

### Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. **The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.**

College: CITE Dept/Division: Engineering Alpha Designator/Number: CE 639  Graded  CR/NC

Contact Person: Asad Salem Phone: 304-696-3207

**NEW COURSE DATA:**

*Civil*

New Course Title: Infrastructure Management Systems

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Alpha Designator/Number: 

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*CE*

Title Abbreviation: 

I	n	f	r	a	s	t	r	u	c	t	u	r	e		M	a	n	a	g	e	m	e	n	t
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(Limit of 25 characters and spaces)

Course Catalog Description: Application of decision analysis, mathematical programming, performance modeling and various heuristics to develop management plans for transportation infrastructure assets, primarily focusing on highway pavements and bridges.  
(Limit of 30 words)

Co-requisite(s): N/A First Term to be Offered: Fall 2019

Prerequisite(s): Graduate Standing Credit Hours: 3

Course(s) being deleted in place of this addition (*must submit course deletion form*): \_\_\_\_\_

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head <u><i>Asad Salem</i></u>	Date <u>10/28/18</u>
Registrar <u><i>Serge HC</i></u> <span style="float: right;"><u>143501</u></span>	Date <u>10/29/18</u>
College Curriculum Chair <u><i>Walter</i></u>	Date <u>10/31/18</u>
Graduate Council Chair _____	Date _____

## Request for Graduate Course Addition - Page 2

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College: CITE

Department/Division: Engineering

Alpha Designator/Number: CE 639

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Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

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1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

James Bryce, Ph.D.

Gregory Michaelson, Ph.D., P.E.

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "**Not Applicable**" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another department(s), identify it/them by name. Enter "**Not Applicable**" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "**Not Applicable**" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "**Not Applicable**" if not applicable.

Not Applicable

6. COURSE OBJECTIVES: (May be submitted as a separate document)

See the attached syllabus

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7. COURSE OUTLINE (May be submitted as a separate document)

See the attached syllabus

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

See the bibliography in the attached syllabus

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture

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### 10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Course project, Homework, Mid-term and Final Exam

### 11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

### 12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See the attached syllabus

## Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:  
Course Number and Title:  
Catalog Description:  
Prerequisites:  
First Term Offered:  
Credit Hours:

Department: Engineering

*Civil*

Course Number and Title: CE 639: Infrastructure Management Systems

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Catalog Description: Application of decision analysis, mathematical programming, performance modeling and various heuristics to develop management plans for transportation infrastructure assets, primarily focusing on highway pavements and bridges.

Prerequisites: Graduate Standing

First Term Offered: Spring 2019

Credit Hours: 3

Course Number/ Title	<b>CE 639: Civil Infrastructure Management Systems – 3 Credit Hour</b>
Semester/Year	Fall / 2019
Days/Time	TBD (Lecture)
Location	WAEC XXXX
Instructor	James Bryce, Ph.D.
Office	WAEC 2301a
Phone	304-696-5653
E-Mail	bryce@marshall.edu
Office/Hours	TBD
University Policies	<p>By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to <a href="http://www.marshall.edu/academic-affairs">www.marshall.edu/academic-affairs</a> and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to <a href="http://www.marshall.edu/academic-affairs/policies/">www.marshall.edu/academic-affairs/policies/</a>.</p> <p>Academic Dishonesty / Academic Dismissal / Computing Services Acceptable Use / Inclement Weather / Students with Disabilities / Academic Probation and Suspension / Academic Rights and Responsibilities of Students / Affirmative Action / Sexual Harassment</p>

### ***Course Description***

Application of decision analysis, mathematical programming, performance modeling and various heuristics to develop management plans for transportation infrastructure assets, primarily focusing on highway pavements and bridges.

