

**From:** [Carpenter, TJ](#)  
**To:** [Reed, Katie](#)  
**Cc:** [Miriti, Maria](#); [Quinzon-Bonello, Rosario](#)  
**Subject:** FW: Master of Engineering Management (MEM) Proposal Change  
**Date:** Monday, May 8, 2023 4:32:28 PM  
**Attachments:** [image001.png](#)  
[MEM\\_Prog\\_Change\\_Info\\_Item\\_to\\_GS.pdf](#)  
[image002.png](#)

---

Katie,

Please find an informational item attached from the College of Engineering regarding their Master of Engineering Management program. Dean Miriti has reviewed this and expressed no major concerns.

Please feel free to reach out to Rosie with any additional questions regarding the informational item.

Let us know if you have any questions. Thanks!



**TJ Carpenter, MS**

Administrative Coordinator

**The Ohio State University**

Graduate School

250H University Hall, 230 North Oval Mall, Columbus, OH 43210

614-688-0230 Office

[carpenter.1112@osu.edu](mailto:carpenter.1112@osu.edu) / [www.gradsch.osu.edu](http://www.gradsch.osu.edu)

Pronouns: He/Him/His

---

**From:** Quinzon-Bonello, Rosario <[quinzon-bonello.1@osu.edu](mailto:quinzon-bonello.1@osu.edu)>  
**Sent:** Monday, May 1, 2023 10:02 AM  
**To:** Carpenter, TJ <[carpenter.1112@osu.edu](mailto:carpenter.1112@osu.edu)>  
**Subject:** Master of Engineering Management (MEM) Proposal Change

Hello TJ,

Attached is a informational item for the Graduate Council's review.

Thanks!

Rosie



**Rosario (Rosie) Quinzon-Bonello, M.Ed.**

Assistant Dean for Curriculum and Assessment

College of Engineering

122 Hitchcock Hall, 2070 Neil Ave.

Columbus, OH 43210

[quinzon-bonello.1@osu.edu](mailto:quinzon-bonello.1@osu.edu)

[engineering.osu.edu](http://engineering.osu.edu)



## Memo

To: Maria Miriti, Interim Associate Dean of the Graduate School  
From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment  
Date: May 1, 2023

Re: Informational Item - Master of Engineering Management (MEM) program

---

The College of Engineering would like to request that the attached proposal, submitted by the College of Engineering Master of Engineering Management (MEM) program, be considered as an informational item. This proposal consists of the following program change:

- Add ISE 5110 *Design of Engineering Experiments* (3 credit hours) to the core curriculum as an alternative to the existing course ISE 5760 *Visual Analytics for Sensemaking* (3 credit hours)

This change was approved by the MEM Graduate Studies committee, and on April 28, 2023, the College Committee on Academic Affairs (CCAA) was informed of this action. In this way, a formal, college-level record and support of this action has been created.

Yours sincerely,

Rosie Quinzon-Bonello

## **Summary**

The Master of Engineering Management (MEM) Graduate Studies Committee decided in a unanimous vote to add ISE 5110 Design of Engineering Experiments (3 credit hours) to the core curriculum of the MEM degree. This course will be offered as an alternative to the existing course, ISE 5760 Visual Analytics for Sensemaking (3 credit hours). Students will then be able to choose either course in fulfilling the degree requirements.

## **Table of Contents**

- I.** Proposal statement
- II.** Background and Rationale
- III.** Programmatic Changes
- IV.** Curriculum
- V.** Impact on Department
- VI.** Appendices
  - a.) Current syllabus for ISE 5110 Design of Engineering Experiments
  - b.) Department letter of support
  - c.) Master Engineering Management degree proposal approved by OAA.

## **Proposal**

The Master of Engineering Management (MEM) Graduate Studies Committee decided in a unanimous vote to add ISE 5110 Design of Engineering Experiments (3 credit hours) to the core curriculum of the MEM degree. This course will be offered as an alternative to the existing course, ISE 5760 Visual Analytics for Sensemaking (3 credit hours). Students will then be able to choose either course in fulfilling the degree requirements.

## **Background and Rationale**

The College of Engineering launched the online Master of Engineering Management (MEM) degree in Autumn 2020. A required core course in the MEM curriculum is ISE 5760 Visual Analytics for Sensemaking.

Based on feedback received from prospective and current students as well as MEM graduates, a need has been identified to add an alternative data analysis course to the core curriculum. While students have provided positive feedback regarding the ISE 5760 Visual Analytics course, they have also stated a desire to see an alternative course on data analysis that isn't just focused on data visualization. ISE 5110 Design of Engineering Experiments is the perfect engineering course to meet this need. Students will be able to select either ISE 5760 or ISE 5110 to fulfill the degree requirements. MEM students will also be able to complete both ISE 5760 and ISE 5110 if they choose because the curriculum includes 12 credit hours in electives for which students must select at least 3 credit hours in Engineering.

ISE 5110 Design of Engineering Experiments will provide students with an understanding of the fundamentals of using data analytics to make data-driven decisions, including statistical analysis, design of experiments, and response optimization. Emphasis will be on applying these techniques to engineering problems. Students will focus on formulating and solving real problems with the appropriate modeling strategies and analytics principles for better decision making. These skills will be utilized in the project portion of the MEM capstone course.

## **Programmatic Changes**

The addition of a project management course will have minimal programmatic changes to the MEM degree. ISE 5110 is offered each autumn semester. The development work converting the course into online format will be done during Summer 2023 and the first offering will be available Autumn 2023.

ISE 5110 Design of Engineering Experiments and ISE Visual Analytics are both three credit hour courses. The MEM is a minimum 30 credit hour program and with this additional course students will still complete the same number of credit hours to graduate.

## **MEM Curriculum** (30 credit hours)

*The current core curriculum:* (15-16 credit hours)

ENGR 6210 Leadership and Team Effectiveness*	3 cr hrs
ENGR 6220 Accounting/Finance for Engineers	3 cr hrs
ENGR 6230 Technology Strategy & Innovation Mgmt	3 cr hrs
PUBAFRS 6050 Management in Public Agencies*	4 cr hrs
ISE 6801 Project Management	3 cr hrs
ISE 5760 Visual Analytics for Sensemaking	3 cr hrs

\*Students select either ENGR 6210 or PUBAFRS 6050.

*Proposed new core curriculum:* (15-16 credit hours)

ENGR 6210 Leadership and Team Effectiveness*	3 cr hrs
ENGR 6220 Accounting/Finance for Engineers	3 cr hrs
ENGR 6230 Technology Strategy & Innovation Mgmt	3 cr hrs
PUBAFRS 6050 Management in Public Agencies*	4 cr hrs
ISE 5760 Visual Analytics for Sensemaking **	3 cr hrs
ISE 5110 Design of Engineering Experiments**	3 cr hrs
ISE 6801 Project Management	3 cr hrs

\*Students select either ENGR 6210 or PUBAFRS 6050.

\*\* Students select either ISE 5760 or ISE 5110.

*Electives* (12 credit hours)

Students complete 12 credit hours in elective courses from Engineering, Fisher College of Business, or John Glenn College of Public Affairs. Students must take at least 3 credit hours in Engineering, but no more than 6 credit hours.

*Capstone Course* (3 credit hours)

All students complete ENGR 6240 Operational Excellence for Engineers.

## **Impact on Department**

The Integrated Systems Engineering (ISE) department will offer both the Visual Analytics and Design of Engineering Experiments courses. As described in the attached email (Appendix B), the Chair of the ISE department agrees that this course can be offered and the impact on the department is positive. The current instructor for ISE 5110 will also teach the online version to MEM students. Faculty compensation will be provided by the MEM degree and through the Professional and Distance Education Programs office.

