MnE 407/507 – Equipment Operations Technology
Fall 2005, MWF 2-2:50

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Prerequisites:
It is assumed that students possess basic computer skills and is familiar with email and the MS Office suite of Word, Excel, and PowerPoint.

Course Description:
Ideal for Mining, Civil, and Industrial engineers to learn the processes of designing, justifying, implementing, operating, and maintaining large-scale heavy-equipment based earthmoving systems. Focus is on methods of materials movement and transportation for both surface and underground earthmoving systems including technological developments in areas such as automation, tele-remote operation, performance analysis, equipment selection, maintenance, and operations research.

Course Resources:
A specific modern text book does not exist for this class. A compilation of notes and readings are provided on-line at the web address above. Additional resources can be requested directly from the instructor.

Course Attendance:
Since participation is a part of this class, attendance is required.

Specific Instructional Goals:
Mining technology has evolved to include not only large machines but also complex technology and computer skills. This course focuses on realistic industrial open-ended problems as the basis for projects and homework assignments. Lectures will cover the basic technologies and include team-based projects sessions, design problems, and computer-based optimization and simulation. A term project, possibility with an industrial partner, will provide students with engineering design and project management opportunities. The teams are to act as a group of project engineers and managers responsible for the application of various technologies to solve specific operations-related problems. A written project report and oral presentation of the results are expected. Peer evaluations of team performance in the oral presentations will also be considered. Written assignments and communications skills are important. All students will undertake field trip reports, assignments, and research projects while graduate credit will require additional project(s). Cooperative learning will be used in this course.

Methodology:
This course will be taught through a combination of readings (both prepared and from text books), lectures, field trips, projects, and assignments. The readings provide the core technical information required to understand and pass the course. These readings will provide the methodologies for design through descriptions and examples. The lectures are designed to provide a forum for discussion, presentation of new technologies, product videos, and general information not traditionally found in readings. Lectures do review some basic materials covered in the readings but not to the extent as covered in the readings. Field trips further enrich the course material by witnessing the technology in an operating environment. Projects will involve a cooperative learning project and a practical industrial project.

Topics:
The equipment component of this course will individually cover the various pieces of equipment used in all the mining and large-scale earthmoving industries. The sections for each piece of equipment will include: basic machine operations, application, systems view, and advanced technology. For each piece of equipment, the technology that specifically addresses or improves the performance of the activity will be presented, for example, automation of Load Haul Dump

machines is covered. Case studies are also provided where appropriate. Additional issues, such as electrical power, road design, and maintenance are also covered. The types of equipment are organized in modules dependant on the processes for which they are responsible. The specific topics will be covered tentatively according to the calendar available for download on the 408 course site, however, note that this is only a tentative schedule. The mandatory module readings must be completed prior to the scheduled final day of lecture on that module. For example, if Module 3 begins on Wednesday, Modules 1, 2, and 3 are required to be read prior to class.

Module 1: Introduction - Describes basic systems analysis, economic evaluation (DCF methods), and materials handling issues.
Module 2: Excavation - Describes the basic operation and design criteria for excavation equipment not covered in MnE415. This relates to scrapers and draglines.
Module 3: Loading Equipment – Loading equipment (primarily surface)
Module 4: Haulage – Surface and underground haulage systems but also includes tire and road design.
Module 5: Materials Transfer – Conveyors, bins, and shafts.
Module 6: Material Handling Process Design & Management – The design component will cover the methodologies used to select and design materials handling processes. Linear programming and low-level operations research tools are used. The management component will cover the methodologies used to manage mining operational processes at a low-level. Some of the tools are used for both design and optimization following implementation.
(if time permits) Module 7: Socio - environmental perspectives – in an effort to increase the understanding and inclusion of wider issues in the design and implementation of earthmoving projects, historical, social, and environmental perspectives are covered in this module.

Contribution to professional component:
Math and basic science (percent of course) ____20%_____
Engineering topics (percent of course) _____40%_____
Design experience (percent of course) _____40%_____

Class requirements:
Class attendance is required. The following lists the tasks that will be assed for grades: homework assignments, cooperative learning project, mid-term, industrial design project and a final exam.

