



**Course Syllabus**  
**CE4404 – Railroad Engineering**  
**Civil and Environmental of Engineering**  
**Fall 2012**

***Instructor Information***

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***Course Identification***

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Course Number (CRN): 83638  
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***

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

***Course Learning Objectives and Instructional Methods***

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Course objective is to gain the basic understanding of railroads as a transportation industry. It will approach the subject from multi-discipline perspective where different fields within and outside engineering are merged together to a complete package. Students will be able to recognize fundamental differences between rail and other transportation modes. Students will be exposed to the both sides of rail transportation, passenger and freight and will recognize the similarities and differences between each. They will have a

basic understanding in the fundamentals of the railroad infrastructure and rolling stock, know the principle components and terminologies used in different aspects of rail transportation, and understand the uniqueness of rail transportation, when compared with other transportation modes. They will also be exposed to the considerations required, when designing rail facilities and conducting rail operations. The course will concentrate on North American industry, but will also cover topics in international aspects of railways. It will 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.

The course will incorporate several different instructional methods. Some of the methods used during the course include reading assignments, interactive lectures, guest lectures, class discussions and exercises, field visits and open ended case studies followed by team presentations. The interactive lectures will be used to overview the materials covered in reading assignments. 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 case studies are used to link the covered material to the real industry problems and discussions and short presentations are geared toward improvements in oral output. Videos and 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 Resources***

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### **Course Website(s)**

- Blackboard <<http://www.courses.mtu.edu>>

### **Required Course Text**

- “*The Railroad, What It Is, What It Does, 5<sup>th</sup> Edition*”, Armstrong, John, Simmons-Boardman Books, Inc.
- Selected texts from various sources, handouts and other additional material will be provided by the instructor during the course and through Blackboard course site or public folder. Students are encouraged to look for additional information from the internet, CN Rail Transportation Education Center and library sources.
- Examples of other references:
  - *AREMA Manuals of Recommended Practices*
  - *Practical Guide for Railroad Engineering* by AREMA,
  - *Railroad Operation and Control* by Joern Pachl,
  - *All About Railroading* by William Vantuono, and
  - *Railway Engineering, 2<sup>nd</sup> Edition* by William Hay.

## Grading Scheme

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### Grading System

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

<b>Grade division</b>	<b>Percent of total grade</b>
Mid-term and final test	40%
Assignments and projects	45%
Attendance and Participation (includes ungraded assignments and potential quizzes)	15%
<b>TOTAL</b>	<b>100%</b>

Course assignments 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, including topics

- introduced to the class through student research and presentations. The first test can be retaken orally within a week after original has been returned, as necessary (max. 50% of the lost points may be recovered). In case of continuing poor preparations by participants, quizzes may be added to the beginning of each class to assess the knowledge of the daily reading assignment.
- The objective of assigned book chapters and other reading assignments is to provide students with necessary background for the topic and to prepare them for discussions during the class.
  - Several group and individual 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.
  - Active participation in the class discussions and preparation to each day's class are absolutely essential to the success. All lectures are interactive and will utilize questions and discussions that require continuous participation by students. Each student will self-evaluate their participation twice in the semester and it will be compared to the instructor's evaluation. 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 category (on-time appearance, participation activity, timeliness and quality of homework, efforts for group learning). This will be compared to instructor's 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 Blackboard discussion forum will be set 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 exceptional circumstances have prevailed, as determined by the instructor. Assignments will be submitted in electronic or paper format, based on instructor instructions.

### **Course Policies**

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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**

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Collaboration on individual and group assignments is recommended.

