Course Syllabus

CEE 4407 - Transportation Design
College of Engineering
Spring 2018

Instructor Information

Instructor:	Pasi Lautala, PhD, P.E., Associate Professor
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Course Identification

Course Name:	Transportation Design
Course Location / Times:	MW 11:05 – 11:55am (130 Fisher) Th 1:05 - 2:55pm (330 EERC)
Prerequisites:	CE 3401 (or CEE3401) and SU 2000. May not be enrolled in one of the following classes: Freshman, Sophomore.

Course Description/Overview

Catalog Description: Introduction to computer aided geometric design of highways and railways. Covers design principles and use of standards for horizontal and vertical alignments and cross sections, including road intersections, railway turnouts and grade crossings. Students develop engineering drawings and related cost estimates for road/rail project

Course Learning Objectives

Upon successful completion of this course, students will be able to:

1. Understand the roadway and railroad track design principles using current recommended practices, standards and guidelines.

2. Understand interrelationships between design, document production and construction in road and rail related projects.
3. Recognize the similarities and differences in railroad track versus roadway design.
4. Demonstrate ability to apply the design principles and guidelines in a computer-aided design process.
5. Demonstrate fundamental level capabilities in using MicroStation and Geopak software for a design application.
6. Participate in a team to apply the principles and tools toward developing set of design plans and documents.

Course Resources

Course Website(s)

- Canvas http://www.courses.mtu.edu

Required Course Text

- No specific textbook.
- Selected guidelines/standards and texts from various sources, including industry track manuals by various Class 1 railroads and AREMA Practical Guide for Railway Engineering (for rail), and MDOT Design Manual and Geometric Design Guide, MMUTCD, MDOT Standard Plans and selected excerpts from Traffic and Highway Engineering, 5th Edition, Nicholar J. Garber and Lester A. Hoel, University of Virginia, Cengage Learning. Bentley materials for MicroStation and Geopak. Handouts and other additional material provided by the instructor.

Grading Scheme

Grading System

Letter Grade	***Percentage***	***Grade points/credit***	***Rating***
A	93% & above	4.00	Excellent
AB	89% – 93%	3.50	Very good
B	85% – 89%	3.00	Good
BC	80% – 84%	2.50	Above average
C	75% – 80%	2.00	Average
CD	70% – 75%	1.50	Below average
D	64% - 70%	1.00	Inferior
F	63% and below	0.00	Failure

I	Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control. A grade of incomplete may be given only when approved in writing by the department chair or school dean.
X	Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up within the next semester in residence or the grade becomes a failure (F). A (X) grade is computed into the grade point average as a (F) grade.

Grading Policy

Grades will be based on the following:

"U.S. roadway/railroad project" presentation	10%	60 pts
Final roadway/railroad track design project plans and report	45%	270 pts
Attendance and participation (includes potential quizzes/competitions)	10%	60 pts
Homework assignments (including MicroStation)	35%	210 pts
Total Percentage / Points	**100%**	**600 points**

The grading of the class will incorporate following methods.

- No written tests are expected during the course (this can be modified if poor class preparation among participants becomes evident), but online and written quizzes and level of active participation during class sessions will be used to evaluate participation grade.
- All absences from the class must be approved by the instructor in advance and students are responsible for securing their access to materials covered during the missed lectures/labs. Active participation and proper preparation to team activities and to interactive lectures are absolutely essential to the success. Each student will provide early feedback on course progress and end of semester feedback on the performance of themselves and their team members. These will be compared with the instructor's evaluation. In total, attendance and participation (including in-class competitions) will affect 10% of the overall grade.
- Homework assignments include both calculations and individual MicroStation/Geopak assignments. They will be used to test the knowledge on instructional material covered during interactive lectures and capability to produce basic designs in MicroStation/Geopak. These homework assignments will account for 35% of the overall grade.

- There will be one team presentation session and design project/written report during the course. First will be in selected U.S. roadway/railroad project and second the final design project. The final project presentation and report (including design plans) will form the majority of the grade (55%). The grades will be based on the quality of the presentations, plans and reports and are determined by course instructor and the evaluations by the fellow students and invited guests. The grade for the presentations and project will be the same for each team member. The design plans and reports will be graded in their draft form, but 50% of the points lost in the draft report grade will be rewarded to those teams, who sufficiently address the reviewer comments in the final report.

Late Assignments

Late submittals of assignments will cause **automatic 50% reduction of available points**, unless exceptional circumstances have prevailed, as determined by the instructor. Assignments will be submitted in electronic or paper format, based on instructor instructions.

Course Policies

Any absence from the class must be discussed in advance and absence without permission will affect negatively to the participation portion of the grade. In case conflicts arise within team members, the teams are expected to solve potential conflicts internally and are advised to approach the instructor for conflict resolution only when internal efforts haven't been effective.

