ME 4365 Global Sustainability Experience in Design and Manufacturing at Ghana
(3.0 cr; ME 2105, ME 3130, BSIE or BSME candidates)

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Course Number and Title: ME 4365: Global Sustainability in Design and Manufacturing
Course Web Page: http://www.d.umn.edu/~eenemuoh/Teaching/ME4365/
Course Semester: Summer 2011

Course Time and Location: 2.5 hours per day

ABET BSME and BSIE Program Outcomes: The BSME and BSIE programs will produce graduates who are able to:

a. An ability to apply knowledge of mathematics, science and engineering appropriate to an industrial engineer
b. An ability to design and conduct experiments, analyze and interpret data, and report findings
c. An ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment, and energy
d. An ability to function on multi-disciplinary teams
e. An ability to identify, formulate and solve industrial engineering problems
f. An understanding of the professional and ethical responsibilities of an industrial engineer
g. An ability to communicate effectively, including oral, written and visual forms
h. The broad education necessary to understand the impact of industrial engineering solutions in a global and societal context
i. A recognition of the need for, and the ability to engage in life-long learning
j. A knowledge of contemporary industrial engineering issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice
l. A working knowledge of manufacturing processes and systems

ABET program outcomes addressed by this course:
- An ability to apply knowledge of mathematics, science and engineering appropriate to an mechanical engineer (a)
- An ability to identify, formulate and solve mechanical engineering problems (e)
- An ability to communicate effectively, including oral, written and visual forms (g)
- An ability to use the techniques, skills, and modern engineering tools necessary for mechanical engineering practice (k)
- The broad education necessary to understand the impact of industrial engineering solutions in a global and societal context
Course Objectives:
When you finish this course, it is hoped that you will:
- Explain environmental, social, and economic aspects of sustainability in design and manufacturing context
- Describe resource consumption and its drivers
- Analyze a materials life cycle with emphasis on bamboo and ceramic
- Select Eco-informed material for design of a product
- Select Eco-informed processes for manufacture of a product
- Conduct Eco-audits using CES eco-audit tool
- Analyze eco-data: values, sources, precision
- Relate legislation with sustainability with application to Ghana and USA
- Write report on a sustainability design and manufacture project
- Make oral presentation on Ghana trip experience and project

Required Texts (and recommended readings):

Required Software:
2. EduPack Software, Granta Design Ltd, University of Cambridge

Grading Policy, including the weight given to each graded component:
Point breakdown is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Project</td>
<td>40%</td>
</tr>
<tr>
<td>Presentations</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

COURSE CONTENT: The course content is tentative depending on time and the instructor’s discretion. The syllabus can be downloaded from “www.d.umn.edu/~eenemuoh/Teaching/ME 4365/”

TENTATIVE COURSE OUTLINE
Module 1: Class introduction and Africa (Ghana), orientation to the Ghana trip done at UMD
Module 2: Intro to sustainable development, ISO 14000
Module 3: Sustainable design process
Module 4: World engineering materials with emphasis on bamboo, clay, and textiles
Module 5: World engineering manufacturing processes with emphasis on bamboo, clay and textiles
Module 4: CES software – Life Cycle Analysis (LCA) of products and manufacturing processes
Module 5: Eco Auditing using CES software with emphasis on embodied energy, carbon footprint, water footprint
Module 6: Tour of manufacturing sites, historical places, and cultural activities
Module 7: Group research presentations on sustainability project
Module 8: Final report on projects and trip
### TENTATIVE PROGRAM SCHEDULE

This course schedule may be altered by the instructors depending on availability of time. There are 13 instructional days equivalent to 32.5 hours (2.5 hours per day) and several hours for tours and cultural activities (estimated at 40 hours total).

