grid Optimization. Supplier and customer relationship management, contracts management. Lean-Six Sigma energy system process design. Power systems reliability and control, preventive maintenance, predictive maintenance, process and service quality control.

**SEGR 4964: Case Studies in the Energy Industry (3)** Pre/Co-requisite: SEGR 4961 Introduction to Energy Systems, Prerequisite: Junior standing, Basic math, economics, or consent of instructor. This course will introduce students to interpret and analyze real world business cases in the energy sector. Cases will explore the concepts behind natural monopolies, utility ownership, regulation & de-regulation, utility rates and service standards. Additionally, economic concepts such as supply & demand, market pricing, producer surplus, monopolistic pricing and ratemaking (regulatory goals, revenue requirements and the rate base and rate cases) will be applied. Some of the cases will explore decision-making strategies surrounding marginal prices, congestion management, congestion revenue, electric and gas transmission rights both in terms of physical versus financial markets, locational marginal prices (LMP), financial transmission rights in terms of revenue adequacy and auction revenue rights and typical energy trading hedging practices.
### Academic Plan of Study:

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**STUDENT LEARNING OUTCOMES:** If applicable, please indicate what SLOs are supported by this course or whether this curricular change requires a change in SLOs or assessment for the degree program.

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<thead>
<tr>
<th>No.</th>
<th>Proposed Course</th>
<th>Learning Outcome</th>
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<tbody>
<tr>
<td>1</td>
<td>SEGR 4150 Leadership Skills for Engineers</td>
<td>Outcome (f) An understanding of professional and ethical responsibility</td>
</tr>
<tr>
<td>2</td>
<td>SEGR 4961 Introduction to Energy Systems</td>
<td>Outcome (j) A knowledge of contemporary issues</td>
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<tr>
<td>3</td>
<td>SEGR 4962 Energy Markets</td>
<td>Outcome (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
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<td>SEGR 4963 Energy Systems Planning</td>
<td>Outcome (e) An ability to identify, formulate, and solve engineering problems</td>
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<td>5</td>
<td>SEGR 4964 Case Studies in the Energy Industry</td>
<td>Outcome (g) An ability to communicate effectively</td>
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**TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

SEGR 4964: Case Studies in the Energy Industry course is planning to leverage case studies which are available in electronic format.

**IMPORTANT NOTE:** A Microsoft Word version of the final course and curriculum proposal should be sent to facultygov@unc.edu upon approval by the Undergraduate Course and Curriculum Committee and/or Graduate Council chair.
Appendix: Syllabi for New Courses

THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
The William States Lee College of Engineering
Systems Engineering and Engineering Management

SEGR 4150: Leadership Skills For Engineers

Course Description:
Overview of the skills needed to practice the most popular leadership styles in industry today. The first half of the course covers an introduction to the different styles of leadership and how they are applied by Engineers within an organization. The second half of the course covers the critical leadership skills and competencies needed to build and lead powerful teams in a global environment.

Instructor: Dr. Jonathan Mayhorn
Phone: (704) 687-1957  FAX: (704) 687-3616  E-mail: jpmayhorn@uncc.edu
Office: CARC 218  Office Hours: TBA

Prerequisite: Junior Standing.

Required Textbook
None

Supplementary Materials: Lecture notes will be provided through the course web-site on Moodle.

Learning Objectives:
After completion of this course you will be able to:

1. Recognize the four major leadership styles used in industry today
2. Find the leadership style that works for you
3. Prepare for the future of the workforce
4. Build and lead powerful teams even in a global environment
5. Learn how to communicate effectively using influence
6. Continually develop your leadership style and improve your skills
7. Have the ability to use leadership coaching to improve yourself and others

Course Topics
- Transactional Leadership
- Transformational Leadership
- Situational Leadership
- Strategic Leadership
- Critical Leadership Competencies in the Global Environment
- Building and Leading Powerful Teams
- Using Coaching for Improved Work Performance
Course Policies, Requirements and Assessment:

Tests- Two exams will be given. No make-up exams are given so make every effort to attend the exams.