Collaboration/Plagiarism Rules

Collaboration on individual and group assignments is HIGHLY recommended, but each student must submit their own assignments, unless otherwise instructed. One submission by each group is required for group assignments.

Cell phones, Blackberries, iPods, PDAs, or any other electronic devices are not to be used in the classroom unless related to the instructional process. Please make sure to bring a calculator with you to class. Calculators on other devices are strictly prohibited. Information exchanges on these devices during class are also prohibited and violate the Academic Integrity Code of Michigan Tech.

University Policies

Current university academic policies for course syllabi can be found at https://www.mtu.edu/ctl/instructional-resources/syllabus/policies/index.html . All students should be aware of these policies.

Student work products (exams, essays, projects, etc.) may be used for purposes of university, program, or course assessment. All work used for assessment purposes will not include any individual student identification.

Course Schedule

Tentative content: (lecture / lab topics may be reorganized or changed as deemed necessary. Detailed assignment schedule can be found at the Canvas site.

Module	Week(s)	Topics/Activities
1	**1**	**Welcome to transportation design course & Road/Railroad Project process** • Monday, Jan 15, MLK Day Recess (No class) • Review of the syllabus and Canvas Site. • Introduction to the reference materials. • Roadway vs. railway principles; similarities and differences • Transportation project justification and introduction to the project phases/steps. • **Team Ass 1. – U.S. Rail/Road Project Presentations** • **Lab: MS 1 – Introduction to Microstation.** Getting started with MicroStation. Doing the setup, discussing the levels and completing a tutorial.
2	**2-3**	**Geometric design principles –Horizontal curves and transitions** • Horizontal curves and railroad vs. highway curve comparison. Arc/chord definition in curve design, limits of curvature and reasons behind them. Design speeds and stopping sight distances. • Curve and superelevation transitions • **Ass 1. Curve Calculations & Transition Design** • **Lab: MS 2 – Introduction to Geopak** • **Lab. MS 3 – Curve & Transition Design**
	1/24	***Last day to drop full semester courses with a refund*** ***Last day to add full semester courses or change a section***
	2/02	***Last day to drop full semester courses without a grade appearing on the academic record - No Refund***
3	**4**	**Geometic design principles – Turnouts and Intersections** • Geometric design of diverging locations (railroad turnouts and roadway intersections). Design vehicles/speeds. • Critical dimensions and design parameters. • **Ass 2. Turnout/Intersection Design** • **Lab: MS 4 – Turnouts/Intersections (on Week 5)**
	2/7-9	***Winter Carnival***

4	**5**	**Geometric design principles – Alignments and Clearances** • Horizontal alignment development and critical points. • Alignment development and stationing. Horizontal and vertical clearance considerations. • **Ass 3. Alignment Design** • **Lab: MS 5 – Horizontal Alignments (Week 6)**
5	**6-7**	**Vertical design principles** • **U.S. Railroad Project poster/presentation session.** • Introduction to vertical curves and profiles. • Limits of grades, vertical curves and reasons behind them. No vertical curve areas and special considerations for vertical curves. • Track profile development principles and design. Matching profile elevations • **Ass 4. Vertical Curves & Alignments** • **Lab: MS 6 – Vertical Alignments (Week 7)** • **Team Ass 2. – Final Project.**
6	**8**	**RR/Road Structure and Cross-sections** • Introduction to structural components and related materials. • Typical sections, cross sections and critical issues in developing existing and proposed cross sections. • Drainage considerations. • **Lab: MS 7 – Typical section development & Plan Production**
Week 8.5		**Spring Break**
7	**9**	**Grade crossing/pavement markings design** • Types and materials used in the crossings. • Critical geometric design elements and considerations. • Roadway pavements markings. Other MUTCD issues. • **Guest railroad design lecture (tentative)**
8	**10-11**	**Quantity and Cost estimates for rail projects** • Quantity takeoffs from design documents and cross sections. Typical work items descriptions and units. • Unit costs and their application in the process. Different types of contracts at the unit cost estimate. Other types of cost estimates and alternative comparisons through cost estimates. • Applying quantity and cost data to a project environment. • Developing engineer's estimate. • **Ass 5. Quantities and costs**

	3/30	***Last day to drop full semester courses with a grade of 'W'***
9	**12-13**	**Other considerations and construction process** • Utilities • Environmental challenges and considerations. • Construction documents and specifications. • **Guest roadway design lecture (tentative)** • **Draft Final plans due.**
10	**14**	**Feedback and conclusions** • Feedback on draft design plans to be incorporated in the final reports. • Course feedback session. • **Draft Final Reports due**
10	**Finals week**	**Final plans and reports due (TBD).**