



Course Syllabus
CE4404 – Railroad Engineering
Civil and Environmental of Engineering
Fall 2014

Instructor Information

Main Instructor: Pasi Lautala, PhD, P.E., Assistant Professor, CEE
Director, Rail Transportation Program

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Assistants: David Nelson (301 J Dillman Hall, dannelso@mtu.edu)

Course Identification

Course Number (CRN): 83248

Course Name: Railroad Engineering

Course Location: 214 Dillman Hall

Class Times: Tu, Th 3:35 -4:50 p.m.

Prerequisites: Junior standing or above

Course Description/Overview

This 3 credit course provides an overview of basic elements, roles and terminology of rail transportation, including history, organizations and economics, infrastructure, track-train dynamics, safety, intercity and urban passenger rail, freight operations and capacity, signals and communications, motive power and equipment, construction and maintenance.

The course will incorporate several different instructional methods. Some of the methods used during the course include reading and other assignments, interactive class discussions and exercises, field visits and open ended investigations. The interactive lectures and classroom activities will be used to review the materials covered outside the class periods. The purpose is to clarify the potential misunderstandings of assignments and to provide a deeper understanding to the content through guided discussion. Guest lecturers by industry professionals and real life examples are used to link the covered material to the real industry problems. Discussions and short presentations are geared toward improvements in oral output. Videos and potential field visits are used to provide the link between the topics studied and the actual practices. This will deepen the students' understanding of the topics by providing visual examples of the course contents.

Course Learning Objectives

Course has three key goals:

- 1) Understanding the uniqueness of rail transportation, when compared with other transportation modes and recognizing the elements that together form a complete rail transportation system.
- 2) Providing fundamental knowledge of each key element in the system and introduce students to commonly used terminology, tools and methodologies.
- 3) Improve student's skills to analyze and utilize covered material by making questions and through individual and group research and will require students to use creative thinking and team work for solving open ended problems.

Course Resources

Course Website(s)

- Canvas <<https://mtu.instructure.com/login>>

Required Course Text

- No required text.
- Selected texts from various book sources, handouts and other additional material will be provided by the instructor during the course and through Canvas course site. Students are encouraged to look for additional information from the internet, CN Rail Transportation Education Center (316 Dillman Hall) and library sources.
- Examples of references:
 - *"The Railroad, What It Is, What It Does, 5th Edition"*, by John Armstrong
 - *Practical Guide for Railroad Engineering* by AREMA,
 - *Railroad Operation and Control* by Joern Pachl,
 - *All About Railroading* by William Vantuono, and
 - *Railway Engineering, 2nd Edition* by William Hay.

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:

Grade division	Percent of total grade
Tests	30%
Assignments and projects	55%
Attendance and Participation (includes ungraded assignments and potential quizzes used to evaluate student understanding)	15%
TOTAL	100%

Course assignments and tests are mainly open book and are designed to enhance students' capabilities to use collaboration and team work toward one common goal. They will also enhance students' independent analyzing skills and help them apply data to the practical applications. It is extremely important that all the deadlines are honored, unless agreement for extension has been negotiated in advance.

The grading of the class will incorporate following methods.

- There will be two graded tests during the course. They will both be open book format. The tests consist of all the material covered to date, but second test will concentrate heavily on later part of the course. Tests include all topics introduced to the class, including student research and presentations. The first test can be retaken orally to recover max. 50% of the lost points within a given timeframe after original has been returned.
- Individual group and assignments will be used during the course. Teams are organized across disciplines to enhance interdisciplinary activities. Assignments often include a team presentation followed by discussion or a debate. If significant portions of an assignment are missing or inaccurate, assignment must be resubmitted with corrections.
- The objective of readings videos, etc., provided in Canvas prior to the class is to provide students with necessary background for the topic and to prepare them for discussions during the class. Most pre-class assignments will come with questions for discussion during the following meeting. In case of continuing poor

- preparations by participants, quizzes may be added to the beginning of each class to assess the knowledge of the assignment.
- Active participation in the class discussions and preparation to each day's class are absolutely essential to the success. All class meetings are interactive and will utilize questions and discussions that require continuous participation by students. Any absence from the class must be discussed in advance and absence without permission will affect negatively to the participation portion of the grade.
 - Attendance and participation grade is based on Instructor's evaluation and student self-evaluation, which is performed in the middle and at the end of the semester. In the evaluation, students will evaluate, how many points they have earned in each 4 participation categories (on-time appearance, participation activity, timeliness and quality of homework, efforts for group learning). This will be compared to instructor and peer evaluation and final participation grade will be determined by instructor after comparison.
 - In addition to the official instructor evaluation, students are encouraged to provide informally both oral and written feedback about instructor's performance. A Canvas discussion forum will be set up for submitting anonymous feedback. An informal feedback session will be held at mid-term and in the end of semester to review the course progress and to identify necessary improvements.

Late Assignments

Late submittals of assignments will cause automatic 50% reduction of available points, unless prior approval has been obtained, or 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 second absence without permission will affect negatively to the participation portion of the grade. 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 **recommended**.

Cell phones, Blackberries, iPods, PDAs, or any other electronic devices can be used in the classroom for Railroad Engineering education related activities only. Please make sure to bring a calculator with you to class. Information exchanges on these devices during class are prohibited (unless otherwise advised) and violate the Academic Integrity Code of Michigan Tech.