For questions contact either:

Dr. Avi Benatar  
Chair, MEM Graduate Studies Committee  
[Benatar.1@osu.edu](mailto:Benatar.1@osu.edu)  
614-292-1390

Bob Mick  
Director, Professional and Distance Education Programs  
[Mick.15@osu.edu](mailto:Mick.15@osu.edu)  
614-292-0393

## Appendix A

# Design of Engineering Experiments Syllabus

ISE5110 Spring 2023

## Course Information

- **Course times:** Tuesdays and Thursdays from 2:20 p.m.-3:40 p.m. (synchronous).
- **Credit hours:** 3
- **Mode of delivery:** Effectively Hybrid – In person Baker 188 – Distance Learning For Those Excused By Email: Microsoft Teams meeting  
**Join on your computer or mobile app**  
<https://osu.zoom.us/my/ttallen> Password: tedisfun

## Instructor

- **Name:** Theodore T. Allen
- **Email:** allen.515@osu.edu

**Office location:** Online primarily but at Baker 250 by appointment

([Click here to join the meeting](#) Tuesdays and [Click here to join the meeting](#) Thursdays)

- **Office hours:** *Tuesdays* from 11 am – 2 pm
- **Preferred means of communication:**
  - My preferred method of communication for questions is **email**.
  - My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your [notification preferences](#) (go.osu.edu/canvas-notifications) to be sure you receive these messages.

## Teaching Assistant

- **Name:** Dai, Yongzheng
- **Email:** dai.651@buckeyemail.osu.edu
- **Recitation times:** available by appointment

## Course Prerequisites

None (familiarity with t-tests is recommended)



THE OHIO STATE UNIVERSITY

[College]  
[Department]



# Course Description

Learn skills and concepts associated with statistically design experiments and empirical optimization

## Learning Outcomes

By the end of this course, students should successfully be able to answer:

- How do I show that level 1 of factor A results in a significantly better engineering design than level 2 (all other factors held constant)?
- I vary a medium number of factors at >2 levels and collect data. How do I show which factors are significant?
- For the significant factors in question 2, how do I show which levels are significantly better than others.
- ABET(c) How do I, with a small number of tests, find the significant factors from the long list of factors? (The ability to design and conduct experiments, as well as analyzed data is assessed using the class project.)
- ABET(c) How do I create an accurate prediction model of the response as a function of the few factors that I believe are significant? (The ability to design and conduct experiments, as well as analyzed data is assessed using the class project.)
- How do I optimize the prediction model to create the best engineering system design?
- How do I optimize the prediction model to create the best engineering system considering all related uncertainties, i.e., "robust" optimization?
- How do I do optimal experimental planning for linear models so that we can handle categorical response variables to achieve fewer runs than with repeated applications of response surface designs.
- How can I plan computer experiments to simultaneously to optimize a response and generate a spline empirical metamodel to facilitate possible re-optimizations?
- How can I model a system using deep learning and Artificial Neural Nets?

## General Education Expected Learning Outcomes

As part of the Quantitative and Logical Skills category of the General Education curriculum, this course is designed to prepare students to be able to do the following:

- Develop quantitative literacy and logical reasoning, including the ability to identify valid arguments
- Use mathematical models
- Critically evaluate results based on data

This course fulfills these learning outcomes by training empirical modeling building, analysis, and discussion of evidence and optimization.

# How This Blended Course Works

**Mode of delivery:** This course is available online but, if possible, please attend in person (required but not enforced) to get the full experience. There are no required sessions when you must be logged in to Carmen at a scheduled time.

**Pace of online activities:** This course is divided into **weekly modules** that are released one week ahead of time. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

**Credit hours and work expectations:** This is a [3] credit-hour course. According to [Ohio State bylaws on instruction](http://go.osu.edu/credit%20hours) (go.osu.edu/credit hours), students should expect around [3] hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to [6] hours of homework (reading and assignment preparation, for example) to receive a grade of [C] average.

**Attendance and participation requirements:** Because this is an in person course, your attendance is based on your activity and participation. The following is a summary of students' expected participation:

- **Participating in person or online activities for attendance: at least twice per week**  
You are expected to log in to the course in Carmen every week. During most weeks you will probably log in many times. If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible*.
- **Office hours and live sessions: optional**  
All live, scheduled events for the course, including my office hours, are technically required but not enforced. Coming to office hours in person is desirable so that you can get to know your instructor to learn about research and/or to support writing recommendations.
- **Participating in Carmen: two or more times per week**  
As part of your participation, each week you can expect to post at least twice as part of our substantive class discussion on the week's topics during the scheduled times.

# Course Materials, Fees and Technologies

## Required Materials and/or Technologies

- Allen, T. T. (2019). Introduction to Engineering Statistics and Lean Six Sigma: Statistical Quality Control and Design of Experiments and Systems. 3rd Edition. Springer (pdf provided online free of charge on Carmen).
- Minitab 18 or higher.
- JMP 14 or higher.

## Recommended/Optional Materials and/or Technologies

- Picheny, V., Wagner, T., & Ginsbourger, D. (2013). A benchmark of kriging-based infill criteria for noisy optimization. *Structural and Multidisciplinary Optimization*, 48(3), 607-626.

## Fees and/or Additional Requirements

- None

## Required Equipment for Online Participation

- **Computer:** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

## Required Software

**Microsoft Office 365:** All Ohio State students are now eligible for free Microsoft Office 365. Visit the [installing Office 365](https://go.osu.edu/office365help) (go.osu.edu/office365help) help article for full instructions.

## CarmenCanvas Access

You will need to use [BuckeyePass](https://buckeyepass.osu.edu) (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](https://go.osu.edu/add-device) (go.osu.edu/add-device) help article for step-by-step instructions.



- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- [Install the Duo Mobile application](https://go.osu.edu/install-duo) (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at [614-688-4357 \(HELP\)](tel:614-688-4357) and IT support staff will work out a solution with you.

## Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- [Navigating CarmenCanvas](https://go.osu.edu/canvasstudent) (go.osu.edu/canvasstudent)
- Microsoft Teams or Maybe [CarmenZoom virtual meetings](https://go.osu.edu/zoom-meetings) (go.osu.edu/zoom-meetings)
- [Recording a slide presentation with audio narration and recording, editing and uploading video](https://go.osu.edu/video-assignment-guide) (go.osu.edu/video-assignment-guide)

## Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat:** [go.osu.edu/it](https://go.osu.edu/it)
- **Phone:** [614-688-4357 \(HELP\)](tel:614-688-4357)
- **Email:** [servicedesk@osu.edu](mailto:servicedesk@osu.edu)

## Digital Flagship

Digital Flagship is a student success initiative aimed at helping you build digital skills for both college and career. This includes offering an engaging collection of digital tools and supportive learning experiences, university-wide opportunities to learn to code, and a Design Lab to explore digital design and app development. Digital Flagship resources available to help Ohio State students include on-demand tutorials, The Digital Flagship Handbook (your guide for all things tech-related), workshops and events, one-on-one tech consultations with a peer or Digital Flagship staff member, and more. To learn more about how Digital Flagship can help you use technology in your courses and grow your digital skills, visit [go.osu.edu/dfresources](https://go.osu.edu/dfresources).

# Grading and Faculty Response

## How Your Grade is Calculated

Assignment Category	Points
Carmen	35
Project	35
Exams	30

See [Course Schedule](#) for due dates.

