RICE UNIVERSITY

RICE Center for Engineering Leadership
RCEL 501 Engineering Management & Leadership (EML) Theory & Application, F-2025

Class Instruction:	**501-001 On-campus Saturday 9am-12pm**
Assignments Due:	**Thursday 11:59 PM**
Class Instruction:	**501-901 Online Wed. 6:30pm – 8PM, Zoom**
Assignments Due:	**Monday 11:59 PM**

INSTRUCTOR:
Steve Gomez, Professor of the Practice, RCEL, School of Engineering
Contact: Steve.Gomez@rice.edu, sg125@rice.edu
Office hours by appointment

OVERVIEW:
Technology-based innovation is the grand driver of economic progress, which hinges on strong technical leadership guiding technical teams in mid-to-large corporate organizations and startup to small companies. By surveying and learning about the different type of EML approaches, this course outlines frameworks for technical professionals to progress from individual contributor to engineering/technical manager to engineering/technical executive (e.g., Vice President (VP) of Engineering, VP of R&D, Chief Technology Officer).

Practical methods from the engineering management literature that addresses technology-based innovation issues that have engineering management implications will be introduced. Seminal technology management principles, such as disruptive innovation, technology maturity frameworks, and digital platform strategy, found in companies ranging in size from start-up to large, will be examined. The instructor will discuss past technology development, deployment and leadership experiences, while also reviewing EML case studies to teach students how to evaluate and shepherd technical product ideas through corporate resource allocation processes.

The class will consist of three parts: Identity, Management, and Leadership. The first part guides the student to develop a technical identity which is the foundation of management and leadership. The second part exposes the student to key management frameworks to manage a team and the team's work. The third part connects identity and management to leadership and introduces the student to frameworks to lead at the organizational level. The class learning outcome with prepare the student to make informed decisions at any level of the leadership pipeline.

ASSUMPTIONS:
1. You can learn and develop technical management and leadership competencies.
2. Management and Leadership is practiced.
3. Best Practices and Standards will be drawn from the American Society for Engineering Management.
4. The class guiding definition, comes from Thomas Day, and defines technical/engineering manager as a "decision maker in the processes involving technology-based activities to ensure the most practical and accepted endeavors are contrived, supported, pursued, and completed."

3. Technical leaders leverage leadership competencies, visual management, and communication skills to advance. Classic essay writing skills are important but less impactful.
4. You are pioneers in the field of EML and technical management and will help with the improvement of this course through constructive feedback and recommendations. You will remain positive and adapt along with the instructor!

REQUIRED READINGS - Purchase:
1.Purchase HBR Case Studies Packet – You must purchase by week 2.
https://hbsp.harvard.edu/import/1317695
2. Papers, articles, chapters posted on the Canvas course site. The readings will include theory and practice-based research papers, business school articles, case-studies, and book chapters. The readings will inform our class discussions and assignments.
3. Zone to Win book – Wait until covered in class to check out from Fondren Library or buy
Zone to Win from Fondren Library
Link: Zone to Win: Amazon Digital Book

Engineering Kit:
You may be asked to purchase a small engineering kit $50 USD for a potential E Ink or Cubesat project.

RECOMMENDED REFERENCE BOOKS (not required):
1. Alexander Kossiakoff, Steven M. Biemer, and Samuel J. Seymour. Systems Engineering Principles and Practice (2nd edition). Wiley.
Fondren Library ebook link
2. Annie McKee. Management A Focus On Leaders (2nd edition). Pearson.
Link to Amazon Digital Book
SOFTWARE APPLICATIONS:
1. Course Management – Canvas, Rice email
2. Online Collaboration – ZOOM, Miro, Meisterplan
3. Software Tools – Word processor, spreadsheet, presentation tool, Python 3, OpenSCAD, Fusion360

LEARNING OBJECTIVES (You will succeed!):
Students successfully finishing this class will:
- Understand the technical and behavioral competencies of engineering/technical management & leadership,
- Develop self-awareness of one's engineering/technical leadership skills and actively practice improving them,
- Be able to visualize and apply EML frameworks and tools to practical and professional based work environments,
- Practice communication and keeping it short,
- Have a personal leadership foundation to achieve your professional goals over the next 10 years.

