Jordan University of Science and Technology

Faculty of Engineering

Civil Engineering Department

CE743 Advanced Pavement Analysis And Design - JNQF Level: 9
Second Semester 2023-2024

Course Catalog
3 Credit Hours. Historical developments, road tests, design factors, stresses and strains in flexible pavements, stresses and strains in rigid pavements, traffic loading and volume, pavement performance, reliability methods, pavement design methods, design of pavement shoulders, computer applications.
Teaching Method: On Campus

Text Book	
Title	Pavement Analysis and Design
Author(s)	Huang, Y. H.,
Edition	1st Edition
Short Name	Text #1
Other Information	Prentice Hall, Englewood Cliff, N.J., 1993.

Course References

Short name	Book name	Author(s)	Edition	Other Information
Text#2	Principles of Pavement Design	Yooder, E. J. and Witzak, M. W., ?	1st Edition	John Willey Inc., New York, N. Y., 1975.

Instructor	
Name	**Prof. Saad Abo-Qudais**
Office Location	C2 L2
Office Hours	
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Class Schedule & Room

Section 1:
Lecture Time: Mon : 13:00 - 16:00
Room: DRNHALL

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	2. Review: - Types of Pavements, - Highway Vs Airport Pavement - Pavement Serviceability Index - Stresses and Strains in Flexible Pavements (One Layer Systems, Two Layer Systems).	
Week 2	3. Stresses and Strains in Flexible Pavements - Three Layer Systems - Principle of Viscoelastic Stresses	
Week 3	Computer Programs for Flexible Pavements Stress and Strains Analysis	
Week 4	Stresses and Strains in Rigid Pavements; - Curling Stresses - Loading Stresses - Friction Stresses - Combined Stresses - Stresses and Design of Joints, - Stresses and Design of Dowel Bars - Stresses and Design of Tie Bars	
Week 5	6. Computer Programs for Rigid Pavements Stress and Strains Analysis	
Week 7	Environment Effect	
Week 8	Drainage Materials and Design	
Week 9	Equivalent Single Wheel Loads	
Week 10	Equivalent Axle Loads	
Week 11	Traffic Analysis for Pavement Design	
Week 12	Reliability in Pavement Design	
Week 13	Design of Flexible Highway Pavements - AASHTO Method - Asphalt Institute Method and other methods - Design of Flexible Pavement Shoulders	
Week 14	Design of Rigid Highway Pavements - AASHTO Method - PCA Method	
Week 15	Design of Flexible Airport Pavements - Corps of Engineers (CBR) Method - The Asphalt Institute Method	
Week 16	Design of Rigid Airport Pavements: - PCA Method 17. Design of Overlays	