## Descriptions of Major Course Assignments

### Carmen Exercises

**Description:** Solve multiple choice or numerical assignments either individually or as teams.

### Experimental Design and Analysis Project

**Description:** Plan, perform, and analyze an experiment to achieve an important objective.

**Academic integrity and collaboration:** Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow MLA/APA/Chicago etc. style to cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in but no one else should revise or rewrite your work. You are not allowed to work together on the exams but many Carmen assignments and the project are team assignments.

## Late Assignments

Late assignments may receive points off at the discretion of the instructor.

## Instructor Feedback and Response Time

I am providing the following list to give you an idea of my intended availability throughout the course. Remember that you can call [614-688-4357 \(HELP\)](tel:614-688-4357) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact me first through my Ohio State email address. I will reply to emails within **24 hours on days when class is in session at the university**.
- **Class announcements:** I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check [your notification preferences](https://go.osu.edu/canvas-notifications) (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Discussion board:** I will check and reply to messages in the discussion boards once mid-week and once at the end of the week.
- **Grading and feedback:** For large weekly assignments, you can generally expect feedback within **fourteen days**.

## Grading Scale

93–100: A  
90–92.9: A-  
87–89.9: B+  
83–86.9: B  
80–82.9: B-  
77–79.9: C+  
73–76.9: C  
70–72.9: C-  
67–69.9: D+  
60–66.9: D  
Below 60: E



# Other Course Policies

## Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources:** When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

## Academic Integrity Policy

See [Descriptions of Major Course Assignments](#) for specific guidelines about collaboration and academic integrity in the context of this online class.

### Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's [Code of Student Conduct](http://studentconduct.osu.edu) (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct. There will be a plagiarism check on any project work.

**If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- [Committee on Academic Misconduct](http://go.osu.edu/coam) (go.osu.edu/coam)
- [Ten Suggestions for Preserving Academic Integrity](http://go.osu.edu/ten-suggestions) (go.osu.edu/ten-suggestions)
- [Eight Cardinal Rules of Academic Integrity](http://go.osu.edu/cardinal-rules) (go.osu.edu/cardinal-rules)

## Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

## Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options on [Ohio State's Title IX website](http://titleix.osu.edu) (titleix.osu.edu) or by contacting the Ohio State Title IX Coordinator at [titleix@osu.edu](mailto:titleix@osu.edu). Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information, visit the [OIE website](http://equity.osu.edu) (equity.osu.edu) or email [equity@osu.edu](mailto:equity@osu.edu).

## Commitment to a Diverse and Inclusive Learning Environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them.



We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach their own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

## Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, [on-demand mental health resources](https://go.osu.edu/ccsondemand) (go.osu.edu/ccsondemand) are available. You can reach an on-call counselor when CCS is closed at [614- 292-5766](tel:614-292-5766). **24-hour emergency help** is available through the [National Suicide Prevention Lifeline website](https://www.suicidepreventionlifeline.org) (suicidepreventionlifeline.org) or by calling [1-800-273-8255\(TALK\)](tel:1-800-273-8255). [The Ohio State Wellness app](https://go.osu.edu/wellnessapp) (go.osu.edu/wellnessapp) is also a great resource.

# Accessibility Accommodations for Students with Disabilities

## Requesting Accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with [Student Life Disability Services \(SLDS\)](#). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

## Disability Services Contact Information

- Phone: [614-292-3307](tel:614-292-3307)
- Website: [slds.osu.edu](http://slds.osu.edu)
- Email: [slds@osu.edu](mailto:slds@osu.edu)
- In person: [Baker Hall 098, 113 W. 12th Avenue](#)

## Accessibility of Course Technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- [CarmenCanvas accessibility](http://go.osu.edu/canvas-accessibility) ([go.osu.edu/canvas-accessibility](http://go.osu.edu/canvas-accessibility))
- Streaming audio and video
- Microsoft Teams or Maybe [CarmenZoom accessibility](http://go.osu.edu/zoom-accessibility) ([go.osu.edu/zoom-accessibility](http://go.osu.edu/zoom-accessibility))
- Collaborative course tools

# Course Schedule

Tues.	Day 1 – Topic, Reading, and HW	Day 2 – Topic, Reading, and HW
01/10	Syllabus and course goals (Ch1&11)	Q1: 1 factor 2 level experiments
01/17	Q1-Q2: >1 factor &/or >2 levels (Ch11)	Q2: >1 factor &/or >2 levels
01/24	Q3: Which levels differ?	Q3: Which levels differ? Review
01/31	Exercise	Q4: Screening >3 factors?
02/07	Q4: Screening >3 factors	Q4: Screening >3 factors?
02/14	Q5: Regression (Ch13 & Ch14)	Q5: Regression/Optimization
02/21	Exercise-Q6: Optimization & Projects	Q7: Optimization under uncert. (Ch14)
02/28	Q7: Optimization under uncert. (Ch14)	Review
03/07	Q7: Optimization under uncertainty	Q8: Optimal experimental des. (Ch18)
03/14	Spring Break – No Class	Spring Break – No Class
03/21	Q8: Optimal experimental design	Q8: Optimal experimental design
03/28	Q8: Optimal experimental design	Q9: Sequential Kriging optimization (Ch16, Handout)
04/04	Q9: Sequential Kriging optimization	Q9: Sequential Kriging optimization
04/11	Q10: Artificial neural nets (Handout)	Q10: Artificial neural nets (Ch16, Handout)
04/18	Q10: Artificial neural nets	Presentations

Refer to the Carmen-Canvas course for up-to-date due dates.

Week	Points	Topics, Readings, Assignments, Due Dates
2	5	Carmen
4	5	Carmen
5	15	Quiz 1
6	5	Carmen
8	5	Carmen
9	15	Quiz 2
10	5	Carmen
12	Drop-able	Carmen
14	Drop-able	Carmen
15	35	Project
16	Drop-able	Quiz 3

# Appendix B

**From:** [Pourboghrat, Farhang](#)  
**To:** [Mick, Robert](#)  
**Cc:** [Lavender, Steve](#); [Allen, Theodore](#)  
**Subject:** Re: New course for MEM degree  
**Date:** Friday, March 24, 2023 10:23:57 AM

---

Hi Bob,

I'm sorry for the late response to your email. I support the addition of the ISE 5110 course to MEM degree program to be taught by Prof. Ted Allen. Please let me know if you need anything else.

Best,

Farhang

Get [Outlook for iOS](#)

---

**From:** Mick, Robert <mick.15@osu.edu>  
**Sent:** Friday, March 24, 2023 4:55 AM  
**To:** Pourboghrat, Farhang <pourboghrat.2@osu.edu>  
**Cc:** Lavender, Steve <lavender.1@osu.edu>; Allen, Theodore <allen.515@osu.edu>  
**Subject:** RE: New course for MEM degree

Hi Farhang,

I'm sorry to be a pest, but can you please let me know when you can provide an answer on support or not? I need to get all of this together and to CCAA right away if the course is going to be offered AU23.

Thank you for your time,

**Bob Mick**

Director

[Professional & Distance Education Programs](#)

The Ohio State University, College of Engineering  
356A Bevis Hall, 1080 Carmack Rd., Columbus, OH 43210  
614-292-0393 Office

[Mick.15@osu.edu](mailto:Mick.15@osu.edu) [Professionals.engineering.osu.edu](http://Professionals.engineering.osu.edu)

Connect with us on [LinkedIn](#) or [Twitter](#)

# Appendix C

## THE OHIO STATE UNIVERSITY

### College of Engineering

#### Proposal for a professional Master of Engineering Management degree

### Executive Summary

The proposed Master of Engineering Management (MEM) degree is a professional program aimed at practicing engineers seeking to increase their management and leadership skills. MEM degrees are technically based programs that teach methods to manage business initiatives, projects and team members in an engineering setting. These methods can be applied throughout any engineering discipline. Courses in Master of Engineering Management programs are designed to develop an understanding of how to manage both the technological and human resources sides of engineering. The MEM program is designed for working professionals and delivered completely online.