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Activity</th>
<th>Tour/Cultural Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>05/16/11</td>
<td>Mon</td>
<td>Depart USA from Minneapolis via DC to Accra</td>
<td></td>
</tr>
<tr>
<td>05/17/11</td>
<td>Tue</td>
<td>Arrive Accra, spend the night at Accra</td>
<td>Legon Univ. and Accra</td>
</tr>
<tr>
<td>05/18/11</td>
<td>Wed</td>
<td>Drive to Kumasi</td>
<td>Arts Centre and Mausoleum</td>
</tr>
<tr>
<td>05/19/11</td>
<td>Thu</td>
<td>Lecture: Intro to Sustainability, Assignment of Groups, Assignment of Projects</td>
<td></td>
</tr>
<tr>
<td>05/20/11</td>
<td>Fri</td>
<td>Lecture: Environmental auditing methods, Embodied Energy, CO₂, Water</td>
<td>Kente Production, Bamboo Forest, Bobiri Forest</td>
</tr>
<tr>
<td>05/21/11</td>
<td>Sat</td>
<td>Weekend</td>
<td></td>
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<tr>
<td>05/22/11</td>
<td>Sun</td>
<td></td>
<td></td>
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<tr>
<td>05/23/11</td>
<td>Mon</td>
<td>Lecture: Review of Sustainability in traditional Design Process</td>
<td>Ahwiaa Wood Village</td>
</tr>
<tr>
<td>05/24/11</td>
<td>Tue</td>
<td>Lecture: Review of World Engineering Materials</td>
<td>Manhyia Palace</td>
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<tr>
<td>05/25/11</td>
<td>Wed</td>
<td>Lecture: Review of World Engineering Processes</td>
<td>Military Museum</td>
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<td>05/26/11</td>
<td>Thu</td>
<td>Lecture: CES EduPack Software and Application</td>
<td>Cultural activity: key boarding</td>
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<tr>
<td>05/27/11</td>
<td>Fri</td>
<td>Lab: CES EduPack</td>
<td>Cultural activity: basketeering</td>
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<tr>
<td>05/28/11</td>
<td>Sat</td>
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<td>05/29/11</td>
<td>Sun</td>
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<tr>
<td>05/30/11</td>
<td>Mon</td>
<td>Lecture/Project: Group work and consultation with Faculty</td>
<td>Cultural activity: textile dying</td>
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<tr>
<td>05/31/11</td>
<td>Tue</td>
<td>Lecture/Project: Group work and consultation with Faculty</td>
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<tr>
<td>06/1/11</td>
<td>Wed</td>
<td>Lecture/Presentations: Group presentations</td>
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<tr>
<td>06/2/11</td>
<td>Thu</td>
<td>Drive to Accra for departure back to USA</td>
<td>Kakum Forest</td>
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<td></td>
<td></td>
<td>Flight leaves at 10:00 P.M.</td>
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<tr>
<td>06/3/11</td>
<td>Fri</td>
<td>Arrival to Minneapolis</td>
<td></td>
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Special out-of-class requirements (computers, software, field trips, etc.): You need knowledge of spreadsheet and word processing software to complete your projects. CES EduPack software will be provided by the instructor.

Statement on Participation: It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact their instructor to discuss their individual needs for accommodations. The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Student Academic Integrity Policy: Academic dishonesty tarnishes UMD’s reputation and discredits the accomplishments of students. UMD is committed to providing students every possible opportunity to grow in mind and spirit. This pledge can only be redeemed in an environment of trust, honesty, and fairness. As a result, academic dishonesty is regarded as a serious offense by all members of the academic community. All faculty, staff, and students are expected to participate in maintaining the highest levels of academic integrity.

Prohibited Conduct: All forms of academic dishonesty are prohibited, including (but not limited to):
• Submission of false records of academic achievement
• Cheating on assignments or examinations
• Submitting sentences or ideas as your own without proper acknowledgment or citation (plagiarizing)
• Altering, forging, or misusing a University academic record or forging the signature of any member of the University community
• Taking, acquiring, using, or circulating test materials without faculty permission
• Acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement
• Facilitating academic dishonesty by knowingly assisting another student to violate the Student Academic Integrity Policy, such as providing course work for another student to turn in as his or her own effort or taking an exam for another student
• Presenting as one’s own a plot, succession of ideas, or list/outline of another without proper acknowledgment
• Attending a class, completing an assignment, or taking a quiz/test in the name of another student
• Altering or viewing computer records, dispensing or releasing information gained via unauthorized access, modifying computer programs or systems, or interfering with the use or availability of computer systems or information (refer to UMD policy)
• Purchasing or otherwise presenting work as your own when it was done by another person
• Submitting the same paper or work (or generally similar papers or work) to meet the requirements of more than one course without the approval and consent of faculty
• Depriving another student of necessary study or research materials or in any way impeding another student’s work and pursuit of education
• Submitting falsified data, such as bibliographic resources and experimental data or altering graded academic work/quizzes/tests and resubmitting them in order to get a higher grade
• Use of electronic devices for the unauthorized assistance in academic work, quizzes, or tests