

## **Pavement Design**

CGN 4503/6905

**Class Periods and Locations:** MWF, Period 6 (12:50pm-1:40pm) at Weil 234

W, Period 9 (4:05-4:55 pm) at Weil 408E

**Academic Term:** Fall 2024

### **Instructor:**

Dr. Jian Zou

zouj@ce.ufl.edu

Weil 265 K

Office Hours: Wednesday 10am-11am or By Appointment

### **Course Description**

Function and material requirements of different elements of flexible and rigid pavement systems; characterization of soils, materials, traffic loads, and environment for design; flexible and rigid pavement design; pavement distress; new developments. Credits: 3.

### **Course Pre-Requisites / Co-Requisites**

CGN 3501C Civil Engineering Materials or Equivalent Courses

### **Course Objectives**

After taking this course, the students will be able to:

- Describe basic characteristics of pavement structures
- Analyze stress distribution throughout multilayer pavements systems
- Identify pavement distresses and possible causes
- Obtain properties for pavement materials
- Calculate traffic loads for highway design
- Determine pavement structures using the AASHTO design procedure

### **Professional Component:**

This course is part of engineering topics for the curriculum. This course is primarily engineering design with elements of engineering science.

### **Relation to Program Outcomes:**

This course requires the student to apply basic math, science and engineering principles to analyze and design pavement structures.

### **Recommended Textbooks**

#### Pavement Analysis and Design

- Huang, Y. H.; 2nd edition, 2004; ISBN: 0131424734

#### Pavement Design and Materials

- Papagiannakis, A. T. and Masad, E. A.; 1st edition, 2008; ISBN: 0471214612, 9780471214618

#### Mechanistic-Empirical Pavement Design Guide: A Manual of Practice

- American Association of State Highway and Transportation Officials (AASHTO); 3rd edition, 2020; ISBN: 978-1-56051-748-1

### **Recommended Reading**

The student should read the assigned chapter(s) or notes prior to class and come prepared to discuss the material. Class discussion, with participation by all, is an integral part of the learning process.

***Tentative Course Schedule***

Topic 1	Introduction: Course Description; Fundamental Design Principles; Pavement Types Reference: Chapter 1 (Huang); Chapter 1 (Papagiannakis)	Week 1-2
Topic 2	Flexible Pavement Stress Analysis: Load-Induced Stresses in Flexible Pavements; Analytical Software Reference: Chapter 2 (Huang); Chapter 2 (Papagiannakis)	Week 2-4
Topic 3	Material Characterization: Strength and Deformation Tests, CBR, Resilient Modulus, Soil Classification Reference: Chapter 7 (Huang); Chapters 4-6 (Papagiannakis)	Week 4-6
Topic 4	Flexible Pavement Distress: Flexible Pavement Distress and its Causes – Design Factors Reference: Chapter 9 (Huang); Chapter 9 (Papagiannakis)	Week 6-7
	Exam 1	Week 8
Topic 5	Traffic: Vehicle and Traffic Characterization for Design Reference: Chapter 6 (Huang); Chapter 2 (Papagiannakis)	Week 8-9
Topic 6	Flexible Pavement Design: Part a – Mechanistic Empirical Design Procedure (Asphalt Institute Method) Part b – AASHTO Design Procedure for Flexible Pavements Reference: Chapter 11 (Huang); Chapter 11 (Papagiannakis)	Week 9-11
Topic 10	Mechanistic Empirical Pavement Design Guide Reference: MEPDG – A Manual of Practice (AASHTO)	Week 11-12
	Exam 2; Project Kickoff	Week 13
Topic 7	Rigid Pavement Stress Analysis: Curling Stresses; Load-Induced Stresses in Rigid Pavements; Combined Effects of Temperature and Load Reference: Chapters 4-5 (Huang); Chapter 8 (Papagiannakis)	Week 12-14
Topic 8	Rigid Pavement Design: AASHTO Design Procedure for Rigid Pavements Reference: Chapter 12 (Huang); Chapter 12 (Papagiannakis)	Week 14, 16
Topic 9	Rigid Pavement Distress: Rigid Pavement Distress and its Causes – Design Factors Reference: Chapter 9 (Huang); Chapter 9 (Papagiannakis)	Week 16
	Project Due	Week 17

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance in this course is not mandatory. However, students are strongly recommended to attend all the lectures. Please come to class prepared to ask and answer questions and actively participate in group discussions. Note that a large portion of the information necessary for the completion of the course is made available during lectures.

All the homework assignments will be based on the content covered in class and/or reading materials. Collaborating with others is fine as long as you finish and turn in your own assignment. Copying of other's work is plagiarism and will not be allowed. Homework is due at the start of the class period on the day specified, unless otherwise noted. Late homework will be accepted at a 25% reduction if turned in within 48 hours from the due time. No credit will be given for homework submitted thereafter. Prior consent with the instructor must be made if there are special circumstances. There will be three exams. Requests for make-up exams are strongly discouraged. Such requests will be accommodated only under special circumstances and when prior permission from the instructor has been sought adequately in advance.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework	16%
Exam 1	30%
Exam 2	30%
Project	24%
	100%

### ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 77.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

### ***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the

evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Homework Format***

The cover page should include your name, class designation (CGN 4503/6905 or Pavement Design), homework number, and the submission date at the top of the sheet. All homework must be submitted using only one side of the page. Begin each problem with a problem statement of what is being solved. Work should be organized and neat. Assumptions should be clearly stated, appropriate units should be noted on answers and answers should be boxed, underlined or otherwise appropriately labeled. Where appropriate include references to figures, tables or other sources. The homework in this class should be submitted to the instructor as though the assignment is an engineering project. Assignments that do not meet a minimum standard of neatness and organization will receive penalties of up to 25% reduction. Where appropriate, neat sketches should be included to explain design calculations or appropriate problems. Numerical answers should be given with an appropriate number of significant digits.

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Calculator Policy for Exams***

The only calculators that are permitted for use during tests are the same as those permitted for the Fundamentals of Engineering Exam, which all civil engineering students are required to take prior to graduation. There are no exceptions to this requirement. The only acceptable models of calculators are Casio (All fx-115 models), Hewlett

Packard (The HP33 and HP35s), and Texas Instruments (All TI-30X and TI-36X models). Use of any other calculator during the exam must be approved by the instructor at least 24 hours before the exam.

### ***Cellular Telephone Policy***

Cellular telephones are disruptive during class and should be turned off. Cellular telephones must be turned off and stored away (preferably in a book bag) during exams. Any student using a cellular telephone during a test will be in violation with the academic honesty policy and will be subject to disciplinary action.

### ***Campus Resources:***

#### ***Health and Wellness***

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](http://www.title-ix.ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### ***Academic Resources***

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu). <https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://care.dso.ufl.edu>.