#### I. Introduction and Overview

The College of Engineering (CoE) at The Ohio State University, in partnership with the John Glenn College of Public Affairs and The Fisher College of Business, proposes a new professional master's degree in Engineering.

**a) *Designation***

The degree will be called the Master of Engineering Management (MEM).

**b) *Rationale***

The proposed degree is a professional degree at the post-baccalaureate level aimed at practicing engineers. It is not a research degree and thus the Master of Science degree is not appropriate. The title of Master of Engineering Management is intended to convey both the technical aspects of an engineering degree and the equally important management and leadership skills necessary to succeed in a business management as well as in economic, social and political domains.

The target audience for the MEM degree is engineers in business, industry and government who have worked in the field for three to ten years. More recent graduates will also be considered for the program based on their qualifications and experience, but the focus is on early to mid-career engineering professionals. Prospective students may be employed in either the public or private sectors (for profit or non-profit). They aspire to learn engineering management skills that prepare them to be leaders in their organizations.

**c) *Purpose, Focus and Significance***

Master of Engineering Management degrees bridge the gap between the fields of engineering and business management. MEM degrees are technically based programs that teach methods to manage business initiatives, projects and team members in an engineering setting. MEM coursework typically includes topics such as project management, leadership, team building, innovation, and financial management.

The College of Engineering launched a technically based program in Autumn 2014,

the online Master Global Engineering Leadership (MGEL) degree. The MGEL is similar to other existing MEM degrees because the core curriculum includes courses in business and policy. What separates the MGEL from traditional MEM degrees is its inclusion of a technical track – four specialized, advanced engineering courses in a single discipline (e.g. automotive systems engineering) like a traditional MS student may take. (See Appendix A for complete MGEL curriculum)

The College of Engineering Strategic Plan, revised in 2018, calls for the addition of a traditional MEM degree in order for the college to meet the needs of students from two different populations. Students who enroll in the existing MGEL program are likely to lead technical teams in a singular engineering discipline matching the area of their chosen technical track. While MEM students are likely to be desirous of growing their careers with general management positions in a variety of engineering environments.

The content for the Master of Engineering Management degree will be provided by faculty in the College of Engineering, content area experts in the John Glenn College of Public Affairs and The Fisher College of Business. The delivery by distance education technology provides the ideal environment for working professionals.

Engineers who complete the MEM will be able to:

- understand the numbers in financial statements, apply the fundamentals of managerial accounting to manage projects to success, and support the financial objectives of an organization;
- lead diverse, effective teams in innovative directions including projects in the context of their enterprise's overall strategic mission, whether in the public or private sector, including the implications of managing globally;
- evaluate performance and conduct productive communication with business leaders, teams, and subordinates;
- understand intrapreneurship and entrepreneurship to advance new products and services and apply knowledge more effectively in innovative directions;
- learn information visualization techniques that help managers analyze massive amounts of digital data to combat overload and aid sensemaking with engineering applications in business and financial decision making;
- understand the complexities between science, engineering, and public policy, while recognizing the importance of global trends in their fields from the entire curriculum and capstone course.

## **II. Proposed Curriculum**

The proposed curriculum is a minimum of 30 semester credit hour program. Students have the flexibility of taking the curriculum on a full or part time basis over a period of up to four years unless the Graduate Studies Committee (formed specifically for this program) grants an extension. Students may earn up to three hours of credit for previous coursework completed elsewhere. (See Appendices B & C for more details) The curriculum includes three components:

**a) The Required Core (15-16 credit hours):**

This integrated core includes business, public administration and engineering courses including topics such as engineering leadership, project management, innovation, entrepreneurship, teambuilding, and financial accounting.

- ENGR 6210 Leadership and Team Effectiveness (3 credits)\*
- ENGR 6220 Accounting/Finance for Engineers (3 credits)
- ENGR 6230 Technology Strategy & Innovation Management (3 credits)
- ISE 6801 Project Management (3 credits)
- ISE 5760 Visual Analytics for Sensemaking (3 credits)
- PUBAFRS 6050 Management in Public Agencies (4 credits)\*
- PUBAFRS 6060 Managerial Leadership in Public and Nonprofit Organizations (3 credits)\*

\*Students take either ENGR6210, PUBAFRS 6050 or PUBAFRS 6060 depending on whether they are focused on the public or private sector. PUBAFRS 6050 or PUBAFRS 6060 can be taken as an elective if ENGR 6210 is chosen.

**b) Electives (12 credit hours)**

The elective courses provide opportunities for students to enhance their engineering management in areas of sustainability, global supply chains, risk analysis, policy, and data analytics. Students select courses from the following to full-fill the electives portion of the curriculum:

- ENGR 7200 Engineering Ethics and Professionalism (1 credit)
- ISE 5810 Lean Sigma Foundations (4 credits)
- ENVENG 6600 Assessment for Human Rights and Sustainability (3 credits)
- ENVENG 5600 Science, Engineering and Public Policy (3 credits)
- PUBAFRS 5610 Innovation, Policy, and the Global Economy (3 credits)
- PUBAFRS 5750 The Business-Government Relationship (3 credits)
- PUBAFRS 5770 Risk and Decision Analysis in Public Affairs (3 credits)
- PUBAFRS 6075 Data, Models & Evaluation (3 credits)
- MBA 6233 Operations Management (3 credits)
- BUSMHR 7244 Negotiation (3 credits)
- MBA 6273 Data Analysis for Managers (3 credits)
- MBA 6253 Marketing Management (3 credits)

Note: Students can take a max. 10 hrs in PUBAFRS courses from the core and electives.

**c) Capstone Course (3 credit hours)**

The capstone course is a culminating experience providing students the opportunity to solve real-world challenges by utilizing skills learned from the MEM courses, while implementing the principles of operational excellence and lean systems in an organization. (Proposed course syllabus in Appendix D)

ENGR 6XXX Capstone Project in Operational Excellence for Engineers (3 credits)

**III. Administrative Arrangements** (Details on arrangements are in Appendix B)



The MEM degree will be administered by the College of Engineering through the Professional and Distance Education Programs Office. The MEM Graduate Studies Committee (GSC) will be established within the College to coordinate the operation of the program.

**a) *Graduate Studies Committee (GSC)***

The MEM Faculty Director will act as the chair of the MEM-GSC. The MEM-GSC will consist of these voting members, the MEM Faculty Director, one representative from the John Glenn College of Public Affairs, one representative from the Fisher College of Business, and two Engineering faculty who teach MEM courses. The MEM-GSC will include the College of Engineering Director of Professional and Distance Education Programs and the PDEP Program Coordinator, as non-voting members.

**b) *Office of Distance Education and eLearning (ODEE)***

The proposed program will be developed in partnership with the Office of Distance Education & eLearning (ODEE).

**c) *Industry Advisory Board (IAB)***

The Industry Advisory Board for the MGEL degree will also be utilized and engaged for the MEM degree to help ensure the curriculum remains relevant to the needs of industry.

**d) *MEM Operations***

The Director of Professional and Distance Education Programs (PDEP) in the College of Engineering will be responsible for the overall administration of the MEM degree. The PDEP Program Coordinator for the MGEL degree will also act as the Program Coordinator for the MEM and be responsible for the day-to-day operations.

