College of Engineering

Department of Civil Engineering

CE 432 Highway Laboratory

Credit and Contact hours	1 / 0 (Lectures), 0 (Tutorials), 2 (Laboratory)
Required, or Elective	Required for a BSCE degree
Course Description	Highway materials, Purpose of highway materials testing, sampling methods, soil and aggregate properties and testing, bituminous material properties and testing. Dituminous mix design and distresses of asphalt pavements.
Prerequisites or Co-requisites	**Pre-requisites:** CE 430 (Transportation Systems), CE 380 (Soil Mechanics Laboratory), CE 382 (Geotechnical Engineering-I). **Co-requisites:** CE 431 (Highway Engineering).
Course Learning Outcomes	Students completing this course successfully will be able to

Course Learning Outcomes	*Related Student Outcomes (SO)*
CLO1. Investigate the properties of paving materials (aggregates, soils, and bituminous binders) by using standard test methods to draw conclusions on its compliment with the relevant specifications.	**SO6**
CLO2. Analyze the properties of hot mix asphalt mixtures and interpret their effect on pavement performance.	**SO6**
CLO3. Design hot mix asphalt for different pavement conditions by Superpave and Marshall Methods.	**SO2**

Student Outcomes related to this Course	**SO2**. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. [ABET 2] **SO6.** An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. [ABET 6]

<table>
<tr><td>Topics Covered</td><td>
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<tr><th>List of Topics</th><th>Related CLOs</th></tr>
<tr><td>1. Highway Materials types, purposes of highway materials testing disadvantages)</td><td>CLO1</td></tr>
<tr><td>2. Aggregates characteristics and testing
- Grain-size Analysis of coarse and fine Aggregates (Sieve Analysis - AASHTO Designation T27)
- Resistance to Wear (Los Angeles Abrasion Test)
- Durability (Resistance to Weathering) (Soundness Test, AASHTO Designation T104).
- Specific Gravity and Absorption of coarse and fine Aggregates.
- California Bearing Ratio (CBR) of coarse and fine aggregates Test.
- Sand Equivalent Test.</td><td>CLO1</td></tr>
<tr><td>3. Bituminous Materials characteristics and testing:
- Specific Gravity (AASHTO Designation T228)
- Flash Point (Cleveland Open Cup), (AASHTO Designation T48).
- Solubility of Bituminous Materials (AASHTO Designation T228).
- Kinematic Viscosity (AASHTO Designation T201)
- Penetration Test (AASHTO Designation T49).
- Softening Point (ring and Ball Method), (AASHTO Designation T53).
- Ductility Test (AASHTO Designation T51).
- Thin-Film Oven Test (AASHTO Designation T179).
- Pressure Aging Vessel (PAV)
- Dynamic Shear Rheometer (DSR)
- Bending Beam Rheometer (BBR)
- Direct Tension Test (DTT)</td><td>CLO1</td></tr>
<tr><td>4. Design of Hot Mix Asphalt part 1
- Distresses of Asphalt Pavements
- Desired properties of Hot Mix Asphalt
- Effect of HMA properties on pavement performance</td><td>CLO2</td></tr>
<tr><td>5. Design of Hot Mix Asphalt part 2
- Marshall Mix Design Method
- Superpave Mix Design Method</td><td>CLO3</td></tr>
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<tr><td>Textbook(s) and Other Required Material</td><td>Highway Engineering, 7th Edition, (2004), by Paul H. Wright & Karen Dixon</td></tr>
<tr><td>Grading System</td><td>Two Mid-term Exams 40 %
Lab Reports 10%
Design Project 5%
Homework/quizzes 5%
Final Exam: 40%</td></tr>
<tr><td>Instructors</td><td>Dr. Hamad A. Alsolieman (2A22), email; halsolieman@ksu.edu.sa</td></tr>
<tr><td>Date of Review</td><td>November, 2020</td></tr>
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