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Understand Pavement Types and Serviceability (Weeks 1-2) Differentiate between highway and airport pavements, recognizing key distinctions in design requirements and performance metrics. Explain the concept of the Pavement Serviceability Index (PSI) and its role in assessing pavement condition over time. Analyze stresses and strains in flexible pavements, including one-layer and two-layer systems, as well as extend this understanding to three-layer systems and principles of viscoelastic stresses in pavement materials. [1L9K1, 1L9K2, 1L9K3, 1L9S2, 1L9C1, 1L9C2, 1L9C4, 1L9C6]	20%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Utilize Pavement Stress and Strain Analysis Tools (Weeks 3 & 5) Demonstrate proficiency in using software programs for flexible and rigid pavement stress and strain analysis. Apply computer-based analysis techniques to simulate stress responses in pavements under various loading and environmental conditions. [1L9K1, 1L9K2, 1L9S1, 1L9S2, 1L9C2, 1L9C4, 1L9S3, 1L9C6]	5%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Evaluate Environmental Impacts on Pavement Performance (Week 7) Assess the effects of environmental factors such as temperature, moisture, and seasonal changes on the performance of both flexible and rigid pavement. [1L9K1, 1L9K2, 1L9S1, 1L9S2, 1L9C1, 1L9C4, 1L9S3, 1L9C6]	5%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Design Drainage Systems for Pavement (Week 8) Identify suitable drainage materials and design effective drainage systems that enhance pavement longevity and prevent water-related damage. [1L9K2, 1L9K3, 1L9S1, 1L9S2, 1L9C2, 1L9C4, 1L9C6]	10%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Analyze Load Equivalency for Pavement Design (Weeks 9-10) Calculate Equivalent Single Wheel Loads (ESWL) and Equivalent Axle Loads (EAL) for pavement design purposes, considering load distribution characteristics. [1L9K1, 1L9S2, 1L9S3]	10%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Conduct Traffic Analysis for Pavement Design (Week 11) Perform traffic analysis to estimate design traffic loads, including traffic volume, axle load distribution, and growth rate for pavement lifespan predictions. [1L9K1, 1L9K3, 1L9S1, 1L9S3, 1L9C6]	10%	Mid-Term Exam, Final Exam, Project, Presentation and HW
Integrate Reliability Concepts in Pavement Design (Week 12) Apply reliability principles in pavement design to account for variability in traffic, material properties, and environmental conditions, enhancing design accuracy and durability. [1L9K1, 1L9K2, 1L9S1, 1L9C2]	5%	Final Exam, Project, Presentation and HW
Design Flexible and RigidHighway Pavements (Week 13) Use the AASHTO, Asphalt Institute, and other methods to design pavements, considering specific requirements for highway applications and shoulder design. [1L9K1, 1L9K2, 1L9K3, 1L9S1, 1L9S2, 1L9C1, 1L9C2, 1L9C3, 1L9C4, 1L9S3, 1L9C6]	30%	Final Exam, Project, Presentation and HW

Design Flexible and Rigid Airport Pavements (Weeks 15-16) Apply the Corps of Engineers (CBR) and Asphalt Institute methods for designing flexible airport pavements, adjusting for aircraft load demands. Use the PCA method to design rigid airport pavements, addressing unique airport pavement load and performance requirements. [1L9K1, 1L9K3, 1L9S1, 1L9S2, 1L9C1, 1L9C2, 1L9C3, 1L9C4, 1L9C5, 1L9C6]	5%	Final Exam, Project, Presentation and HW

Relationship to Program Student Outcomes (Out of 100%)											
PI-1a	PI-2a	PI-2b	PI-2c	PI-2d	PI-3a	PI-4a	PI-4b	PI-5a	PI-6a	PI-6b	PI-7a

Relationship to NQF Outcomes (Out of 100%)											
L9K1	L9K2	L9K3	L9S1	L9S2	L9C1	L9C2	L9C3	L9C4	L9C5	L9S3	L9C6
13.56	9.16	9.16	9.16	11.74	6.35	9.03	3.23	8.41	0.5	9.31	10.41

Evaluation	
Assessment Tool	**Weight**
Mid-Term Exam	30%
Final Exam	50%
Project	10%
Presentation and HW	10%

Policy	
1. Attendance and Participation	Regular attendance is usually mandatory, with participation in discussions, group work, and presentations often required.
Assignments and Project Deadlines	Timely submission of assignments, including individual projects, and homework, is generally expected.
Exams and Grading Criteria	The course includes two exams, midterm and final, covering theoretical and applied knowledge of pavement design principles. Grading often combines assignment scores, project evaluations, participation, and exams results, with clear rubrics provided.
Academic Integrity	Emphasis on academic honesty is common, with strict policies against plagiarism, cheating, and unapproved collaboration on assignments. Consequences for violations might range from grade penalties to more severe academic actions.
Use of Software and Tools	Students are often required to use specialized software (such as AASHTOWare Pavement ME Design or similar) for simulation and analysis.
Consultation and Office Hours	Office hours were assigned for additional support and may encourage or require students to seek feedback during project work or on complex topics.

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