Tentative Calendar
The exact dates for specific lectures and assignments can be downloaded from the website – follow the 'calendar' link.

Grading (note: this can be changed throughout the semester):

	Pts per instance	Frequency	Total Points Und.	Total Points Grad.	Grade distribution Und.	Grade distribution Grad.
Assignments	75	5	375	375	22%	19%
Professionalism	100	1	100	100	6%	5%
Term Project	400	1	400	400	24%	20%
Quiz	100	2	200	200	12%	10%
Mid-term	200	1	200	200	12%	10%
Final Exam	400	1	400	400	24%	20%
Graduate Project	300	Grad only		300	0%	15%
totals			1675	1975	1	1

Grading is as follows (may be altered at semester end):
A = 90-100% B = 80-89% C = 70-79% D = 60-69% E = < 60%

Note that this course is relatively simple technically where undertaking the prescribed readings at the assigned time will guarantee high grades. Do not fall behind in the readings. Approximately 2-3 hours/week for each credit hour is the official standard for the UA.

Quizzes may have questions from the readings, and from the lectures so take notes in class. Attendance of at the lectures is mandatory. Absences may be excused prior to the class, whereupon a digital copy of the PowerPoint sides will be provided. Students with language challenges can also arrange to procure a digital copy of the slides.
Assignments are due at the BEGINNING of class time of due dates given. Late acceptance must be pre-arranged 1 day before the homework is due. Emailing the assignments is strongly encouraged. Hand-written assignments (unless mathematical in nature) will not be accepted. The UA library has mining research specialist that may help students research topics for assignments and projects, her contact coordinates are: Chestalene Pintozzi, 621-6392, pintozzic@u.library.arizona.edu. The Assignment instructions are preceded by an ABET definition explaining how this assignment is designed to test your knowledge and how it contributes to your education.
Professionalism can be considered a 'participation' grade. Behavior such as bullying other students or disrespecting any person in the classroom will not be tolerated. According to the rules of the University of Arizona, after 2 oral warnings, a student is given a written warning. A third incident will result in the student being ejected from the class, only to be re-admitted after a meeting with the department head. These provisions were put in place after the massacre in 2002 in the UA nursing. A lack of professionalism includes reading the paper in class, undertaking an assignment, eating, or having a cell phone ring during lecture. Participation points are awarded to students who contribute working experiences or provide constructive commentary. Those students too shy to contribute to a class discussion can contribute via email. Lectures (especially when a guest speakers) and Field trips are mandatory. Missing these would constitute a serious loss of participation points unless pre-arranged with the instructor. In-class participation activities will also make-up part of the professionalism grade.
Term & Graduate projects: term and graduate projects will be explained in a lecture.
Mid-term exam will be held sometime in October during class-time.
Final exam date is December 17th from 2-4 PM.

Course ABET distribution:
B – Medium
C – High
D – Low
G - Low

ABET Learning OUTCOMES:
A. Demonstrate proficiency in mathematics through differential equations; physics including mechanics, thermodynamics and circuits; basic chemistry and laboratory techniques; basic geosciences, probability and statistics; including the ability to conduct experiments and analyze data.
B. Be able to complete a design project including elements of project management
C. Be able to solve engineering analysis problems with increasing difficulty through the curriculum, including open-ended problems, and the impact of solutions on safety and quality
D. Prepare technical reports (including team based) in written form including graphs and tables and oral reports in prepared presentations and be able to identify the need for information, locate the information, assess the quality of the information and use the information effectively (M)
E. Demonstrate exposure to issues in humanity (N)
F. Be involved in professional societies and or outreach or research (N)
G. Ability to integrate computers and software to solve engineering problems and have a working knowledge of mining equipment/tools (M)

Important notes
- All information on this syllabus may change at the discretion of the instructor.
- It is the responsibility of the student to add or drop themselves from this class.