Syllabus CE 596 – Pavement Evaluation and Management (3 credits) Spring 2018

LECTURES: TR 1200-1320, BAT 150

INSTRUCTOR
Dr. Erdem Coleri
Office: Owen Hall - 308
E-mail: erdem.coleri@oregonstate.edu

Office Hours:
Coleri TR 1400-1500
Owen 308 *Also by appointment*

COURSE SPECIFICS

3 Credits
Pre-requisites: CE 492 (or equivalent); or instructor's consent

SYLLABUS OVERVIEW

This syllabus serves as a guideline for the course. It describes the planned course content and schedule, learning objectives, criteria for completing assignments, information regarding examinations (in-class assignments and term project), and grading information. Listed course topics will be covered to the extent allowed by the schedule. The topics covered and the course schedule may change due to learning abilities, time conflicts and limitations, and other unforeseen circumstances.

EMAIL

When you send an email to the instructor, please include "*CE 596*" in the subject line. This allows for easy searching to avoid missed emails pertinent to the class. If "*CE 596*" is NOT in the subject line, I cannot guarantee that I will respond to your email in a timely manner.

COURSE DESCRIPTION

This new course focuses on:

- pavement distress mechanisms;
- pavement distress surveys;
- pavement maintenance and rehabilitation strategies;
- non-destructive pavement testing and performance backcalculation procedures;
- automated pavement condition survey (APCS) technologies and their integration with pavement management systems (PMS);
- the use of PMS to develop the most sustainable strategies for pavement maintenance and rehabilitation; and
- the use of life cycle cost analysis, life cycle assessment, and environmental criteria in the pavement maintenance and rehabilitation decision-making procedures.

COURSE OBJECTIVES

Course objectives are:

a. Briefly review mechanisms responsible for primary pavement distresses, present models for distresses based on critical pavement stresses, strains and deflections under traffic and climate, relate distresses to serviceability of the facility;
b. Present frameworks for mechanistic-empirical and empirical design methods for rehabilitation, through review of several example methods;
c. Learn how to conduct falling weight deflectometer (FWD) tests and use the results to backcalculate pavement performance;
d. Identify and describe automated pavement condition survey (APCS) technologies for evaluating condition of existing pavements, with regard to roughness; stiffness, water content, thickness of pavement layers; presence of distresses at the surface;
e. Learn the use of ProVal software to process laser profiler data and calculate international roughness index (IRI) for highway sections;
f. Show the effects of construction on the properties and performance of pavement materials;
g. Review maintenance and rehabilitation strategies, appropriate applications, and methods of determining optimal practice;
h. Learn the operation of pavement management systems;
i. Discuss empirical models for use in pavement management systems, and integration with pavement business practice;
j. Investigate the use of life cycle cost analysis, life cycle assessment, and environmental criteria in the pavement maintenance and rehabilitation decision-making procedures; and
k. For all of the subject areas described above, identify gaps in the knowledge and gaps in application of the knowledge.

COURSE RESOURCES

Required

A. Scanned papers, reports, and software user's manuals uploaded to Canvas.
B. Pavement Guide Interactive: http://www.pavementinteractive.org/ and other links provided in this syllabus
C. Openpave software will be given to students (uploaded to Canvas).
D. MEPDG software will be available in the computer labs.

Additional

P. Ullidtz, *Modelling Flexible Pavement Response and Performance*, Polyteknisk Forlag, 1998.

Y. Huang, *Pavement Analysis and Design*, 1993, Prentice-Hall

COURSE INFORMATION

The primary method for dissemination of course information will be through **Canvas**. Additional handouts may be given during lecture. Every effort will be made to post these additional materials to Canvas as well. Occasionally, course-related information may be disseminated through the class e-mail list, which requires an ONID account; thus, it is advised that you check your ONID e-mail account daily.

SCHEDULE - The topics covered in the course are listed in the following schedule. Also listed are the minimum reading requirements for each topic.

Lecture	Topic	General papers	Websites for reading	Homework assigned
1: 4/3	Course Overview, Pavement types, distress mechanisms, design objectives and context		Pavement interactive website ("Pavement" and "Materials" tabs)	
2: 4/5	Pavement types, distress mechanisms, design objectives and context (cont.)		Pavement interactive website ("Pavement" and "Materials" tabs)	
3: 4/10	APAO board – Oregon BMD – Asphalt lab visit			
4: 4/12	Pavement maintenance and rehab		Pavement interactive website ("Maintenance and rehab" tab)	
5: 4/17	Pavement evaluation manuals	1. ODOT GFP rating manual 2. ODOT distress manual 3. ODOT 2014 pavement condition report	ODOT Pavement condition report	
6: 4/19	DCP testing and backcalculation – Lab tour and research discussions **at OCB 177**		Pavement interactive website ("Pavement management" >"Pavement evaluation"> DCP test)	HW1 (Pavement eval.)
7: 4/24	Calculation of stresses, strains and deflections-flexible pavements, Openpave software	Ullidtz book: Ch2,3, and 4.0-4.1 (uploaded to Canvas)		
8: 4/26	FWD testing and backcalculation		Pavement interactive website ("Pavement management" >"Pavement evaluation"	Term project assigned
9: 5/1	FWD testing (cont.), sensors and rolling wheel deflectometers	ODOT rolling wheel document	Pavement interactive website ("Pavement management" >"Pavement evaluation"	
10: 5/3	Automated pavement condition surveys (APCS) – Systems and procedures	Timm and Mc Queen; Sivaneswaran et al; Ong et al.		HW2 (FWD and DCP)

