

College of Engineering

Department of Civil Engineering

جامعة  
الملك سعود  
King Saud University



## CE 537 Advanced Pavement Design

<b>Credit and Contact hours</b>	3/ 3 (Lectures), 0 (Tutorials), 0 (Laboratory)														
<b>Required, or Elective</b>	Required for a MSCE degree														
<b>Course Description</b>	<p>The course provides master students an advanced topics in pavement analysis and design The course also includes topics related to pavement rehabilitation. The course covers distresses in flexible and rigid pavements (types, causes, and suggested repair), analysis of pavement performance, evaluation of the structural condition of a pavement, analysis of elastic and viscoelastic layer system, mechanistic-empirical pavement design (AASHTOWare Pavement ME Design), sustainable pavement practices and perpetual pavement, and overlay design for both flexible and rigid pavements. The course may includes a brief review on advanced pavement materials testing if the student does not have a previous knowledge. Beside these topics, the course attempts to address recent topics related to pavement design through reviewing recently published researches. The course also include report/research assignments on the topics covered.</p>														
<b>Prerequisites or Co-requisites</b>	<p>No prerequisite courses are required provided that the student had finished the following undergraduate courses or equivalent courses:</p> <ul style="list-style-type: none"><li>- CE 431 (Highway Engineering)</li><li>- CE 432 (Highway Materials Lab.)</li></ul> <p>The required previous knowledge includes the following topics:</p> <ol style="list-style-type: none"><li>1. Design of pavements</li><li>2. Characteristics and testing of pavement materials.</li><li>3. Methods of Economic Analysis.</li></ol>														
<b>Course Learning Outcomes</b>	<p>Students completing this course successfully will be able to</p> <table border="1"><thead><tr><th>Course Learning Outcomes</th><th>Related Program Outcomes</th></tr></thead><tbody><tr><td><b>CLO1:</b> Determine stresses and strains in flexible and rigid pavements.</td><td><b>S1</b></td></tr><tr><td><b>CLO2:</b> Analyze pavement structure.</td><td><b>S1</b></td></tr><tr><td><b>CLO3:</b> Design both flexible and rigid pavements by the Mechanistic Empirical method.</td><td><b>C2</b></td></tr><tr><td><b>CLO4:</b> Evaluate the performance of existing pavements</td><td><b>C2</b></td></tr><tr><td><b>CLO5:</b> Design overlay for existing pavements.</td><td><b>C2</b></td></tr><tr><td><b>CLO6:</b> Make decision regarding the use of sustainable pavement and perpetual pavement.</td><td><b>C2</b></td></tr></tbody></table>	Course Learning Outcomes	Related Program Outcomes	<b>CLO1:</b> Determine stresses and strains in flexible and rigid pavements.	<b>S1</b>	<b>CLO2:</b> Analyze pavement structure.	<b>S1</b>	<b>CLO3:</b> Design both flexible and rigid pavements by the Mechanistic Empirical method.	<b>C2</b>	<b>CLO4:</b> Evaluate the performance of existing pavements	<b>C2</b>	<b>CLO5:</b> Design overlay for existing pavements.	<b>C2</b>	<b>CLO6:</b> Make decision regarding the use of sustainable pavement and perpetual pavement.	<b>C2</b>
Course Learning Outcomes	Related Program Outcomes														
<b>CLO1:</b> Determine stresses and strains in flexible and rigid pavements.	<b>S1</b>														
<b>CLO2:</b> Analyze pavement structure.	<b>S1</b>														
<b>CLO3:</b> Design both flexible and rigid pavements by the Mechanistic Empirical method.	<b>C2</b>														
<b>CLO4:</b> Evaluate the performance of existing pavements	<b>C2</b>														
<b>CLO5:</b> Design overlay for existing pavements.	<b>C2</b>														
<b>CLO6:</b> Make decision regarding the use of sustainable pavement and perpetual pavement.	<b>C2</b>														

	<b>CLO7:</b> Evaluate recent research and state-of-art in pavement developments, and judge its applicability in practice.	<b>C1</b>
<b>Student Outcomes related to this Course</b>	<p><b>S1.</b> Provide solution for complex and real-life engineering problems through critical thinking and using modern engineering tools and identify its impact on social and ethical issues.</p> <p><b>C1.</b> Criticize and discuss scientific research reports /papers related to Civil Engineering issues with high level of ethics and proficiency, independently, or as a team work.</p> <p><b>C2.</b> Design novel advanced Civil Engineering systems and evaluate its performance and effectiveness for engineering practice and its impact on society.</p>	
<b>Topics Covered</b>	<b>List of Topics</b>	<b>Related CLOs</b>
	1. Distresses in flexible and rigid pavements (types, causes, and possible repair)	<b>CLO4</b>
	2. Pavement evaluation: surface condition, serviceability, roughness, surface friction.	<b>CLO4</b>
	3. Materials Characterization. Plate-loading Tests, Triaxial Compression Test, California Bearing Ratio Test, Resilient modulus test	<b>CLO1</b>
	4. Stresses and strains in flexible pavements: elastic and visco-elastic theory.	<b>CLO1</b>
	5. Stresses in rigid pavements.	<b>CLO1</b>
	6. Mechanistic-empirical pavement design according to MEPDG method: "AASHTOWare Pavement"	<b>CLO2</b> <b>CLO3</b>
	7. Overlay of flexible and rigid pavements	<b>CLO5</b>
	8. Pavement drainage	<b>CLO6</b>
	9. Overview of sustainable pavement requirements, designing a sustainable pavements, perpetual pavement, endurance limit.	<b>CLO6</b> <b>CLO7</b>
<b>Textbook(s) and Other Required Material</b>	<ul style="list-style-type: none"> <li>• Huang, Yang H., "Pavement Analysis and Design", Prentice-Hall, Inc. Englewood Cliffs, NJ, 2nd ed., 2010</li> <li>• Rajib Mallik, Tahar ElKorchi, Pavement Engineering: Principles and Practice, 3rd Edition, 2017</li> </ul>	
<b>Grading System</b>	Assignments and Quizzes	15%
	Research Report	5%
	Project Work	15%
	Midterm Exam	25%
	Final Exam	40%
<b>Instructors</b>	Dr. Hamad Alsolieman (2A21), halsolieman@ksu.edu.sa	
<b>Date of Review</b>	February, 2021	