#### **IV. Evidence of Need**

The College of Engineering conducted extensive research for the development of the MGEL degree that is also relevant and provides evidence of need for the MEM. More importantly, the PDEP office that manages the MGEL degree has collected additional and significant information and data providing evidence of need for the MEM degree.

There are many universities that offer traditional Master of Engineering Management degrees. The college's MGEL degree was intended to be a unique version of an MEM with the addition of a technical track. While the MGEL has had strong interest, there has been a significant number of requests for a more traditional program.

Since 2014, the MGEL program has received 597 direct program inquiries through email, phone calls, and online information sessions. Of the 597 inquiries, 401 potential students stated that while they were interested in the program, they would not apply because our technical tracks were not of interest to them and they wanted to pursue a traditional MEM.

Based on the large number of direct inquiries including those who have spoken out in favor for an OSU MEM degree, there is a strong evidence of need. Additionally, there

is a very low cost associated with developing the MEM degree. The core courses of the MEM and MGEL will be very similar so this reduces the need for additional resources. The MEM and MGEL will be great compliments to each other and the college can increase enrollment in existing courses, professional education programs overall, while also meeting the needs of potential students and alumni.

In Ohio, Case Western Reserve University offers a Masters of Engineering as well as Ohio University. Our MEM degree will be unique from their offerings because of the partnership with other content area specialists in the John Glenn College of Public Affairs and The Fisher College of Business. The courses in Operational Excellence and Data Analytics will also differentiate our degree. The addition of an MEM from OSU will strengthen engineering education in the state.

## **V. Prospective Enrollment and Student Demand**

### **a) Demand**

Based on our marketing data and inquiries for the MGEL degree, we believe the MEM program will quickly enroll 10-20 students in the first year and grow to 30-50 students afterwards.

### **b) Access and Retention of underrepresented Groups**

Details in Appendix B.

## **VI. Available Resources and Additional Costs**

The MEM degree program will use current faculty already teaching in the MGEL degree. Administrative support for the MGEL degree will also be able to manage the MEM degree. It will also enable the college to achieve maximum utilization of the core courses of the MGEL degree that will be included in the MEM. The only additional costs required for the MEM will be compensation to faculty for development time when converting their courses in to online format.

## **VII. Assessment Plan**

The MEM administration will continuously assess all of the program's activities. This will be accomplished in several ways. Details in Appendix B.

### **Proposal Contact Information**

Bob Mick  
Director  
Professional & Distance Education Programs  
Mick.15@osu.edu  
614-292-0393

Dr. Avi Benatar  
Associate Professor  
MGEL Graduate Studies Chair  
Benatar.1@osu.edu  
614-292-1390

## Appendix A

<b>Master Global Engineering Leadership Curriculum</b>				
<b>Course Courses (16-17 cr hrs)</b>				
	<b>Dept</b>	<b>Course #</b>	<b>Course Names</b>	<b>Cr Hrs</b>
Core	ENGR	6210	Leadership and Team Effectiveness	3
Core	ENGR	6220	Accounting/Finance for Engineers	3
Core	ENGR	6230	Technology Strategy & Innovation Mgmt	3
Core	PUBAFRS	6050	Management in Public Agencies	4
Core	PUBAFRS	5750	The Business-Government Relationship	3
Core	ENGR	7200	Engineering Ethics and Professionalism	1
Core	ISE	6801	Project Management	3
				<b>16-17</b>
Note: Students select either PUBAFRS 6050 or ENGR 6210				
<b>Technical Track Specializations (12 cr hrs)</b>				
<b>Automotive Systems Engineering Track (students select two focus areas)</b>				
Focus Area 1: Advanced Propulsion Systems (can be taken in any order)				
	ME	7383	Electrochemical Energy Conversion and Storage Systems for Automotive Applications	3
	ME	7384	Energy Modeling, Simulation, Optimization and Control of Advanced Vehicles	3
Focus Area 2: Powertrain Modeling and Control (must take 7236 before 5554)				
	ME	7236	Powertrain Dynamics	3
	ECE	5554	Powertrain Control Systems	3
Focus Area 3: Dynamic Systems and Engine Modeling (can be taken in any order)				
	ME	5339	Simulation Techniques for Dynamic Systems	3
	ME	7440	Internal Combustion Engine Modeling	3
<b>Enterprise Systems and Architectures track</b>				
	CSE	5231	Enterprise Software Engineering	2
	CSE	5234	Applied Enterprise Distributed Computing for Engineers and Scientists	3
	CSE	5235	Enterprise Services and Architectures	3
	CSE	5241	Introduction to Databases	2
	CSE	TBD	Independent Study (1 hr for 5241; 1 hr for 5231)	2
<b>Welding Engineering</b>				
	WELDENG	7001	Physical Principles in Welding Processes I	3
	WELDENG	7101	Welding Metallurgy I	3
	WELDENG	7201	Engineering Analysis for Design and Simulation	4
	WELDENG	7406	Welding of Plastics and Composites	3
<b>Radar Systems</b>				
	ECE	5010	Wireless Propagation and Remote Sensing	3
	ECE	5206	Medical Imaging and Processing	3
	ECE	5011	Antennas	3
	ECE	5013	An Introduction to Radar Systems	3
<b>Civil and Environmental Track</b>				
	ENVENG	6600	Assessment for Human Rights and Sustainability	3
	ENVENG	5600	Science, Engineering, and Public Policy	3
	ENVENG	5195	Engineering Design for Environmental Health	3
	CIVILEN	6100	Advanced Topics in Surveying for Smart Cities	3
<b>Integrative Project (5 cr hrs)</b>				
	ENGR	7100	Integrative Project	5

## Appendix B

### Processes

#### I. Selection of Personnel

##### *Faculty Director*

The MEM Faculty Director will be selected by the Dean of the College of Engineering and the MGEL Graduate Studies Committee (MGEL-GSC). The MEM Faculty Director will serve at the pleasure of the Dean in a half time administrative role. The MEM Faculty Director have graduate faculty status with the Graduate School.

##### *Administrative Staff*

The Director of Professional and Distance Education Programs (PDEP) will act as the MEM Director and report to the Dean of the College of Engineering. A MEM Program Coordinator will be selected and report to the Director of Professional and Distance Education Programs.

#### II. Master Engineering Management –Graduate Studies Committee (MEM-GSC)

The MEM Faculty Director will act as the chair of the MEM-GSC. The MEM-GSC will consist of these voting members; the MEM Faculty Director, one representative from the John Glenn College of Public Affairs, one representative from the Fisher College of Business, and two Engineering faculty who teach MEM courses. All voting members of the MEM-GSC will have graduate faculty status with the Graduate School. The MEM-GSC will include the College of Engineering Director of Professional and Distance Education Programs and the PDEP Program Coordinator, as non-voting members. The MEM-GSC will handle all tasks normally associated with a graduate studies committee (admissions, new courses, progress of students, and so on).

#### III. Industry Advisory Board

The MEM will benefit from a strong industry advisory board to ensure that the degree and curriculum is relevant to the needs of industry. The MGEL Industry advisory board members will be engaged and utilized as well for the MEM degree.

## **IV. Admissions**

### ***a) MEM Entrance Requirements***

The Masters of Engineering Management program normally requires a candidate to have a B.S. in Engineering from an accredited program (ABET, CAB) at a college or university. The admissibility of a candidate with a BS not in engineering will be evaluated by the MEM-GSC acting as the admissions committee for the degree program.