### ***Course Pre-Requisites / Co-Requisites:***

PR: Graduate standing

***Required textbooks:*** *N/A – This course will use a variety of available materials published by the Transportation Research Board, Federal Highway Administration, World Bank and other sources freely available online.*

### ***Bibliography:***

1. U.S. National Archives and Records Administration. Code of Federal Regulations. 23 CFR Part 490. National Performance Management Measures: Assessing Pavement Condition for National Highway Performance Program and Bridge Condition for National Highway Performance Program. 2017.
2. FHWA. Fixing America’s Surface Transportation Act or “FAST Act”. U.S. Department of

- Transportation, Washington, D.C., 2017. <https://www.fhwa.dot.gov/fastact/summary.cfm>.
3. Cambridge Systematics, Inc. NCHRP Report 632: An Asset Management Framework for the Interstate Highway System. Transportation Research Board of the National Academies, Washington, D.C., 2009.
  4. Cambridge Systematics, Inc. NCHRP Report 551: Performance Measures and Targets for Transportation Asset Management. Transportation Research Board of the National Academies, Washington, D.C., 2006.
  5. Cambridge Systematics, Inc. NCHRP Report 545: Analytical Tools for Asset Management. Transportation Research Board of the National Academies, Washington, D.C., 2005.
  6. International Infrastructure Management Manual (IIMM), International Edition 2011
  7. Transportation Asset Management Guide. AASHTO, Washington, D.C., 2002.
  8. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, 1997.
  9. Hendrickson and Au, Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders, Chapter 6, "Economic Evaluation of Facility Investments," First Edition originally printed by Prentice Hall, ISBN 0-13-731266-0, 1989 with co-author Tung Au. Second Edition prepared for world wide web publication in 2000. Version 2.2 prepared Summer, 2008. [http://pmbok.ce.cmu.edu/06\\_Economic\\_Evaluation\\_of\\_Facility\\_Investments.html](http://pmbok.ce.cmu.edu/06_Economic_Evaluation_of_Facility_Investments.html)
  10. Ang and Tang, Probability Concepts in Engineering, John Wiley & Sons, 2007.
  11. Flintsch, G.W. and J.W. Bryant, Jr. Asset Management Data Collection for Supporting Decision Processes. May 2006.
  12. FHWA. Transportation Asset Management Case Studies. Pavement Management System: The Washington State Experience. Report No. FHWA IF-08-010. 2008.

### ***Course learning Outcomes***

At the conclusion of the course, students will

- Evaluate the functional and structural condition of transportation infrastructure assets using multiple performance measures
- Model the expected performance of transportation infrastructure components for time horizons up to 10 years or greater
- Apply prioritization and optimization techniques to select projects for implementation
- Compare different infrastructure management alternatives using multiple objectives.
- Develop maintenance and rehabilitation schedules for infrastructure assets under the conditions of limited budgets
- Prepare a written report and an oral/visual presentation of a pavement design project.
- Work as a member of an integrated team to complete the project design, report, and presentation.

### **Grading:**

Grading Basis:	Course project:	30%	A:	90-100%
	Homework:	30%	B:	80-<90%
	Mid Semester Exam:	15%	C:	70-<80%
	Final Exam:	20%	D:	60-<70%
	Participation/Attendance:	5%	F:	0-<60%

Receiving full participation credit requires missing no more than 2 classes and contributing to class discussion.



**Attendance:**

Attendance will be taken and participation in the in-class examples will be required; lecture discussions will be the primary source for exam questions. Students missing lecture are responsible for obtaining any material covered from the instructor or another student. Out of respect for your colleagues and me, talk only to participate in class (e.g., do not hold a side conversation) and place cell-phones on silent. I reserve the right to develop a cell-phone policy if it becomes an issue.