Project- Students will work in teams of three people to complete one project over the course of the semester. Students can choose one applied topic relating to Global Leadership within Systems Engineering and write a proposal, final report, and slides to be presented in front of the class during the final exam time (TBD). Some possible topics include but are not limited to: “Strategic Leadership in the Global Environment”, “Utilizing Transformational Leadership in the Workplace”, and “Leading Global Teams”, “Becoming a Successful Engineering Leader”. Final deliverables will include:
1) Electronic copy of the proposal & final report
2) Electronic copy of the slides the team will present
3) Actual presentation of the slides to the class

Assignments- Students will be required to complete assignments throughout the semester relating to the course topics. Assignments are to be completed and returned on the assigned day and time in order to be graded for credit. Late homework assignments will not be graded. Students should only work on assignments independently. The only exceptions to working on assignments independently will be when the instructor specifies that it is a group assignment or project.

Attendance (10% of your Grade)
0 to 1 absences =10%
2 absences = 8%
3 absences=6%
4 absences=4%
5 absences=2%
6 or more absences=0%

Class Attendance & Participation- To further the learning process on the topics covered, students are expected to participate in discussions both in the classroom and through Moodle. Students are also expected to attend all classes and log in to Moodle to take part in any further discussion topics posted by the instructor. It is each student’s responsibility to approach the instructor to make up for any missed classes. If you have legitimate documentation then the absence will not count towards your total number of missed days (examples include: a doctor’s note, funeral, or job interview).

Overall Grading Policy
Exam #1 20%
Exam #2 20%
Assignments 15%
Team Project 35%
Attendance & Participation 10%
Total= 100%

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THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
The William States Lee College of Engineering
Systems Engineering and Engineering Management

SEGR 4961: Introduction to Energy Systems

Course Description:
Overview of energy systems: energy types, generation, conversion, storage, transportation/transmission, and utilization. Principles, physical structure, processes, and utilization of fossil fuel, nuclear, and renewables for transportation, thermal, and electrical energy generation are discussed along with associated performance metrics. The course also provides an introduction to environmental impacts of energy production, life-cycle analysis, energy efficiency concepts and metrics, transmission systems, grid reliability, and the impact of smart grid technologies. All topics are presented in the context of industry standards as well as federal and state regulations.

Instructor: Prof. Badrul H Chowdhury
Phone: (704) 687-1960   FAX: (704) 687-5588   E-mail: b.chowdhury@uncc.edu
Office: EPIC 1162  Office Hours: TBA
Prerequisite: Basic math, economics, or consent of the instructor.

Required Textbook

Reference Textbooks

Supplementary Materials: Lecture notes will be provided through the course web-site on Moodle.

Learning Objectives:
After completing the course, the students will be able to
1. Have a working knowledge of the various forms of energy usage and their impact
2. Understand energy systems design from an engineering perspective
3. Understand life cycle economics of energy systems
4. Understand how systems design is changing the way we generate, convert, deliver and use energy.
5. Understand how policies can impact the use of energy.
## Course Contents & Tentative Schedule

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Energy Systems; conventional/fossil-based energy sources</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Alternative energy sources (nuclear, fuel cell technologies, advanced engines, dish/Stirling engines): design and economics</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Renewable energy sources (solar photovoltaics, solar thermal, CSP, wind, biomass, geothermal, ocean, tide, etc.): design and economics</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Historical development of energy resources</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Power vs. energy; units of energy; performance metrics</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Basic energy economics (supply/demand considerations, time value of money, cash flow analysis, cost estimation, project evaluation, life cycle analysis)</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Energy storage</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Economics of energy production, transportation, storage and utilization</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Energy management; sustainability</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Energy utilization (electricity, transportation, heating/cooling, etc.)</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Cyberphysical systems; Smart Grid/microgrid and impact on energy utilization</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Energy efficiency in homes, businesses, buildings and industry</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Environmental impact of energy production, transportation, and utilization; climate change; solutions for decarbonization</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>Federal and State policies regulations and standards in energy production and distribution</td>
<td>2</td>
</tr>
</tbody>
</table>

## Course Policies, Requirements and Assessment:

1. **Exams**: There will be two exams during the semester. There will be no final exam. In lieu of the exam, you will have to turn in a term paper and present your findings in front of the class. Exams will be closed book unless otherwise announced. You may bring a calculator to tests.