Applicants for admission to the MEM degree program must have a cumulative point hour ratio for undergraduate work of at least 3.0 (4.0 scale). Applicants with cumulative point hour ratios for undergraduate work below 3.0/4.0 must submit results for the GRE General Test to be considered for admission.

The MEM-GSC may request applicants with a B.S. engineering degree from a non-ABET or non-CAB (Canadian Accreditation Board) accredited program to submit the results of the GRE General Test.

Applicants with non-engineering BS degrees will usually be required to take specified makeup work before their applications will be considered for graduate admission. These applicants may also be required to submit the GRE General Test results regardless of grade point average.

### ***b) Professional Work Experience***

Students applying to the MEM will normally have at least a year of post-B.S. work experience in an engineering-related job. The MEM-GSC may, however, choose to admit exceptional students directly from the B.S. Any such student must have significant internship, co-op, or work experience that will enable them to bring something to the classroom and will allow them to appreciate the professional skills that make up the MEM core. This will normally imply at least two internships or co-op experiences; however the exact requirement may vary by student at the discretion of the MEM-GSC.

### ***c) Student Progress***

Students must complete the degree within four years. Student progress will be tracked by the MEM Program Coordinator and report progress to the MEM Director and MEM-GSC. The Director and the Program Coordinator will work together to ensure that all students make good progress toward completion of the degree.

*d) Credit for previous course work*

Students may obtain up to three semester hours of credit for class work outside of the MEM curriculum. Careful documentation will be essential. The decision to grant credit or not and the amount of credit granted will be made by the MEM-GSC upon application of the student.

*e) Partner Colleges*

A key strength of the MEM program is its ties to partner Colleges within OSU. It is important that these relationships be carefully fostered by the PDEP Director and the MEM-GSC. Each partner will be asked to identify voting representative to the MEM-GSC so that the partner's interests and concerns can be represented on the committee. The PDEP Director will also meet with each of these representatives (individually or as a group) at least once a year to discuss how the program is going and any concerns or issues that the partners' representatives wish to bring forward.

## **Access and Retention of Underrepresented Groups**

Excellence cannot be achieved without diversity and the diversification of the engineering student body is a major priority for the College of Engineering as indicated in the College's Strategic Plan. According to this goal, the College will "Increase the diversity of students, faculty and staff". The college has a well-established and nationally-respected Minority Engineering Program (MEP). It was founded as part of a national effort to increase the representation of African-Americans, Hispanic-Americans, and Native Americans in the professional engineering population. MEP offers a wide range of programs and services to assist in the recruitment, retention, motivation and graduation of minority students. Some of these include: academic and personal counseling, an early-warning monitoring system, a test and reference library, skills-building workshops, and social activities.

Similarly, the College of Engineering established the Women in Engineering (WiE) Program to encourage young women to consider engineering as a career choice, to recruit women into undergraduate and graduate programs, to support women as they matriculate through the engineering programs, and to assist women as they transition to the workforce after graduation. The resources that reside within these two programs are very effective in their charges and their services will continue to evolve as the needs of the MEM degree emerge. In addition, the MEM will have access to OSU's many resources for recruiting and retaining under-represented groups. Linkages with national organizations of minority and women engineers (such as the National Society of Black Engineers, the Society of Hispanic Professional Engineers, and the Society of Women Engineers) are already in place and thriving in the College. The College actively recruits

from these organizations and also works from GRE lists and the Summer Research Opportunity Program (SROP) lists.

In the marketing of the program we will use all of OSU's resources and make every effort to recruit members of underrepresented groups. The MEM offers an outstanding opportunity to enhance the careers of female and minority engineers and, in the process, create more role models to improve the diversity of engineering in general.

Consistent with the University's Diversity Plan, efforts to recruit and retain engineers who are members of the LGBTQ community are receiving increasing emphasis in the College of Engineering. Recruitment efforts through an established link with the National Organization of Gay and Lesbian Scientists and Technical Professionals will be engaged to assist in bringing additional diversity to the MEM program. Retention efforts for LGBTQ engineers are beginning to be addressed within the context of the College's evolving diversity plan and within the College's updated Performance Plan.

## **Assessment Plan**

The MEM administration will continuously assess all of the program's activities. This will be accomplished in several ways.

The most important measure is the satisfaction of the students. In order to gauge this metric, the MEM administration will send individual emails to newly admitted students during the first two weeks of classes to ask if everything is going well and to determine if they're having any problems acclimating as an online student in the degree. Upon the completion of each semester, students will be provided a short survey to assess their satisfaction with the program covering topics not included in the university's SEI. A program exit survey will be provided to graduating students. All of these surveys will be reviewed by the program administration and MEM-GSC and corrective action taken regarding any substantiated negative feedback. If any student leaves the program or doesn't enroll in any classes for two consecutive semesters without any explanation, the PDEP Director will contact the student and attempt to learn why.

The MEM Graduate Studies Committee will have a curriculum assessment plan which will consider both the core and elective courses in the degree. Faculty involved in the program will have constant opportunities to evaluate the distance education facilities and other aspects of the program. The PDEP Director will summarize these evaluations in an annual report to the College's Dean.

All constituencies will be asked to evaluate the level of customer service, the ease of use of the distance education facilities and products, the value of the different aspects of the program and the overall quality of the degree on a regular basis. It will be the responsibility of the Director to summarize all evaluations in an annual report, to determine in consultation with the GSC and the Dean when there are problems requiring action and to determine what action should be taken.

**Appendix C: Sample Plan of Study**

The Master of Engineering Management is designed to be completed in 2-3 years

Master of Engineering Management ( 2 year plan of study)									
Year 1 Autumn		Year 1 Spring		Year 1 Summer		Year 2 Autumn		Year 2 Spring	
Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs
ENGR 6220 Accounting/Finance for Engineers	3	PUBAFRS 5750 Business/Government Relationship	3	ISE 6801 Project Mgmt	3	ENGR 6230 Technology Strategy & Innovation Mgmt	3	PUBAFRS 5610 Innovation, Policy & Gobal Economy	3
ENGR 6210 Leadership & Team Effectiveness	3	ISE 5760 Visual Analytics for Sensemaking	3			ENVENG 6600 Assessment for Human Rights	3	ENVENG 5600 Science, Engineering and Public Policy	3
								ENGR 6XXX Capstone Project in Operational Excellence for Engineers (Capstone Course)	3
Total Hours	6		6		3		6		9

Master of Engineering Management ( 3 year plan of study)															
Year 1 Autumn		Year 1 Spring		Year 1 Summer		Year 2 Autumn		Year 2 Spring		Year 2 Summer		Year 3 Autumn		Year 3 Spring	
Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs	Course	Cr Hrs
ENGR 6210 Leadership & Team Effectiveness	3	ENGR 6230 Technology Strategy & Innovation Mgmt	3	ISE 6801 Project Mgmt	3	ENGR 6220 Accounting/Finance for Engineers	3	PUBAFRS 5750 Business/Government Relationship	3	PUBAFRS 5610 Innovation, Policy & Gobal Economy	3			ENGR 6XXX Capstone Project in Operational Excellence for Engineers (Capstone Course)	3
		ISE 5760 Visual Analytics for Sensemaking	3			ENVENG 6600 Assessment for Human Rights	3	ENVENG 5600 Science, Engineering and Public Policy	3						
Total Hours	3		6		3		6		6		0			3	3



# Appendix D

## ENGR 6XXX: Capstone Project in Operational Excellence for Engineers

### *Course Description*

**ENGR 6XXX, Capstone Project in Operational Excellence for Engineers** is a culminating experience providing students the opportunity to solve real-world challenges by utilizing skills learned from the MEM courses, while implementing the principles of operational excellence and lean systems in an organization. The course will focus on creating learning organizations through problem solving and continuous improvement. This spans every human endeavor and seeks to drive change in the way we work and the way we live. Students will focus on the principles of operational excellence and lean systems as a baseline and explore the detailed workings of processes throughout the enterprise. We will learn how to focus on value and creativity as the engine for change.