11: 5/8	APCS – IRI concept and ProVal	ProVal#1; Profiling book; ProVal#2; ProVal#3; ProVal#4	Smooth pavements	
12: 5/10	ODOT – Intelligent Compaction	ODOT IC USER GUIDE LINK	CLICK HERE!	
13: 5/15	Pavement Management and Pavement Management Systems (PMS)	Wolters et al.; Greenroads	Pavement interactive website ("Pavement management" >"Pavement management"	HW3 (APCS-ProVal)
14: 5/17	PMS (cont.)		Pavement interactive website ("Pavement management" >"Pavement management"	
15: 5/22	Pavement life cycle assessment and life-cycle cost analysis (LCCA)	Coleri et al. – TRR (2018)	Pavement interactive website ("Pavement management" >"Analysis"	HW4 (PMS)
16: 5/24	Pavement life cycle assessment and life-cycle cost analysis (LCCA)			
17: 5/29	Term project discussion and progress review			
18: 5/31	ODOT – Visit for PMS and lab			
19: 6/5	Wrap up			
20: 6/7	Presentation of student term projects			
Term Project Report: Thursday 6/7/2018 at 12 PM				

ASSIGNMENTS AND GRADING

Homework assignments are due in class at the beginning of the period (12 PM).

Assignments submitted AFTER THE DUE DATE AND TIME AND UP TO ONLY TWO (2) DAYS LATE will receive a 25% penalty, once graded.
This means a regular score of 80 will receive a score 60 if it is turned in up to 2 days late.
Absolutely NO assignments will be accepted after the 2-day late (25% reduction) policy.
These assignments will receive a score of 0 "zero".

Homework

Homework assignments will be issued throughout the course. These are intended to help you grasp fundamental concepts and expose you to techniques and skills for applying these principles to real-life situations. Understanding how to do the homework problems will go a long way toward understanding how to do well on the in-class assignments and term project. You may discuss homework problems with your classmates and work together. However, the submitted solution should be only your own work written up independently.

Use the following guidelines for assignment preparation:

- Engineering paper is preferred; neatness is important and **required**. Work that is difficult to follow may not be graded, or will receive a reduced score. Typewritten work is also acceptable and must have the same headings as that shown below.
- Write on only one side of the paper, and start a new problem on a new sheet of paper (unless a problem only requires a short answer).
- Write the following in the upper part of each page: assignment number (e.g., HW #1) and due date, CE 596, your name, and page number/total pages as follows:

	HW#1 May 6, 2016	CE 596	DOE, JOHN	1/5

- Provide a problem number before each problem. Provide sketches or screenshots whenever appropriate. Show all of your work (i.e., calculations). For graphical solutions, label the axes of your graph and include units. Double underline or box your final answer(s).
- Securely staple all pages; **do not fold the corner or use a paper clip**.
- Homework will be graded according to a set grading rubric. Grading discrepancies should be discussed with the Instructor.

In-Class Assignments

There will be in-class assignments throughout the term covering subject matter presented during lectures. In-class assignments will be due during the class period assigned.

Term Project

The research paper will be on a subject selected by the student and approved by the instructor. The paper should be about 12 to 15 pages, double spaced (so I can make comments), 12 point font (so I can read it), including any figures. The paper can be a literature survey, or the results of investigative analyses performed by the student, or a design project. The paper should not be work from another class, or routine design or project analyses.

For literature surveys, the paper should discuss current state of the research, or trace the arc of research from initial development to current state of the practice. Literature survey papers must be original work, not compendiums of quoted material from other sources. For analyses of a pavement problem or a design project, the work should consist of an original investigation and calculations that contribute to knowledge, and not be a repeat of work performed by someone else or from another class.

Full reference citations are required for any work not your own. All paper topic must be discussed with the instructor and approved by April 26th. Papers are due at the last lecture on June 7th. The paper will be graded primarily on content, secondarily on conciseness, and thirdly on grammar and presentation.

A 15-minute presentation on the paper subject should be prepared for the last lecture (June 7th).

Listed below are some suggested potential topics. These are broad topics and some narrowing should occur in discussion between student and instructor.

