

Course	CE 31600 – Civil Engineering Materials Laboratory
Type of Course	Required for Civil Engineering Program
Catalog Description	Introduction to civil engineering materials laboratory and design of experiments, with focus on mechanical and physical properties of construction materials; including measurement of strains using mechanical gauges and electrical resistance strain gauges; experiments on metals, aggregates, Portland cement, concrete, asphalt and asphalt mixtures, and wood.
Credits	1
Contact Hours	3
Prerequisite Courses	CE 31500
Corequisite Courses	None
Prerequisites by Topics	Civil Engineering Materials
Textbook	M. Mamlouk and J. Zaniewski, <i>Materials for Civil and Construction Engineers</i> , Pearson - Prentice Hall, Current Edition.
Course Objectives	<p>The objective of this course is to understand the characteristics and behavior of civil engineering materials used in buildings and infrastructure.</p> <p>Students will learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.</p> <p>Students will have exposure to practical applications including writing of a technical report related to each experiment.</p>
Course Outcomes	Students who successfully complete this course will be able to:

1. Prove good understanding of concepts and their applications in the lab. [1, 7]
2. Write formal technical report & convey engineering message efficiently. [3]
3. Understand ethical issues associated with engr. experiments and professional practice. [4]
4. Work in teams to perform experimental tasks. [5]
5. Use commercial engineering test equipment [Tinus Olsen Test Machine and Charpy Impact Tester] to determine mechanical properties of engineering materials. [6, 7]
6. Experimentally verify the assumptions made in the study of CE Materials. [2, 6]
7. Evaluate the strength and toughness properties of steel and aluminum. [6]
8. Determine the gradation, moisture content, unit weight, absorption capacity, voids content, and specific gravity of coarse and fine aggregate samples. [6]
9. Determine the initial and final setting times of Portland cement. [6]
10. Design and make conventional and high performance Portland cement concrete mixtures and evaluate their fresh and hardened properties. [1, 2, 6]
11. Understand the process of preparation of asphalt concrete specimens using the gyratory compactor and determining its bulk S.G. and the binder content. [6, 7]
12. Evaluate the strength of wood. [6]
13. Statistically analyze and interpret laboratory test results. [6, 7]

Lab Topics

1. Introduction and lab safety
2. Measurement devices and concepts
3. Impact test on steel
4. Tension test on steel and aluminum
5. Aggregates gradation, bulk unit weight and voids
6. Aggregates moisture conditions and S.G.
7. Normal consistency and setting times of Portland cement
8. Slump test, air content test using the pressure method, unit weight test, and preparation of concrete cylinders and beams
9. Project: Design conventional and high performance concretes to meet specific requirements and limitations in the plastic and hardened concrete states. Students will verify their design by making and breaking specimens to test their compressive strength.
*** field trip to Erie Haven Concrete, Inc., Fort Wayne, IN.
10. Microscopic inspection of concrete and metal samples

11. Nondestructive testing of concrete using the rebound hammer
12. Compression test on wood
13. Preparation of AC specimens using the gyratory compactor and measuring the bulk S.G. of asphalt concrete samples
*** Experiments will be conducted at City of Fort Wayne Asphalt Plant and Materials Lab

Computer Usage	Medium
Laboratory Experience	High
Design Experience	Low
Coordinator	Fawad S. Niazi, Ph.D.
Date	22 August 2022