EML FRAMEWORKS covered in course (You can learn them!):
1. Leadership pipeline
2. Boyatzis Expert Leadership Model
3. Discretionary Leadership Model
4. Technical Leadership Competency Model
5. Intentional Change Theory
6. Decision Making Framework
7. Sheridan's Automation Diagrams for Industry 4.0

8. Product Development Funnel & Management
9. Design Structure Matrix: Alignment Matrix
10. People, Process, and Technology Maturity frameworks for Industry 4.0
11. Systems Engineering Management
12. Strategy for Industry 4.0
13. Zone to Win, Disruptive Innovation
14. Strategy for Start-ups

LEARNING METHODS (Leadership can be learned through practice!):

Two learning theories will inform the teaching and participation of the course. The first learning theory is Kolb's experiential learning theory. Kolb holds that learning is accomplished through the four circular phases of Doing, Reflecting, Theorizing, and Practicing. The second theory of learning is Mezirow's transformative learning theory. Mezirow posits that learning is accomplished through a change of one's frameworks and through one-to-one dialogue with a coach. Our classroom discussions will be designed around these two theories of learning.

Kolb
- We will cover the **theory** behind EML frameworks and management tools.
- We will **practic**e these frameworks both in class and outside of class.
- You will **reflect** on the frameworks within your professional environment.
- You will **do** the class assignments to demonstrate your learning.

Mezirow
- You will be exposed to EML frameworks and you will practice communicating and improve through feedback.

GRADING* (Your grade depends on your relative personal growth as a leader!):

*I reserve the right to make changes to the Syllabus, Canvas course, and grading structure to address the needs of the class as the semester progresses.

The default Rice Canvas grading scheme is used. I do not round up to be fair to all students.

Your grade will depend on your demonstration of leadership skill improvement, visual management presentations, group, and one-to-one communications, and personal engineering leadership resumes and a personal EML project.

Grade: You must submit all assignments to receive a grade, failure to do so will result in a D/F or INC. LATE Policy: 15% per day (see above)	Max Points	How Graded
Participation		
Class Attendance & Participation YOU MUST ATTEND CLASS WITH VIDEO ON.	70	0 to 5
Ice Breaker QUESTIONS	48	0 to 4
Weekly Reflection Sentences	48	0 to 4
Management: Visual and Verbal Communication		
Weekly Miro Assignments	176	0 to 16
Weekly Video Assignments (< 2 minutes)	Peer Review	88	0 to 8
Mid-term Miro Case Study Analysis	100	0 to 100
Leadership		
Optional E Ink / Cubesat Project 1 Pager	100	0 to 100

Ideal Resume assignment 1 Pager	100	0 to 100
Personal EML Projects	200	0 to 200
TOTAL	930	

CLASS NORMS (We are team and respect each other):

- Come fully prepared to class by completing readings and assignments.
- When emailing the instructor please include Class Number in Heading.
- Practice good listening skills.
- Control your emotions and have respectful open discussions and debates - great leaders have great emotional intelligence.
- For Zoom, please keep your cameras on as much as possible, give your full attention, and be respectful.
- For Discussion Boards and Miro please be professional with your content.
- Many students in the program work at a company. We need to practice discretion and trust each other not to share what is said in class, outside of the Rice community.
- For Peer Review on Miro Videos- only positive, strength-based comments are allowed.

ACADEMIC INTEGRITY:

You and I are required to follow the Rice University Honor Code.
http://gradhonor.rice.edu/

Understanding how and when to use generative artificial intelligence (AI) tools (such as, but not limited to, ChatGPT or Dall-E 2) is quickly emerging as an important skill for future professions. To that end, you are welcome to use AI tools in this course, as long as your use aligns with the learning outcomes or goals associated with assignments. Please keep in mind that you are responsible for the information you submit, including any inaccurate, biased, offensive, or otherwise unethical content, regardless of whether it comes from you, an AI tool, or any other source.

Use of AI tools must be properly cited and documented for any work submitted in this course. Content from an AI tool included in a document must be cited as a source. (How to cite an AI source in a document is currently in flux. Depending on the tool you're using, a link may be available or you may need to take screenshots. Here are instructions for how to use ChatGPT share links. Instructions for citing a source may be updated during the semester.) Failure to cite an AI tool as a source is a form of plagiarism and a violation of Rice University's Graduate Honor Code.