2. **Absences**: Studies have shown that a student’s performance in class deteriorates with multiple absences. Absence is therefore discouraged.

3. **Excused absence**: A medical certificate will be required to make up a test because of absence from a test due to illness. For absences from tests or quizzes because of plant trips, you will need to provide some documentation or proof, 24 hours in advance, that you will be going on a plant trip. Usually a travel itinerary from the company or a copy of the ticket is sufficient.

4. **Homework**: is due on the second class period after the assigned date unless otherwise announced. For some assignments, students will be working in groups, but Individual Assignments should be completed independently. Students who plagiarize from other sources or hand in assignments identical to or copied from others (except for assignments submitted as a group) will be violating scholastic honesty regulations and will not receive credit.

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will be subject to university's procedures and policies! You must submit all work in class before class begins on the date the homework is due. If you wish to submit your work early, you may certainly do so in person.

5. I will try my best to return all graded homework/quizzes/tests in a timely manner. The Final Exam will not be returned. You are, however, allowed to see your exam after grading is completed.

6. If you wish to discuss the grade received on homework/tests, you will have 4 weeks from the date of the homework submission or the date of the test to do so. After that, no change will be made on the grade. You will have a full semester after the date of the final exam to ask to see the final. However, the review must be done in person.

7. You are encouraged to visit with me during office hours. If you have a conflict with my posted hours, please call for an appointment. Email exchanges are always encouraged.

**Grading Policy:**

- Exam I: 20%
- Exam II: 20%
- Term Project and Presentation: 25%
- Homework: 20%
- Attendance and Participation: 15%

**The Code of Academic Integrity:**

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THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
The William States Lee College of Engineering
Systems Engineering and Engineering Management

SEGR 4962: Energy Markets

Course Description:
Energy and power systems in regulated and competitive environments and implications on business decisions for firms in these industries. Topics include: mechanism of energy markets; comparative market systems; determination of prices under different market structures; gas, oil, coal, and electricity market architecture; electricity market design; dispatch and new build decisions; smart grid and renewable energy in electricity markets; risk and risk management in energy including demand and price volatility and use of financial derivatives; and the impact of financial market trends and current and proposed policies on the energy industry.

Instructor: Prof. Badrul H Chowdhury + Adjunct faculty members
Phone: (704) 687-1960    Fax: (704) 687-5588    E-mail: b.chowdhury@uncc.edu
Office: EPIC 1162    Office Hours: TBA

Prerequisite: Basic math and economics or consent of instructor. Recommended: SEGR 4961/EMGT 5961 Introduction to Energy Systems.
Corequisite: If students have not completed SEGR 4961/EMGT 5961 Introduction to Energy Systems, they should enroll in that course concurrently with this one.

Required Textbook: None

Reference Textbooks:

Supplementary Materials: Lecture notes will be provided through the course web-site on Moodle.
Learning Objectives:
After completing the course, the students will be able to
6. Have a working knowledge of the mechanisms of energy markets
7. Understand supply and demand dynamics
8. Understand marginal cost
9. Understand electricity market economics and the constitution of locational marginal price
10. Understand the impact of transmission congestion on pricing
11. Understand risk management policies.

Course Contents & Tentative Schedule:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to energy and the economy, wealth, and human prosperity</td>
<td>1</td>
</tr>
<tr>
<td>Energy value chains; energy costing – cost decomposition, time value of money, cost estimation, levelized cost</td>
<td>2</td>
</tr>
<tr>
<td>Review of microeconomics – marginal costs, cost curves, supply/demand</td>
<td>1</td>
</tr>
<tr>
<td>Fuel markets (coal, gas, oil, refined products, uranium, etc.) – costs, structure (with introduction to types of markets - spot, forwards, futures), pricing mechanisms, policy, supply/demand outlook</td>
<td>2</td>
</tr>
<tr>
<td>Power generation costs – fossil, nuclear, and renewable technologies, transmission and distribution</td>
<td>3</td>
</tr>
<tr>
<td>Generation stack, marginal price of electricity, dispatching</td>
<td>2</td>
</tr>
<tr>
<td>Comparative power market designs – regulated, deregulated, open, managed</td>
<td>3</td>
</tr>
<tr>
<td>Market architecture: day-ahead, hour ahead, and real-time markets; ancillary services markets</td>
<td>2</td>
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<tr>
<td>Transmission congestion; transmission rights</td>
<td>2</td>
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<tr>
<td>Distribution system markets</td>
<td>2</td>
</tr>
<tr>
<td>Risk in the electric power industry – types of risk (project, market, commodity, etc.) and mechanisms to manage risk, including financial derivatives</td>
<td>2</td>
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<tr>
<td>Investing in energy - project evaluation, customer and investor perspectives</td>
<td>2</td>
</tr>
<tr>
<td>Regulated utility economics: rate cases, allowed return, impact on decision-making</td>
<td>2</td>
</tr>
<tr>
<td>Externalities, emissions regulations, emissions markets, and impact on generation choices</td>
<td>2</td>
</tr>
</tbody>
</table>

