



College: Engineering Department: Civil Engineering

Course Title: Pavement Design

Course No: 0901406

Credit Hours: 3

Semester: 2021 / 2020

About The Course

Course Title: Pavement Design Class: 1 & 2
Course No: 0901406
Credit Hours: 3 Lecture Room: 409

Obligatory/ Optional: Obligatory

Text Book: Principles of Pavement Design. "Second Edition". E. J. Yoder and M. W. Witczak. 1975, John Wiley & Sons, Inc.

The Instructor

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Course Description

This course covers: Pavement types. Pavement layers and materials: mineral aggregates, aggregate specifications and tests, aggregate gradation, asphalt cement, asphalt cement specifications and tests, factors affecting performance of flexible and rigid pavements. Design of hot-mix asphalt concrete: design objectives and constraints, volumetric properties of asphalt mixtures, design approaches. Stresses and strains in pavements: tire pressure, contact pressure and contact area, stresses and strains in multi-layered systems. AASHTO road test and other road experiments. AASHTO design method: equivalent single axle load (ESAL), design procedure.

Course Objectives

Furnish the student with advance understanding of highway materials
Provide the student with the information needed for the design of different types of pavements.

Learning Outcome

After successfully completing this course, the students should be able to :

1. Understand pavement material characterization
2. Understand principles of design of bituminous mixtures
3. Calculate flexible and rigid pavement stresses (layer systems)
4. Calculate the traffic loads for highways and airports
5. Design flexible and rigid pavements for highways and airports by different methods.

Course Outline and Time schedule

Week	Course Outline
First week	Introduction: Text Book, References, and Outlines
	Types of Pavement
2 nd week	Typical cross section of a conventional flexible pavement.
	Typical cross section of a conventional rigid pavement
3 rd week	Physical Properties of Soils
	Soil Classification

4 th week	Soil Classification: AASHTO System (Numerical Examples)
	Subgrade Soil Strength: Factors and Tests
5 th week	Soil Stabilization and Soil Compaction
	Physical Properties of Soils: (Numerical Examples)
6 th week	First Exam
	Pavement Response under Loads: The basic functions of pavement courses
7 th week	Stresses and Deflection: Contact Area between tire and pavement
	Stresses and Deflection: Basic Types of Wheel Configuration
8 th week	Multi Layer Elastic Theory: Concepts and assumptions
	Multi Layer Elastic Theory: Boussinesq Theory (one layer theory)
9 th week	Multi Layer Elastic Theory: Burmister Theory (two layer theory)
	Multi Layer Elastic Theory: Conversion Theory
10 th week	Multi Layer Elastic Theory: Numerical Examples
	Multi Layer Elastic Theory: Numerical Examples
11 th week	Second Exam
	Traffic Loading and Volume: Design Procedures
12 th week	Equivalent Single-Wheel Load (ESWL): ESWL based on equal vertical subgrade stress
	Equivalent Single-Wheel Load (ESWL): ESWL based on equal vertical deflection
13 th week	Equivalent Single-Wheel Load (ESWL): Numerical Examples
	Design of Flexible Pavements: AASHTO Method
14 th week	Design of Flexible Pavements: AASHTO Method (Numerical Examples)

	Design of hot-mix asphalt concrete
15 th week	Final Exam

Presentation methods and techniques

Methods of teaching varied according to the type of text, student and situation. The following techniques are usually used:

- 1- Lecturing with active participations.
Involve the civil engineering students in asking some questions related to the target topic of the course.
- 2- Problem solving.
Encourage the students to solve the given assignments and submit them at the definite time,
- 3- Cooperative learning.
By enhancing the students studying in groups .
- 4- Discussion.
To discuss the results and the answers of the target problems.
- 5- Learning by activities.
To encourage the students to some group activity.
- 6- Connecting students with different sources of information.

Sources of information and Instructional Aids

Power Point

Using weight board.

Assessment Strategy and its tools

The assigned syllabus is assessed and evaluated

Through: feed back and the skills that are acquired by the students

The tools:

Formal (stage) evaluation

- | | |
|-------------------------------|-----|
| a) Class Participation | 10% |
| b) Group activity and Quizzes | 10% |
| c) 1st Exam | 20% |
| d) 2nd Exam | 20% |

Tool & Evaluation

Tests and quizzes are permanent tools & assessment, in addition to the activity file which contains curricular and the co-curricular activities, research, report papers and the active participation of the student in the lecture.

The following table clarifies the organization of the assessment schedule:

Test	Date	Grade
First Exam		20%
2 nd Exam		20%
Activities & Participation	Students should be notified about their marks	20%
Final Exam		40%

Activities and Instructional Assignment

- 1- Practical assignments to achieve the syllabus objectives.
- 2- Group Activity and demonstrations.

Regulations to maintain the teaching-Learning Process in the Lecture:

- 1- Regular attendance.
- 2- Respect of commencement and ending of the lecture time.
- 3- Positive relationship between student and teacher.
- 4- Commitment to present assignments on time.
- 5- High commitment during the lecture to avoid any kind of disturbance and distortion.
- 6- Allowed Absence percentages is (15%).

Internet websites

1. <https://www.fhwa.dot.gov/>
2. <https://www.pavementinteractive.org>

References :

1. AASHTO: Guide for Design of Pavement Structures (1993)
2. Traffic and Highway Engineering. 2009. Nicholas J. Garber and Lester A. Hoel. Fourth Edition. University of Virginia.
3. Pavement Analysis and Design. Second Edition. Yang H . Huang

Syllabus Classification

Objectives	Learning outcome	Assessment tools
<ul style="list-style-type: none"> • Introduction to the pavement types. Typical cross section of a conventional flexible pavement. Typical cross section of a conventional rigid pavement. 	<p>To produce student in civil engineering to be familiar with different types of pavements.</p>	<p>Power point and weight board.</p>
<ul style="list-style-type: none"> • Physical Properties of Soil: Soil Classification (AASHTO System), Subgrade Soil Strength (Factors and Tests), Soil Stabilization and Soil Compaction 	<p>To improve the ability of the student to evaluate different types of soil</p>	<p>By using solved problems. Power point and weight board</p>
<ul style="list-style-type: none"> • Pavement Response under Loads and Multi-Layer Theory 	<p>Introducing the student to the concept and methodology of:</p> <ul style="list-style-type: none"> - Stresses and Deflection - Contact Area between tire and pavement - Basic Types of Wheel Configuration - Multi-Layer Elastic Theory and its assumptions 	<p>By using solved problems. Power point and weight board</p>
<ul style="list-style-type: none"> • Design of Flexible and rigid Pavements 	<p>Enable students to understand and use Methods of designing paving layers Design of asphalt mixtures</p>	<p>By using solved problems. Power point and weight board</p>