We begin with an historical overview and an understanding of lean processes based on Toyota Motor Company's experiences. The heart of the course begins with foundational elements to bring stability to a process, then take steps to achieve higher levels of productivity, profitability, and the professionalism of the workforce. It is not enough to make an organization more efficient; we have to make better places for people to work. As we apply specific lean tools, we will discover their benefits not only to increase productivity, but also to create great workplaces with highly satisfied employees.

### *Course Objectives*

1. Analyze processes to identify problems and develop solutions to improve the performance of those processes.
2. Solve a problem in a work environment.
  - a. Define and document the current situation using value stream map (Concern)
  - b. Analyze a problem to find its root cause (Cause)
  - c. Develop and evaluate multiple countermeasures for the root cause (Countermeasure)
  - d. Plan and implement the best overall countermeasure
    - i. Create flow through a series of processes in a value stream.
    - ii. Regulate the flow of materials or information through a value stream.
  - e. Embed lessons learned into ongoing work practices (Confirm)
3. Model appropriate leadership behaviors to drive changes in the culture of an organization.
4. Build systems to apply and manage lean tools, techniques, principles, and practices in a workplace.

### *Faculty*



David S Veech

Email: [veech.1@osu.edu](mailto:veech.1@osu.edu)  
Twitter: @davidveech  
Office: 334 Fisher Hall  
Office Phone: 614-292-4730  
Office Hours: By appointment

Mr. Veech is a Senior Lecturer in the Department of Management Sciences at the Fisher College of Business, The Ohio State University. Mr. Veech joined the University in 2013 after serving as Executive Director of the Institute for Lean Systems (ILS) for seven years, coaching and consulting with clients in a wide range of industries. His coaching focuses on people in organizations and how lean, leadership, and learning systems contribute to overall employee satisfaction and well-being.

### *Required Course Materials (Kindle Versions are Acceptable)*

1. Lean Lexicon: A graphical glossary for Lean Thinkers, Fifth Edition, Lean Enterprise Institute, ISBN: 978-0966784367
2. The C4 Process (Veech & Damodaraswamy), Robert G. Clark Consulting LLC, ISBN: 978-098326395
3. Change or Die, Alan Deutschman, Collins, 9780061373671
4. Drive, Daniel H. Pink, Riverhead Books, 9781594488849

### Grading

This course requires active participation in online activities and exercises as well as reading and assigned work outside of class. Grades will be based on contributions to the discussion and completed weekly assignments, including the primary project assignment (C4 or A3 worksheet showing familiarity of the course contents. The Primary Project is due on .

Participation requires reviewing materials identified, then for each discussion question, you are required to post your own answer based on your research and experience, then engage with at least two of your classmates by commenting on their answers. Consistent contribution through the semester is required., There are a number of activities and assignments that will be used to assess your understanding of the material covered in this course. These are listed below.

Component	Total Course Points
Participation (5 points x 7 discussion questions, 5 points for your completed Carmen Profile, 1 point for each of 6 quizzes, and 4 points for instructor discretion)	50
Bi-weekly projects (4 points x 6 assignments)	24
C4/A3 Project Files (See below)	26
<b>Total (Maximum points)</b>	<b>100</b>

#### 1. Attendance/Participation (50%)

- a. Attendance is required. You should attend every class and participate to:
  - i. Learn as much as possible
  - ii. Achieve a grade you will be satisfied with
  - iii. Know how to apply these principles in a work place
- b. Arrive on time. In class activities will be fast-paced.
- c. Participate. You should share your thinking and observations during every class session. Come prepared to discuss things. Consistent contribution through the semester is much more valuable than a few good days where you answered a couple of questions in class.
- d. Complete an accurate Carmen Profile with a recent picture (4 points)
- e. Complete any assigned reading and knowledge reviews before class.
- f. The final 4 points are at my discretion and are unlikely to be awarded except to truly exceptional contribution, or to prevent catastrophe.

#### 2. Bi-weekly projects/homework (24%)

- a. Bi-weekly assignments are **individual** assignments completed without collaboration among your classmates. You are permitted to assemble a small team in your workplace to execute the assignments, but you must name everyone who

- contributed when submitting.
- b. **Submit on time. Late assignments will not be considered** and your score for that assignment will be zero. No excuses.
    - i. All assignments are due on Thursdays at 6:15 pm. Anything later than that, regardless of the reason, will not count.
    - ii. **ONLY UPLOAD .pdf FILES** for assignments in Carmen. Make sure pages are oriented properly. Only .pdf files will be graded.
  - c. Assignments must be neat and complete, and in the correct sequence. Use relevant pictures and graphs where necessary. Use the templates/forms/supporting materials uploaded on Carmen. Remember; never upload any weekly assignment in any format except a pdf.

### **3. C4/A3 Project and Presentation (26%)**

- a. **Each student must complete an individual project in your company or in your home.** You will use C4/A3 problem solving (details will be provided in class) to address a moderate-scope business problem that involves cost, quality, delivery or a combination of these.
- b. Each student must complete one progress review session with the instructor via skype or zoom in a scheduled meeting. This review is worth 13 percentage points.
- c. Submit a complete C4/A3 worksheet AND a completed Master presentation file (PowerPoint format) that will include primary and supporting analysis for your project. The Final C4/A3 AND presentation file is worth 13 points.

Further details will be available on Carmen

#### ***Quizzes and Knowledge Reviews***

There will be six knowledge review quizzes that you are required to complete. You may make as many attempts as you need to finish each quiz with a score of 100%

#### ***Disability Accommodation***

If you need an accommodation based on the impact of a disability, arrange an appointment with me as soon as possible. We need to discuss the course format and explore potential accommodations. I rely on the Office for Disability Services for assistance in verifying need and developing accommodation strategies. You should start the verification process as soon as possible.

#### ***Academic Integrity***

Material submitted for course grade credit must be your own work. All university and college regulations concerning academic honesty shall apply. In general, students are expected to recognize and uphold standards of intellectual and academic integrity. The university assumes as a minimum standard of conduct in academic matters that students be honest and that they submit for credit only the products of their own efforts. It is particularly important that students read and understand the portions of the Ohio State University's Code of Student Conduct that relate to plagiarism, unauthorized collaboration, falsification, and multiple submissions. The Code of Student Conduct is available online. This Policy represents a core value of the University. All members of the University community are responsible for knowing and abiding by its tenets. Students are expected to carefully review the online Policy prior to undertaking any research or other assignments. Students are encouraged to discuss freely with faculty any questions they may have pertaining to the provisions of the Code prior to submitting assignments. Lack of knowledge of the contents of the University Policy on Academic Honesty is not an acceptable defense to any charge of academic dishonesty.