Course Policies, Requirements and Assessment:
8. Exams: There will be two exams during the semester. There will be no final exam. In lieu of the exam, you will have to turn in a term paper and present your findings in front of the class. Exams will be closed book unless otherwise announced. You may bring a calculator to tests.
9. Absences: Studies have shown that a student’s performance in class deteriorates with multiple absences. Absence is therefore discouraged.
10. Excused absence: A medical certificate will be required to make up a test because of absence from a test due to illness. For absences from tests or quizzes because of plant trips, you will
need to provide some documentation or proof, 24 hours in advance, that you will be going on a plant trip. Usually a travel itinerary from the company or a copy of the ticket is sufficient.

11. **Homework** is due on the second class period after the assigned date unless otherwise announced. For some assignments, students will be working in groups, but Individual Assignments should be completed independently. Students who plagiarize from other sources or hand in assignments identical to or copied from others (except for assignments submitted as a group) will be violating scholastic honesty regulations and will not receive credit and will be subject to university’s procedures and policies! You must submit all work in class before class begins on the date the homework is due. If you wish to submit your work early, you may certainly do so in person.

12. I will try my best to return all graded homework/quizzes/tests in a timely manner. The Final Exam will not be returned. You are, however, allowed to see your exam after grading is completed.

13. If you wish to discuss the grade received on homework/tests, you will have 4 weeks from the date of the homework submission or the date of the test to do so. After that, no change will be made on the grade. You will have a full semester after the date of the final exam to ask to see the final. However, the review must be done in person.

14. You are encouraged to visit with me during office hours. If you have a conflict with my posted hours, please call for an appointment. Email exchanges are always encouraged.

**Grading Policy:**

- Exam I: 20%
- Exam II: 20%
- Term Project and Presentation: 25%
- Homework: 20%
- Attendance and Participation: 15%

**The Code of Academic Integrity:**

See UNCC Code of Student Academic Integrity at [http://www.legal.uncc.edu/policies/ps-105.html](http://www.legal.uncc.edu/policies/ps-105.html)
Course Description:

Optimal planning of resources, logistics, distribution and storage in the end to end energy value chain from upstream natural gas production through mid-stream transportation & storage to downstream power generation, utility distribution and consumption. Smart Grid Optimization. Supplier and customer relationship management, contracts management. Lean-Six Sigma energy system process design. Power systems reliability and control, preventive maintenance, predictive maintenance, process and service quality control.

Co-Instructors: Srijib Mukherjee, Ph.D., P.E. and Fred D’Ambrosio, P.E.

Phone (Srijib): (919) 538-5348 E-mail: smukherjee@quanta-technology.com
Phone (Fred): (832) 279-4278 E-mail: fdambrosio@hess.com

Office: TBD, Office Hours: TBD

Prerequisite: Basic math and economics or consent of instructor.
Recommended: SEGR 4961 Introduction to Energy Systems and SEGR 4962: Energy System Economics
Corequisite: If students have not completed SEGR 4961 Introduction to Energy Systems, they should enroll in that course concurrently with this one.

Textbook: TBD

Format:
- Research Assignments: Literature review of an energy topic – selected topics to support an area of interest, 5 one page written papers.
- Tests: Mid-Term & Final (take-home, individual effort)
- Term Project: “Value Creation Project” based on existing global and US domestic energy opportunities

Learning Objectives:

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

1. Understand the natural gas – electric power value chain, its components and how value is created maintained and protected through the chain.
2. Articulate on the primary sources of natural gas, how is it produced, transported and stored through pipelines, and its consumption in power generation or as a direct energy source.