Cell phones, Blackberries, iPods, PDAs, or any other electronic devices are not to be used in the classroom. 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**

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

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 see me as soon as possible so that we can make appropriate arrangements. The Affirmative Action Office has asked that you be made aware of the following:

*Michigan Tech 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, department head or the Affirmative Action Office, at 487-3310*

### **Academic**

**Integrity:**[http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic\\_integrity.html](http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html)

### **Affirmative Action:**

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

### **Disability**

**Services:**[http://www.admin.mtu.edu/urel/studenthandbook/student\\_services.html#disability](http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability)

### **Equal Opportunity Statement:**

<http://www.admin.mtu.edu/admin/boc/policy/ch3/ch3p7.htm>

## ***Course Schedule***

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**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)

*Day*            *Topic*

<b><i>Week</i></b>	<b><i>Topic(s)</i></b>	<b><i>Book chapters (Armstrong)</i></b>
<b><i>Week 1</i></b>	<b>Introduction to railroads</b> <ul style="list-style-type: none"><li>• Railroad history</li><li>• Rail transportation in the U.S. today and tomorrow</li><li>• Railroad organizations</li></ul>	<b><i>Intro &amp; Chapter 1</i></b>
<b><i>Week 2</i></b>	<b>Train dynamics and energy</b> <ul style="list-style-type: none"><li>• Energy usage</li><li>• Train dynamics and resistance</li></ul>	<b><i>Chapter 2</i></b>
<b><i>Week 3</i></b>	<b>Railroad track</b> <ul style="list-style-type: none"><li>• Components and terminology</li><li>• Materials and cross section</li><li>• Track geometry</li></ul>	<b><i>Chapter 3</i></b>
<b><i>Week 4</i></b>	<b>Rolling stock and motive power</b> <ul style="list-style-type: none"><li>• Locomotives</li><li>• Rail car components and types</li></ul>	<b><i>Chapters 4, 5 and 9</i></b>
<b><i>Week 5</i></b>	<b>Railroad safety and braking</b> <ul style="list-style-type: none"><li>• What is train?</li><li>• Train braking</li><li>• Railroad worker safety course</li><li>• Safety performance</li><li>• Grade crossings and trespassers</li></ul>	<b><i>Chapter 6 (and part of 22)</i></b>
<b><i>Week 6</i></b>	<b>Industry visits &amp; mid-term exam</b> <ul style="list-style-type: none"><li>• Industry visits to the classroom (Tuesday)</li><li>• Final project assignment</li><li>• <b>Mid-term test (Thursday)</b></li></ul>	
<b><i>Week 7</i></b>	<b>Signals and communications</b> <ul style="list-style-type: none"><li>• Types of railroad traffic control</li><li>• Other communication features</li></ul>	<b><i>Chapter 7</i></b>

	<ul style="list-style-type: none"> <li>• Positive train control (PTC)</li> </ul>	
<b>Week 8</b>	<b>Urban transit</b> <ul style="list-style-type: none"> <li>• Types of urban transit</li> <li>• History, today and future</li> </ul>	<b>Chapter 17</b>
<b>Weeks 9-10</b>	<b>Intercity and High Speed Passenger Rail</b> <ul style="list-style-type: none"> <li>• Intercity passenger rail in the US</li> <li>• High speed rail systems and technologies</li> <li>• Chinese rail systems (guest lecture)</li> </ul>	
<b>Week 11</b>	<b>Railroad operations</b> <ul style="list-style-type: none"> <li>• Types of freight trains</li> <li>• Movement of cars and trains</li> <li>• Paper path</li> </ul>	<b>Chapters 8, 10, 14-16</b>
<b>Week 12</b>	<b>Terminals and yards</b> <ul style="list-style-type: none"> <li>• Types of yards and components</li> <li>• Interchanging</li> <li>• Classification</li> </ul>	<b>Chapters 11 and 12</b>
<b>Weeks 13-14</b>	<b>Railroad construction and maintenance</b> <ul style="list-style-type: none"> <li>• Construction and maintenance methods</li> <li>• Maintenance strategies</li> <li>• Construction and maintenance equipment</li> <li>• <b>Final Project - Railroad Debate, Thu, Dec. 2)</b></li> <li>• Visit to Pettibone (Tue, Dec. 7 - tentative)</li> <li>• Track maintenance in Europe (guest lecture)</li> <li>• Course feedback session</li> </ul>	
<b>Finals week</b>	<b>Final exam</b>	