COURSE OUTLINE

Course Number	Course Title	Credits
CIV216	**Highway Engineering**	**3**

Hours: Lecture/Lab/Other	Co- or Pre-requisite	Implementation Semester & Year
2/2/0	**ENT116, CIV102, DRA190 or divisional permission**	**Spring 2022**

Catalog description:

Explores the planning, design, construction, and characteristics of highways and city streets, including layout, traffic requirements, safety and control, drainage, sub-grade structure, base courses, and surface pavements. Problems to be solved include geometric design, traffic volume, channelization, and hydrology. Lab projects involve roadway designing.

General Education Category:
Not GenEd

Course coordinator:
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Required texts & Other materials:

Highway Engineering, latest edition
Oglebsy
Wiley & Sons
ISBN-13: 9780471029366

Course Student Learning Outcomes (SLO):
Upon successful completion of this course the student will be able to:

1. Demonstrate highway terminology. [Supports ILG 1; PLO 1]
2. Demonstrate the design requirements for roads and highways. [Supports ILG 1, 11; PLO 1]
3. Demonstrate the construction and inspection requirements of roads. [Supports ILG 1, 11; PLO 1]
4. Demonstrate safety, traffic analyses and vehicle abilities in the design of roads. [Supports ILG 1, 11; PLO 1]
5. Demonstrate drainage design for roads. [Supports ILG 1, 2, 4, 11; PLO 1]
6. Demonstrate the relationship between surveying, and highway design and layout. [Supports ILG 1, 2, 11; PLO 1]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Civil Engineering Technology (PLO)

1. Prepare designs for highways, buildings, and bridges.
2. Perform route/construction surveys using survey equipment and methods.
3. Test and analyze various construction materials.
4. Prepare design drawings.

Units of study in detail – Unit Student Learning Outcomes:

Unit I   Terminology, Highway Planning and Economy [Supports Course SLO #1, 2, 3]

Learning Objectives
The student will be able to:
- Describe the major areas of study and analysis for highway development.
- Describe the different types of governmental highway systems, and give real examples of each.
- Discuss the Interstate Highway system.
- Describe the highway types.
- Describe several highway organizations and associations.
- Describe the various classes of data that must be complied in highway planning.
- Describe the costs to be included in highway economy studies.
- Compute motor vehicle operating costs to the highway user.
- Describe the requirements for a small shopping center parking lot as to space dimensions and angles, driveway widths and turning radii.

Unit II   Road Characteristics; Highway Design [Supports Course SLO #1, 2, 3, 4]

Learning Objectives
The student will be able to:
- Define "perception time" and "reaction time," and give recommended design values.
- Differentiate between the four methods of estimating future traffic volumes.
- Define and calculate service volumes of highways considering the effects of sight distance, obstructions, grades, land widths and commercial vehicles.
- List the factors that reduce highway capacity.
- Compute safe stopping and passing distances for level roadways and for vertical curves in crest or sag.
- Compute super-elevation requirements for horizontal curves considering design speed, friction and radius in the calculations. Describe the meaning of "runout" as it applies to super-elevation of horizontal curves.
- Compute stations and elevations along horizontal and vertical curves.
- Sketch typical cross sections and profiles of highways.
- List the values of typical lane widths, grades and design speeds.
- Determine the minimum vertical curve length to provide safe stopping sight distance and safe passing sight distance.
- Determine the appropriate speed degree of curvature and/or radius for horizontal curves.

<u>**Unit III**</u>　　　**Traffic Engineering [Supports Course SLO #1, 2, 3, 4]**

　　　<u>***Learning Objectives***</u>
　　　The student will be able to:
- Describe various channelizing devices.
- List and describe the general types of intersections at grade and grade separated, and list the advantages and disadvantages of each.
- Draw a space-time diagram between two intersections given the traffic signal cycles.
- Calculate the ideal distance between the intersections given the space-time diagram and the roadway design speed.
- Calculate the ideal speed between two intersections given the distance and traffic signal cycles.
- State the advantages and disadvantages of traffic signals.
- Define traffic actuated and fixed time signals.
- Describe the general contents of the "Manual of Uniform Traffic Control Devices."
- List and describe the various types of traffic control devices.

<u>**Unit IV**</u>　　　**Highway Drainage [Supports Course SLO #1, 2, 3, 4, 5, 6]**

　　　<u>***Learning Objectives***</u>
　　　The student will be able to:
- Compute the water runoff from a drainage area, given the storm frequency, character and slope of ground surface using available charts and graphs and the "rational formula.".
- Explain the meaning of each parameter in the "rational formula."
- Design a circular pipe, trapezoidal culvert and rectangular culvert to efficiently carry a particular water flow, under free flow conditions, using available charts and graphs and the Manning Formula.
- Analyze a given storm drain system for various flow parameters, such as velocity and flow using the Manning Formula.
- Set-up in tabular form the necessary chart for completely analyzing or designing a simple storm drain system.
- List and describe various drainage structures such as manholes, inlets, end-walls and headwalls.
- Classify sub-critical and supercritical flow.

<u>**Unit V**</u>　　　**Sub-grades, Base Courses and Surface Courses [Supports Course SLO #1, 2, 3]**

　　　<u>***Learning Objectives***</u>
　　　The student will be able to:
- Sketch a cross section of a roadway including a description of "surface courses," "base course," "sub-base" and "sub-grade."
- List and describe the soil characteristics which influence the quality of sub-grades under highway pavements.
- Describe the different types of base courses.
- Describe the correct procedures for constructing base courses.
- Contrast and compare rigid and flexible pavements.
- List and/or define the methods for the design of flexible pavements.
- Design a flexible base pavement using the AASHO Method.

- Compare and contrast "elastic," "consolidation" and "plastic" deformations as they apply to loadings of flexible pavements.

<u>Unit VI</u>   **Bituminous Materials and Production Processes [Supports Course SLO # 1, 2, 3]**

<u>Learning Objectives</u>
The student will be able to:
- Explain the procedure for manufacture of "asphalt cements" and "rapid curing," "slow curing," "medium curing" and emulsified asphalt binders.
- Compare and contrast the uses of the various materials listed above.
- List and define the various methods for testing the stability of bituminous concrete mixtures.
- Explain the correct construction procedure for the spreading and compacting of bituminous concrete base and surface courses.
- Explain the various steps in the preparation of bituminous concrete mixtures in a "batch type" plant.
- Define the various types of surface treatments used to restore existing bituminous concrete and stone roads.
- List the items that an inspector should look for at the site of bituminous concrete construction.

Evaluation of student learning:

Course student learning outcomes will be assessed by the following activities:

Tests (2)	40%
Lab and Homework	40%
Final Exam	20%