3. Articulate on the primary sources of fuel for electric generation, how is it produced, transported through transmission and distribution facilities.

4. Understanding the basics of retail gas and electric through smart grid optimization

5. Deal with Energy market dynamics – physical versus financial and how to utilize both to maximize efficiency reliability while managing risk

6. Understand the regulatory requirements imposed on both a state and federal level and the impact of de-regulation across the value chain.

7. Understand the basics of risk with respect to Energy markets

8. Identify “lean” manufacturing processes applicable to energy production

9. Understand “alternate”/”renewable” energy sources and their applications

<table>
<thead>
<tr>
<th>Course Contents &amp; Tentative Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Level Discussion Areas</strong></td>
</tr>
<tr>
<td>Introduction</td>
</tr>
<tr>
<td><strong>Design</strong> (long term-strategic, time scale: quarters - years)</td>
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<tr>
<td>Outsourcing</td>
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<tr>
<td>Design for Green</td>
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<tr>
<td>Customer Segmentation</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Exam 1</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning (near term - tactical, time scale: wks to months)</td>
<td>10</td>
</tr>
<tr>
<td>ERP-Enterprise Resource Planning</td>
<td>How technology is integrated back to billing and purchasing also known as “Enterprise Service Oriented Architecture”</td>
</tr>
<tr>
<td>Demand Planning</td>
<td>11 Energy Consumption – retail energy markets, consumer supply and demand patterns, market pricing and efficiency, home area networks (Forecasting)</td>
</tr>
<tr>
<td>Supply Planning</td>
<td>12 Natural Gas – capacity, production &amp; storage, distribution &amp; logistics Electric – generation resource planning, production planning, storage systems planning (such as battery, fly wheels, etc.) &amp; logistics (production, capacity, resources, storage/inventory, distribution/transportation)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Execution: short term-operational, time scale: hrs - days</th>
<th>Continuous Improvement</th>
<th>Systems reliability and control</th>
<th>Preventive and predictive maintenance planning. Maintenance in Fossil, Nuclear, and thermal generations. Bill of materials management for service parts (Additional gearboxes, spare circuit breakers, etc.)</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day to day operations</td>
<td>Operator decision based on economic dispatch. Physical and Financial commodity markets as they apply to the utility industry. Daily capacity reservation mechanism for electric and gas (e.g. scheduling of production, transportation, maintenance, etc.)</td>
<td>14</td>
<td></td>
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<tr>
<td>Exam 2</td>
<td>16</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Project Presentations</td>
<td>17-18</td>
<td></td>
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</tr>
</tbody>
</table>

Course Requirements and Assessment:

1. **Tests**: There will be two exams.

2. **Assignments**: Students will be required to do 5 assignments. Assignments must be returned on the specified due dates. Late homeworks are not allowed. For some assignments students will be working in groups, but Individual Assignments should be completed independently. Students who are plagiarizing from other sources or handing in assignments identical or copied from others (except for assignments submitted as a group) will be violating scholastic honesty regulations and will not receive credit and will be subject to university’s procedures and policies!

3. **Term Project**: The students will work in teams (2-3 people) on an applied or theoretical project topic related to energy value chain planning. Each team will write a proposal and a final report and present their work during the last week of the class. Specific interests of students related to their job or research work will also be taken into account. Each team needs to follow...
the due dates for the project milestones and provide their respective project deliverables as indicated in the course schedule above. The final deliverables are 1) soft copy of the final report, 2) soft copy of the final presentation, 3) presentation in the class (an online synchronous session will be scheduled for this-details will follow).

4. Class Attendance & Participation - Online Discussions: For participation the students are expected to reply to questions/discussion questions every week 1) post replies to 3 of the posted lecture discussion questions every week, 2) write a follow-up (constructive) comment for at least one of the other classmates’ postings every week, and 3) follow-up with the questions and responses every week. These postings (except for follow-ups) should be substantial in content having at least 100 words each. Due date for the participation is within a week’s time from the posting date of the lecture discussion questions. Follow-up comment should be within 10 days time from the posting date of the lecture discussion questions. Late postings will not receive participation points.

