

College of Engineering

Department of Civil Engineering

جامعة  
الملك سعود  
King Saud University



## CE 437 Analysis and Design of Pavement Systems

<b>Credit and Contact hours</b>	3 / 3 (Lectures), 1 (Tutorials), 0 (Laboratory)	
<b>Required, or Elective</b>	Elective for a BSCE degree	
<b>Course Description</b>	This course provides students the concept of pavement Serviceability, design factors, pavement types, basic differences between pavement types, basic differences between airport and highway pavements, stresses in flexible pavement, traffic considerations, materials and material characterization for different pavement layers, variability in pavement materials, methods of pavement design. Computer application in pavement analysis and design.	
<b>Prerequisites or Co-requisites</b>	CE 431 (Highway Engineering)	
<b>Course Learning Outcomes</b>	<b>Course Learning Outcomes</b>	
		<i>Related Student Outcomes (SO)</i>
	<b>CLO1.</b> Identify the design factors including traffic and loading, environment, pavement materials, and failure criteria for proper pavement design.	<b>SO1</b>
	<b>CLO2.</b> Conduct mechanistic analyses for flexible and rigid pavement structures and determine the equivalent loads using applicable theories and common computer software.	<b>SO1</b>
	<b>CLO3.</b> Investigate the characteristics of pavement materials for the pavement performance prediction and design.	<b>SO6</b>
	<b>CLO4.</b> Analyze the variability of pavement design factors in order to use reliability concept in the design procedure.	<b>SO6</b>
	<b>CLO5.</b> Recommend, justify, and design the most appropriate drainage system for pavements.	<b>SO2</b>
	<b>CLO6.</b> Design highway pavement by MEPDG, AASHTO, and Asphalt Institute Methods.	<b>SO2</b>
<b>Student Outcomes related to this Course</b>	<p><b>SO 1.</b> an ability to <b>identify, formulate, and solve complex engineering problems</b> by applying principles of engineering, science, and mathematics, and using <b>modern engineering tools</b> .[ABET 1]</p> <p><b>SO 2.</b> an ability to apply <b>engineering design</b> to produce solutions that meet specified needs with consideration of <b>public health, safety, and welfare</b>, as well as <b>global, cultural, social, environmental, and economic factors</b> .[ABET 2]</p>	

	<b>SO 6.</b> an ability to <b>develop</b> and <b>conduct appropriate experimentation</b> , <b>analyze</b> and <b>interpret data</b> , and <b>use engineering judgment to draw conclusions</b> . [ABET 6]	
<b>Topics Covered</b>	<b>List of Topics</b>	<b>Related CLOs</b>
	1. Introduction: Pavement Types, Design Factors, methods of pavement design.	CLO1
	2. Stresses and strains in Flexible Pavements: Layered System Concepts, Multilayered Solutions, Two-Layer System, Three-Layer System, and Fundamental Design Concepts	CLO2
	3. Stresses and Deflections in Rigid Pavements: Curling Stresses, Stresses and Deflections due to Truck Loading,	CLO2
	4. Vehicle and Traffic Consideration: Equivalent Single-Wheel Loads (ESWL), Equivalent Axle Loads (EAL) for Highway pavements, Traffic Analysis.	CLO2
	5. Paving Materials Characterization: Plate-loading Tests, Resilient Modulus and Dynamic Modulus Tests for Soil, Aggregate, and Bituminous materials, Asphalt Mix Stiffness, Creep Test, Other tests like California Bearing Ratio Test, Fatigue Tests, Modulus of Rupture, Indirect Tensile Test,	CLO3
	6. Bases and Sub bases for Flexible Pavements: Base Course Function, General Properties of soil-Aggregate Mixtures, Cement-treated Bases, Asphalt-treated Bases, Base and Sub base Construction, and Field Control.	CLO3
	7. Drainage Design for Pavements: Detrimental Effects of Water on Pavements, Methods of Controlling Water in Pavements, Drainage Materials, Drainage Design Procedure	CLO5
	8. Variability of Design Factors: Fundamental Statistical Concepts, Sources of Variance, Probabilistic Method of Design.	CLO4
9. Pavement Design: MEPDG method, AASHTO Method, Asphalt Institute Method.	CLO6	
<b>Textbook(s) and Other Required Material</b>	1. Yoder, E.J. and Witczak, M.W., "Principles of Pavement Design ", Second Edition, John Wiley, & Sons, 1975. 2. Huang, Yang H., "Pavement Analysis and Design", Prentice-Hall, Inc., 1993 3. AASHTO, "Guide for Design of Pavement Structures," 2000. 4. The Asphalt Institute, "Thickness Design-Asphalt Pavements for Highways and Streets," 1994	
<b>Grading System</b>	Home-work	10%
	Two Midterm Exams	50%
	Final Examination	40%
<b>Instructors</b>	Dr. Ali Abdullah Alsahli (2A26), email; adalsahli@ksu.edu.sa	
<b>Date of Review</b>	September 2020	