University Policies

Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled in accordance the University's policies.

Academic Integrity:

<http://www.mtu.edu/dean/conduct/policy/academic-integrity/>

If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please your instructor as soon as possible so that we can make appropriate arrangements.

Disability Services:

<http://www.mtu.edu/dean/disability/policies/>

The Affirmative Action Office has asked that you be made aware of the following:

Michigan Technological University complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office at 487-2212. For other concerns about discrimination, you may contact your advisor, Chair/Dean of your academic unit, or the Affirmative Programs Office at 487-3310.

Affirmative Action:

<http://www.admin.mtu.edu/aao/>

Equal Opportunity Statement:

<http://www.admin.mtu.edu/admin/boc/policy/ch5/>

Course Schedule

The schedule may be changed during the semester to accommodate the needs of students, instructors, or guests.

Approx. 42 hrs of lectures (including field visit)

<i>Week</i>	<i>Topic(s)</i>	<i>Tentative Assignments</i>
<i>Week 1 (9/2)</i>	Introduction to Railroads <ul style="list-style-type: none"> • Railroad history • Rail transportation in the U.S. today and tomorrow • Railroad organizations 	<ul style="list-style-type: none"> • <i>Assignment 1. Train simulator (20 points)</i>
<i>Week 2 (9/9)</i>	Train dynamics and energy <ul style="list-style-type: none"> • Train dynamics and resistance • Train performance • Energy usage 	<ul style="list-style-type: none"> • <i>Assignment 2. Dynamics and energy (20 points)</i>
<i>Week 3 (9/16)</i>	Railroad Track & Design <ul style="list-style-type: none"> • Track components and terminology • Track classification • Special trackwork • Track geometry and design 	<ul style="list-style-type: none"> • <i>Assignment 3. Components and Geometry (25 points)</i>
<i>Week 4 (9/23)</i>	Urban transit and passenger rail (Guest Lecturer, Dr. Bill Sproule) <ul style="list-style-type: none"> • Types of urban transit • History, today and future of commuter and intercity passenger rail in the US 	<ul style="list-style-type: none"> • <i>Assignment 4. Urban transit (10 points)</i>
<i>Week 5 (9/30)</i>	High Speed Passenger Rail (Guest Lecturer, David Nelson / Hamed Pouryousef) <ul style="list-style-type: none"> • Introduction to High speed rail technologies (self-study at http://rail-learning.mtu.edu/) • High speed rail in the world and in U.S. 	<ul style="list-style-type: none"> • <i>Assignment 5. HSR (15 points)</i>
<i>Week 6 (10/7)</i>	Railroad Safety, Railroad Organization & Careers <ul style="list-style-type: none"> • Railroad safety and performance • Railroad worker safety course • Grade crossings and trespassers • Railroad organizations and careers 	<ul style="list-style-type: none"> • <i>Assignment 6. Safety course (20 points)</i>
<i>Week 7 (10/14)</i>	Industry visit, and Test #1 <ul style="list-style-type: none"> • Tuesday class replaced with <i>Rail Day and Railroad Night Activities</i> • <i>Final debate/report assignment</i> • <i>Test #1 (Thursday)</i> 	<ul style="list-style-type: none"> • <i>Assignment 7. Industry Day Paper (10 points)</i> • <i>Final Project</i> • <i>Test #1 - (75 points)</i>

Week 8 (10/21)	Motive Power and Rolling stock <ul style="list-style-type: none"> • Locomotive and rail car types and components • North American fleet characteristics • New technologies • Train brakes 	<ul style="list-style-type: none"> • Assignment 8. Motive power (20 points)
Week 9 (10/28)	Railroad and Terminal Operations <ul style="list-style-type: none"> • Freight train types and configurations • Movement of cars and trains • Yard operations and activities (interchanges, classification, etc.) • <i>Test #1 Re-takes</i> 	<ul style="list-style-type: none"> • Assignment 9. Operations (20 points)
Week 10 (11/4)	Train Performance, Capacity and Scheduling <ul style="list-style-type: none"> • Train performance and metrics • Capacity factors and metrics • Train movements and schedules • Capacity calculations and tools 	<ul style="list-style-type: none"> • Assignment 10. Capacity and Scheduling (15 points)
Week 11 (11/11)	Signals and communications (Guest Lecturer, Eric Peterson, Retired CSX) <ul style="list-style-type: none"> • Types of railroad traffic control • Other communication features • Positive train control (PTC) • <i>Team Report due</i> 	<ul style="list-style-type: none"> • Team Report Due (50 points)
Week 12 (11/18)	Railroad construction and maintenance <ul style="list-style-type: none"> • <i>Field visit (Tentative)</i> • Construction and maintenance methods • Maintenance alternatives and strategies • Equipment 	
Week TK	Enjoy your TK Break!!!	
Week 13 (12/2)	Test #2 & Team Projects (Railroad Debates) <ul style="list-style-type: none"> • Test #2 • Railroad Debate 1 	<ul style="list-style-type: none"> • Test #2 (75 points) • Railroad Debate (50 points)
Week 14 (12/9)	Team Projects (Railroad Debates) & Course Feedback <ul style="list-style-type: none"> • Railroad Debates 2&3 • Course feedback session at the end of final debate (expect the last debate run 15 minutes late) 	<ul style="list-style-type: none"> • Railroad Debate (50 points)
(Finals week)	-----	