- Reliability in design of pavements
- Back-calculation of elastic moduli (rigid or flexible)
- In-place recycling of pavement materials
- Reflection crack propagation retardation methods
- In-place recycling of flexible pavements
- Stabilization of soils for pavements
- New constitutive relations for pavement soils
- Measurement of ride quality in pavements
- Models for ride quality deterioration
- Characterization of climate for pavement design
- Traffic measurement and estimation for pavement design
- Use of ground-penetrating radar in pavement rehabilitation characterization
- Use of accelerated pavement testing in the development of pavement design methods
- Empirical performance modeling for pavement management
- Analysis and optimization methods for pavement management
- Pavement management systems state of the art
- Data collection requirements for pavement management
- Seal coat design for flexible pavement management
- Permeable pavements

- Pavement design for noise reduction
- Flexible pavement reconstruction
- High early strength concrete materials
- Fast-track construction
- Pavement drainage design and performance
- Design and use of fabrics in new and rehabilitated pavements

COURSE GRADING

Grades will be based upon examination of course work. A breakdown is as follows:

- Homework 40%
- In-class assignments 25%
- Term project report 25%
- Term project presentation 10%

CLASS PARTICIPATION

Each student is expected to participate in the class. Participation includes coming to class **on time**, being prepared for class, participating in class discussions, and interacting in a courteous, respectful, and professional manner in accordance with the policies prescribed by the University. If you do miss class, it is your responsibility to find out what was covered and any administrative information presented.

STUDENT CONDUCT

It is expected that you will know and abide by the Oregon State University Student Code: http://studentlife.oregonstate.edu/studentconduct

It is expected that you know and will abide by the CCE Honor Code posted at: http://cce.oregonstate.edu/node/258

Student conduct expectations link: http://studentlife.oregonstate.edu/sites/studentlife.oregonstate.edu/files/code_of_student_conduct.pdf

Two other documents are posted at the website above: CCE as a Professional Community and the Student Code of Conduct. You are also expected to know and abide by these conducting yourself in an according manner.

CCE Honor Code

While representing himself or herself as a member of the CCE community, the CCE student will maintain the highest standards of honesty and integrity. The student will strive for these standards in his or her representations, academic pursuits, research and scholarly activity, and respect for the property and individual rights of others; will uphold the specific principles described in the Code; and will actively support the Code.

In addition to this Honor Code, all CCE students are expected to know fully the OSU Student Conduct Regulations. Likewise, the CE student is expected to read and understand the American

Society of Civil Engineers (ASCE) Code of Ethics, and the Oregon State Board of Examiners for Engineering and Land Surveying (OSBEELS) Rules of Professional Conduct. The CEM student is expected to read and understand the AIC, American Institute of Constructors, http://www.professionalconstructor.org/code-of-ethics and the Construction Management Association of America (CMAA) Ethics Policy

Disruptive Behavior

While the university is a place where the free exchange of ideas allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors that are disruptive to the learning environment will not be tolerated. OSU's policy on disruptive behavior may be found at:
http://oregonstate.edu/studentconduct/disruptive-behavior

Academic or Scholarly Dishonesty

You are expected to be honest and ethical in your academic work. OAR 576-015-0005(2) (see http://oregonstate.edu/studentconduct/) states that, "The assumption upon which this Code is based is that all persons must treat one another with dignity and respect in order for scholarship to thrive." This document describes academic and scholarly dishonesty as follows:

a) *Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another.*
b) *It includes:*
   (i) *CHEATING - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.*
   (ii) *FABRICATION - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.*
   (iii) *ASSISTING - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone's grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).*
   (iv) *TAMPERING - altering or interfering with evaluation instruments or documents.*
   (v) *PLAGIARISM - representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work. Plagiarism includes but is not limited to copying another person's work (including unpublished material) without appropriate referencing, presenting someone else's opinions and theories as one's own, or working jointly on a project and then submitting it as one's own.*

The administration of the classroom rests with the instructor. When evidence of academic dishonesty comes to the instructor's attention, the instructor will (a) document the incident, (b) permit the accused Student to provide an explanation, (c) advise the Student of possible penalties, and (d) take action. The instructor may impose any academic penalty up to and including an "F" grade in the course after consulting with his school head and informing the Student of the action taken. Using the standard form, the instructor will report the incident and the action taken to his school head, who, in turn, shall forward the report to his dean.

For Students not enrolled in the College of Engineering, the Dean of the College of Engineering shall forward the report to the dean of the college or school in which the student is enrolled for possible disciplinary action.

STUDENTS WITH DISABILITIES

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

STUDENT EVALUATION OF COURSES

The online Student Evaluation of Teaching system opens to students the Monday of dead week and closes the Monday following the end of finals. Students will receive notification, instructions and the link through their ONID. They may also log into the system via Online Services. Course evaluation results are extremely important and used to help improve courses and the learning experience of future students. Responses are anonymous (unless a student chooses to "sign" their comments agreeing to relinquish anonymity) and unavailable to instructors until after grades have been posted. The results of scaled questions and signed comments go to both the instructor and their unit head/supervisor. Anonymous (unsigned) comments go to the instructor only.