**Relationships between Course, and Degree Profile Outcomes**

Course learning Outcomes student will:	How students will practice each outcome in this course	How student achievement each outcome will be assessed in this course
Evaluate the functional and structural condition of transportation infrastructure assets using multiple performance measures	<ul style="list-style-type: none"> <li>• In-class examples</li> <li>• Homework Assignments</li> </ul>	<ul style="list-style-type: none"> <li>• Homework Assignments</li> <li>• Mid-term and final exams</li> </ul>
Model the expected performance of transportation infrastructure components for time horizons up to 10 years or greater	<ul style="list-style-type: none"> <li>• In-class examples</li> <li>• Homework Assignments</li> </ul>	<ul style="list-style-type: none"> <li>• Homework Assignments</li> <li>• Mid-term and final exams</li> </ul>
Apply prioritization and optimization techniques to select projects for implementation	<ul style="list-style-type: none"> <li>• In-class examples</li> <li>• Homework Assignments</li> </ul>	<ul style="list-style-type: none"> <li>• Homework Assignments</li> <li>• Mid-term and final exams</li> </ul>
Compare different infrastructure management alternatives using multiple objectives.	<ul style="list-style-type: none"> <li>• In-class examples</li> <li>• Homework Assignments</li> </ul>	<ul style="list-style-type: none"> <li>• Homework Assignments</li> <li>• Mid-term and final exams</li> </ul>
Develop maintenance and rehabilitation schedules for infrastructure assets under the conditions of limited budgets	<ul style="list-style-type: none"> <li>• In-class examples</li> <li>• Homework Assignments</li> </ul>	<ul style="list-style-type: none"> <li>• Homework Assignments</li> <li>• Mid-term and final exams</li> </ul>
Prepare a written report and an oral/visual presentation of a pavement design project.	<ul style="list-style-type: none"> <li>• Semester group project</li> </ul>	<ul style="list-style-type: none"> <li>• Course project report</li> <li>• Final course project presentation</li> </ul>
Work as a member of an integrated team to complete the project design, report, and presentation.	<ul style="list-style-type: none"> <li>• Semester group project</li> </ul>	<ul style="list-style-type: none"> <li>• Course project report</li> <li>• Final course project presentation</li> </ul>

**Homework Requirements**

Students are encouraged to discuss homework problems, check homework answers against each other and to assist each other in understanding the course material. Produce and submit your own work unless it is specified as a group assignment when assigned.

Homework will periodically be assigned throughout the semester and will be typically due prior to the beginning of lecture one week after the date of assignment (unless otherwise stated). Homework will generally be assigned on Thursday via blackboard; active monitoring of blackboard assignments is strongly recommended. Homework assignments are to be turned in electronically on blackboard. Paper assignments handed to me in class will be considered 1-day late.

An assignment that is illegible or is presented in an unprofessional manner will not be accepted.

- Late assignments will be accepted at a 25% penalty per day (including weekends)
- Late assignments will not be accepted after graded assignments have been returned (generally 1



- week)  
 • Homework must be completed in a memo format, complete with a cover letter.

**Tentative Schedule (subject to change)**

Date	Topics
Week 1	Infrastructure Management Frameworks
Week 2	Performance and Level of Service – Selecting and Calculating Performance Measures
Week 3	Performance and Level of Service, Cont'd – Measuring and Evaluating the Performance of Transportation Networks with Non-destructive Means
Week 4	Lifecycle Cost Analysis Using Deterministic and Probabilistic (Monte Carlo) Approaches
Week 5	Lifecycle Environmental Assessment and Sustainability
Week 6	Continuous Performance Modeling
Week 7	Discrete (Markov) Performance Modeling
Week 8	Course Project Proposals Mid-Term Exam
Week 9	Prioritization and Optimization
Week 10	Prioritization and Optimization, Cont'd
Week 11	Risk and Reliability Analysis
Week 12	Maintenance and Rehabilitation Alternatives
Week 13	Maintenance and Rehabilitation Alternatives, Cont'd
Week 14	Developing Lifecycle Management Plans
Week 15	Final Project Presentations and Final Exam Review

**Honor (Academic Dishonesty) Policy**

The university policy will be enforced. See the graduate student catalog provided at the link below. Some examples of academic dishonesty include (but are not limited to) copying another student's assignment, lying about being ill on the day of a test, using a cell phone or other communication device during a test, quoting an author's writing (including material found on the internet) without giving due credit.  
[http://www.marshall.edu/catalog/files/Gr\\_2018-19\\_Published\\_10-01-18.pdf](http://www.marshall.edu/catalog/files/Gr_2018-19_Published_10-01-18.pdf)

**Accommodations for Disabilities**

Students with disabilities must contact the Office of Disabled Student Services in Prichard Hall 117, phone 696-2271 to provide documentation of their disability to ensure proper accommodation. Please visit <http://www.marshall.edu/disabled> for additional information.

**Sexual Harassment**

This course will follow Marshall University's policy on Sexual Harassment, which can be found on p. 71 of the 2018– 2019 online graduate catalog.  
[http://www.marshall.edu/catalog/files/Gr\\_2018-19\\_Published\\_10-01-18.pdf](http://www.marshall.edu/catalog/files/Gr_2018-19_Published_10-01-18.pdf)