4. Due dates for deliverables: The dates above should be followed for deliverables unless they are changed by the instructors during the run of the course. Any change will be announced or indicated as the assignment is posted.

5. Team Evaluations: It is expected that each team member contributes to the group assignments and the term project. A team evaluation will be conducted for all group assignments and for the term project to ensure a balanced effort among the team members. In this evaluation each team member will evaluate themselves as well as the rest of the team members. The evaluations will be taken into account to identify the final grade for each team member at the end of the semester.

6. Team Formation for group assignments: For the group assignments and the project, we will form teams. If you have any preference please do let me know asap. I am going to facilitate the team formations taking into account your preferences. For this course, the recommended number of students in each team is 2-3.

7. Graduate credit: Graduate and undergraduate sections will be taught jointly, but obtaining graduate credit will require additional assignments on the homework, project, and exams.

Grading Policy:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam-I</td>
<td>15%</td>
</tr>
<tr>
<td>Exam-II</td>
<td>15%</td>
</tr>
<tr>
<td>Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Term Project</td>
<td>20%</td>
</tr>
<tr>
<td>Class Attendance &amp; Participation</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The Code of Academic Integrity:
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THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
The William States Lee College of Engineering
Systems Engineering and Engineering Management

SEGR 4964: Case Studies in the Energy Industry

Course Description:
This course will introduce students to interpret and analyze real world business cases in the energy sector. Cases will explore the concepts behind natural monopolies, utility ownership, regulation & de-regulation, utility rates and service standards. Additionally, economic concepts such as supply & demand, market pricing, producer surplus, monopolistic pricing and ratemaking (regulatory goals, revenue requirements and the rate base and rate cases) will be applied. Some of the cases will explore decision-making strategies surrounding marginal prices, congestion management, congestion revenue, electric and gas transmission rights both in terms of physical versus financial markets, locational marginal prices (LMP), financial transmission rights in terms of revenue adequacy and auction revenue rights and typical energy trading hedging practices.

Co-Instructors: Srijib Mukherjee, Ph.D., P.E. and Fred D'Ambrosio, P.E.
Phone (Srijib): (919) 538-5348 E-mail: smukherjee@quanta-technology.com
Phone (Fred): (832) 279-4278 E-mail: fdambrosio@hess.com
Office: TBD, Office Hours: TBD

Prerequisite: Basic math and economics or consent of instructor.
Recommended: SEGR 4961 Introduction to Energy Systems.
Corequisite: If students have not completed SEGR 4961 Introduction to Energy Systems, they should enroll in that course concurrently with this one.

Textbook: None/Case studies and lecture notes will be supplied

Format: The class will use a variety of different formats, including online lectures through streaming video, in-class case discussions and solutions, in-class exercises and participation, assignments, projects and a final exam. To effectively master the material in this course, the student must “roll up your sleeves” and work in assigned groups.

Learning Objectives:

Upon completion of the course the student should be capable of:

1. Have an overview of the types of primary energy supply Utilities (electric and natural gas)
2. How Utilities operate in free markets and natural monopolies including privately owned, government owned and member owned.
3. Have an overview of both electric and gas industry regulation including both state and federal regulation.
4. Have a business understanding of the history and structure behind electric and gas de-regulation in the United States
5. Have an understanding of service standards including obligation to serve, continuity of service, quality of service, safety, cost efficiency, customer service and nondiscriminatory practices
6. Have an understanding of utility rate making through time of use rates, interruptible and curtailable rates.
7. Case studies that incorporate natural gas and electric market concepts which include the difference between physical and financial commodity markets and how they relate to one another, congestion management and locational marginal prices (LMP), and logistical optimization supporting utility purchasing practices

Course Contents:

**Electric Industry – Cases and Exercises:**
- Computation of locational marginal prices
- Energy wheeling in a discriminant market
- Wind and Energy – a case study of Texas
- Enron: The smallest guys in the room – case study
- Linear sensitivity exercises
- Congestion management exercises

**Gas Industry – Cases and Exercises:**
- Logistical optimization, transportation capacity storage utilization
- Price hedging to minimize market volatility
- Enron – an “Insider’s” view