**Schedule** (See Carmen for final requirements)

Date	Topic	Activity and Assignment
Session 1	Problem Solving: C4 and A3	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Apply a problem solving process to solve a work related problem</li> <li>2. Contrast different problem solving processes and their primary focus</li> <li>3. Describe key tools to help identify root causes of problems</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: Intro through Chapter 2, The C4 Process</li> <li>2. Read: Lean Lexicon, A3 Report; PDCA; Problem Solving; Five Whys; Six Sigma</li> <li>3. View the Problem Solving pdf in Carmen</li> <li>4. Card Simulation, Round 1, Conventional with small group discussion (Record Stapling Operation)</li> </ol> <p>Assignment: Identify the potential problems for your Individual Class Project. Due Date – Online</p>
Session 2	Value Stream Mapping & Analysis	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Create a current state value stream map to analyze a set of work processes in a theme area. See the system.</li> <li>2. Calculate takt time</li> <li>3. Evaluate the customer-supplier relationship in a value stream</li> <li>4. Analyze processes in a value stream (calculate takt time, processing time, cycle time, set up time, operators and full-time-equivalent people, value-add time, non-value-add time, and any other data required to complete the analysis.)</li> <li>5. Analyze the flow of materials and information through a value stream</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: Chapter 3, The C4 Process</li> <li>2. Read: Lean Lexicon: Value Stream Mapping; Pull systems; Cell; Continuous Flow; Cycle Time; Cycle time and related terms involving time; First-in-First-out; Flow production; Heijunka; Heijunka box; Information flow; Inventory; Kanban; Material Flow; Operational Availability versus Operating Rate; Overall Equipment Effectiveness; Product Family; Product Family Matrix; Pull Production; Spaghetti Chart; Supermarket; Takt image; Takt time; Value; Value Stream Manager; Appendix (Value Stream Mapping Icons)</li> <li>3. Activity: Pencil Pusher Case/Map Card Simulation Current State</li> </ol> <p>Assignment: Submit your project current state map to the dropbox for feedback. Due Date Online</p>

Session 3	Visual Organization and Management	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Apply the principles of 4S/5S in a work setting and describe its utility and value.</li> <li>2. Analyze a work process using standardized work worksheet sets (Time measurement, Standardized work charts, combination tables, and work balance charts)</li> <li>3. Describe the relationship between 4S/5S and standardized work</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read the attached pdf files on 5S and Standardized Work.</li> <li>2. Read: Lean Lexicon: Andon; Automatic Line Stop; Dashboard; Error-Proofing; Five Ss; Gemba; Gemba Walk; Genchi Genbutsu; Kamishibai Board; Muda, Mura, Muri; Obeya; Operator Balance Chart; Production Analysis Board; Red Tagging; Right-sized Tools; Standardized Work; Visual Management; Waste; Work; Work Element; Yamazumi Board</li> <li>3. Activity: Apply 5S/4S to your project problem</li> <li>4. Activity: Build standardized work for the processes in the Card Simulation</li> </ol> <p>Assignment: Submit your standardized work document set (from the team activity we did in class) to the dropbox. Submit the Standardized Work Chart, Time Measurement Sheet, Combination Table, and Work Balance Chart. Due Date online.</p>
Session 4	Lean Overview	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Differentiate lean systems from mass manufacturing and mass customization</li> <li>2. Translate the key factors that helped Toyota rebuild itself into key factors organizations can use today to help improve their performance</li> <li>3. Evaluate the evolution of work systems and their impact on society</li> <li>4. Create a cause map for a problem</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: pdf on Lean Systems Overview (Carmen)</li> <li>2. Read: Chapter 4, The C4 Process</li> <li>3. Read: Lean Lexicon: Basic Stability; Jidoka; Just-in-Time (JIT) Production; Kaizen; Lean Consumption;; Lean Enterprise; Lean Logistics; Lean Management; Lean Management Accounting; Lean Production; Lean Thinking and Practice; Total Productive Maintenance; Toyota Production System; True North</li> <li>4. Activity: Discussion of Lean Philosophy, the Lean House and Toyota Way principles; Cause Map construction and analysis</li> </ol> <p>Assignment: Complete a cause map for your individual</p>

		class project problem and submit to the dropbox. Due Date online
Session 5	Countermeasures	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Develop a plan to contain the spread of a problem in your workplace</li> <li>2. Define objective evaluation criteria to use in evaluating the feasibility and potential effectiveness of countermeasures</li> <li>3. Develop at least 5 alternative countermeasures for every root cause of a problem</li> <li>4. Create a plan for testing the effectiveness of countermeasures</li> <li>5. Evaluate countermeasures using multiple criteria to select the best overall option to solve a problem.</li> <li>6. Plan the implementation of a selected countermeasure.</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: Chapter 5, The C4 Process</li> <li>2. Read: Lean Lexicon: Coaching; Cross-dock; Downtime; Efficiency; Every Product Every Interval (EPEX); Fixed Position Stop System; Four Ms; Hansei; Heijunka; Heijunka box; Jishuken; Kaikaku; Kaizen Workshop; Kanban; Kata; Material Handling; Milk run; Multimachine Handling; Multiprocess handling; Nemawashi; Paced Withdrawal; Pacemaker Process; Pack-Out Quantity; Pitch; Plan for Every Part (PFEP); Point-of-Use Storage; Preventive Maintenance; Production Preparation Process (3P); Quality Control Circle; Setup Reduction; Single Minute Exchange of Dies (SMED); Trade-off Curves;</li> <li>3. Read: Attached pdf files</li> <li>4. Activity: Develop Countermeasures for Card simulation (Focus on stapling)</li> <li>5. Activity: Run Round 2 and 3 of simulation</li> </ol> <p>Assignment: Prepare and complete a 5S/4S activity in your host company. Submit a 3-page summary of the activity (Concern, Cause, Countermeasure, Confirm) with before and after pictures, along with an explanation of the benefits the host company will enjoy as a result of this activity, and explain in detail how the host can sustain the improvement. Due Date online.</p>
Session 6	Leading Change	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Describe the role of leadership in organizational culture change</li> <li>2. Create and model key leadership behaviors in a team setting</li> <li>3. Evaluate the leadership described in class for effective employee engagement and organizational culture changes</li> </ol>

		<p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: Chapter 7, The C4 Process</li> <li>2. Read: Lean Lexicon: Change Agent; Chief Engineer; Coaching; Group Leaders; Hansei; Huddles; Jishuken; Leader Standard Work; Lean Promotion Office; Ohno, Taiichi (1912-1990); Plan for Every Person; Sensei; Shingo, Shigeo (1909-1990); Strategy Deployment; Team Leader; Toyoda, Kiichiro (1894-1952); Toyoda, Sakichi (1867-1930); Training Within Industry (TWI); Value Stream Manager; yokoten</li> <li>3. Read: Attached pdf files</li> <li>4. Activity: Buffalo Hunter Case Study</li> <li>5. Lecture/Discussion: Leadership</li> </ol> <p>Assignment: Based on your readings and discussions so far this term, prepare and submit a 2-page paper describing how the principles described in class will affect your own leadership style and behavior, including a plan for your personal development. Due Date online.</p>
Session 7	Confirm	<p>Objectives are:</p> <ol style="list-style-type: none"> <li>1. Implement a solution to a problem.</li> <li>2. Capture, record, and monitor results from your problem solution.</li> <li>3. Develop key performance indicators to effectively track and monitor a work process</li> <li>4. Update standardized work.</li> <li>5. Train operators to achieve the defined standard for that process as documented in the standardized work</li> <li>6. Reflect on your experience with the problem solving process and assess future needs of the people participating on the team</li> </ol> <p>Learning Activities:</p> <ol style="list-style-type: none"> <li>1. Read: Chapter 5, The C4 Process</li> <li>2. Activity: Card Simulation Round 4</li> <li>3. Activity: Reflection on course activities &amp; contents</li> </ol> <p>Assignment: None – Continue working your project</p>
Due Date Online	Final Project Prep and Delivery	<p>Submit your final C4 or A3 worksheet. Due Date Online</p>