**Grading Policy:**
- Individual Assignments/Exercises – 20%
- Team engagement and participation (to be evaluated by team mates) – 5%
- Class Participation via discussion board – 5%
- Group Cases – 50%
- Final Exam – 20%

**Case Studies and Assignments:**
The material for this course cannot be effectively mastered only by reading or listening in class. These are necessary, but not sufficient, activities. In order to master the case studies and assignments, team member contributions should reflect exceptional preparation. Arguments to the cases should be well substantiated and persuasively presented. The cases and the individual assignments are due in:
- Hard Copy
- In Class
- At the beginning of the class in which the case is discussed.
- Each team member should keep a copy of the case write-up for use during class discussion

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**Team Engagement and Class Participation:** Team members will evaluate each other for fair contribution to group assignments. There will be a variety of opportunities to contribute to the class discussion specifically via a set up discussion board. Active participation in lectures via asking value added good questions, as well as contributions to the bulletin board will be credited.

**Team Formation for group assignments:** For the group assignments and the project, we will form teams. If you have any preference please do let me know asap. I am going to facilitate the team formations taking into account your preferences. For this course, the recommended number of students in each team is 2-3.

**The Code of Academic Integrity:**
See UNCC Code of Student Academic Integrity at [http://www.legal.uncc.edu/policies/ps-105.html](http://www.legal.uncc.edu/policies/ps-105.html)
Appendix: Consultations

From: Moyer, Patrick
Sent: Monday, January 14, 2013 12:00 PM
To: Ozelkan, Ertunga; Boreman, Glenn
Subject: RE: BSSE Curriculum Revision-Consultation

Dear Ertunga,

Yes, we can handle this change in load with no problems. Thank you for the consultation. Please let me know if you need any more information from us. I assume you are referring to the algebra-based introductory physics sequence 1101/1102, or our 120X courses (Sports and Physics, Physics of Music, Physics In Medicine). Either is good with us.

Thank you and kind regards,

Pat

Patrick J. Moyer
Professor
Department of Physics and Optical Science
The University of North Carolina at Charlotte
Charlotte, NC 28223
plmoyer@uncc.edu
704-687-8148 phone
704-687-8197 fax

From: Ozelkan, Ertunga
Sent: Sunday, January 13, 2013 6:40 PM
To: Boreman, Glenn
Subject: BSSE Curriculum Revision-Consultation

Dear Dr. Boreman,

Hope you had a great start to the new year and the new semester! We are writing a curriculum revision proposal for the BS in Systems Engineering (BSEE) program.

As part of the proposal, we are proposing to add a 3-credit hour science elective course (BIOL 1xxx, BIOL 2xxx, CHEM 120x, PHYS 1xxx) to the list of required courses in order to fulfill ABET Accreditation requirements for science and mathematics.

I would like to bring this to your and related faculty's attention as part of the consultation process. Please let us know if the proposed change is OK for the Physics department and if there is any further feedback, suggestions or questions.

Thanks and Best Regards,
Ertunga Ozelkan

Revised 08/10/12
OAA/lz
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From: Saydam, Gem
Sent: Monday, January 14, 2013 11:49 AM
To: Ozelkan, Ertunga
Cc: Kerr, Daryl
Subject: RE: BSSE Curriculum Revision-Consultation

Ertunga,

These changes are just fine. Copying Daryl Kerr, Assoc. Dean for UG Programs.

Good luck with the accreditation process.

Cem

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Cem Saydam, Ph.D. | Chair | Professor of Operations Management
UNC Charlotte | Dept. of BIS and Operations Management
9201 Univ City Blvd. | Charlotte | NC 28223
Phone: 704-687-7616 | Fax: 704-687-6330
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From: Ozelkan, Ertunga
Sent: Sunday, January 13, 2013 7:33 PM
To: Saydam, Gem
Subject: BSSE Curriculum Revision-Consultation

Hi Cem,

Hope you had a great start to the new year and the new semester!
We are writing a curriculum revision proposal for the BS in Systems Engineering (BSEE) program.

As part of the proposal, we are proposing to remove OPER 3100 (Operations Management) from the list of required courses in order to accommodate ABET Accreditation requirements for science and mathematics. Instead we will list OPER 3100 as an elective course under the Engineering Management Concentration along with OPER 3201 and OPER 3208.

I wanted to bring this to your and related faculty's attention.
Please let me know if there are any questions.

Thanks and Best Regards,

Ertunga

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Dr. Ertunga C. Ozelkan, Ph.D. | Director & Associate Professor,
Systems Engineering and Engineering Management
Center for Lean Logistics and Engineered Systems | Associate Director

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OAA/Iz
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Dear Ertunga,

I have consulted our department and the CLAS dean’s office on this matter. At the projected 20-25 people per year, we shall be able to accommodate your need. However, beyond that, we may encounter difficulties. I am attaching a screen shot of our math2171 sections offered this semester. As you see we have been forced to increase the class sizes of some sections to levels that will hurt the quality of the course due to the recent (somewhat surprising) surge of enrollments in math2171. Dr. Bill Hill (associate dean of CLAS) has agreed to increase our part time budget so that we can add one more section in math2171 in the coming semesters. This is where we stand. Thank you!

Yuanan

From: Ozelkan, Ertunga
Sent: Monday, January 14, 2013 9:10 AM
To: Diao, Yuanan
Cc: Kazemi, Mohammad
Subject: RE: BSSE Curriculum Revision-Consultation

Thanks for the quick response.
Estimated enrollment will be 20-25 people per year for the next year or two.
In the future this number may increase as our enrollment increase.

Regards,

Ertunga

Dr. Ertunga C. Ozekan, Ph.D. | Director & Associate Professor,
Systems Engineering and Engineering Management
Center for Lean Logistics and Engineered Systems | Associate Director
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From: Diao, Yuanan  
Sent: Sunday, January 13, 2013 11:47 PM  
To: Ozelkan, Ertunga  
Cc: Kazemi, Mohammad  
Subject: Re: BSSE Curriculum Revision-Consultation  

Dear Prof. Ozelkan,

What is the expected enrollment of the students in this major and what would be the estimated number of students taking math2171 as the result of this proposal? I think we can accommodate without having to add new resources if the number is moderate. Thanks.

Yuanan

Yuanan Diao, Ph.D. | Professor and Chair  
UNC Charlotte | Dept. of Mathematics and Statistics  
9201 University City Blvd. | Charlotte, NC 28223  
Phone: 704-687-4560 | Fax: 704-687-6416  
ydiao@uncc.edu | http://www.math.uncc.edu

On Jan 13, 2013, at 6:22 PM, Ozelkan, Ertunga wrote:

Dear Dr. Diao,

Hope you had a great start to the new year and the new semester!  
We are writing a BS in Systems Engineering (BSSE) curriculum revision proposal.

As part of the proposal we are proposing to add a mathematics course, MATH 2171 (Differential Equations), to the list of required courses in order to fulfill ABET Accreditation requirements for science and mathematics.

I would like to bring this to your and related faculty's attention as part of the consultation process. Please let us know if the Math department can accommodate the proposed change and if there is any further feedback, suggestions or questions.

Thanks and Best Regards,

Ertunga Ozelkan

Dr. Ertunga C. Ozelkan, Ph.D. | Director & Associate Professor,  
Systems Engineering and Engineering Management  
Center for Lean Logistics and Engineered Systems | Associate Director
Consultation on Library Holdings

To: Dr. Erzulka Ozelkan

From: Alison Bradley

Date: 1/16/13

Subject: BSSE Curriculum proposal

Summary of Librarian’s Evaluation of Holdings:

Evaluator: Alison Bradley

Date: 1/16/13

Check One:

1. Holdings are superior
2. Holdings are adequate
3. Holdings are adequate only if Dept. purchases additional items.
4. Holdings are inadequate

Comments:

Library holdings should be adequate to support student research for this proposed curriculum change. Since most of the proposed changes are simply related to the order that existing courses are taken, research demand will not be affected. The new concentration in Energy Systems will be supported through the substantial purchasing commitment for EPIC and also funding for collections supporting the Belk College of Business. Students will have access to relevant databases including Compendex, Inspec, IEEE Xplore, Business Source Complete, and many others. If new areas of research require additional purchasing support, faculty from the SEEM program should contact the librarian directly, as they do not have a faculty representative.

Alison Bradley

Evaluator’s Signature

1/16/13

Date