In addition, you must describe the use of an AI tool in preparing an assignment, even if you do not use generated content in a document or in the assignment. Usage may include performing research, brainstorming, outlining, drafting, revising, etc. Include the description of your usage in an addendum to a submission or as a separate upload, depending on the assignment. Failure to acknowledge your use of an AI tool will be considered a violation of Rice University's Graduate Honor Code.

STUDENTS WITH DISABILITIES:

If you have a documented disability that may affect academic performance, you should: 1) make sure this documentation is on file with Disability Resource Center (Allen Center, Room 111

TOPICS, ASSIGNMENTS, and DETAILS:
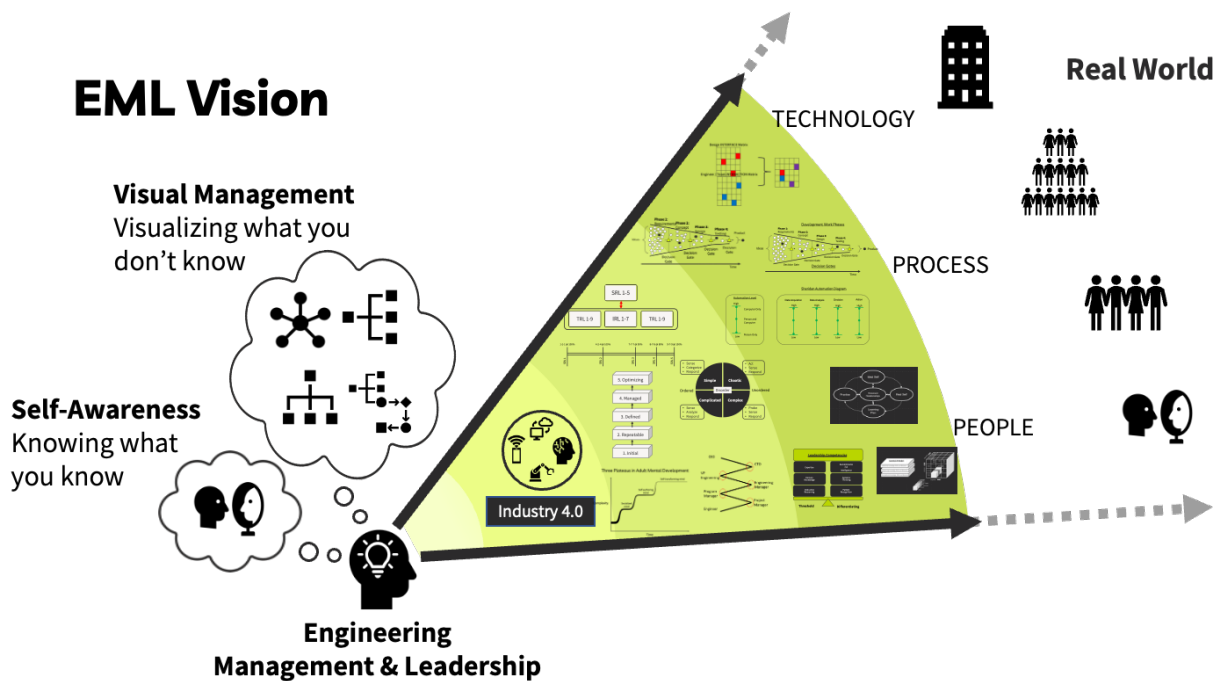
TOPICS

Module	Part	Topics
1	Identity	Expert Leadership and your TODAY Resume
2	Identity	Changing to be a Leader for Industry 4.0 and REAL Resume
3	Management	Decisions & Automation
4	Management	Product Development Fundamentals, Decisions & People
5	Management	Product Development Fundamentals, Decisions & Systems
6	Management	Product Development Fundamentals, Decisions & Process
7	Management	Product Development Fundamentals, Decisions & People Revisited
8	Management	Putting it all together – Data Storytelling
9	Leadership	Systems Engineering
10	Leadership	Strategy and Industry 4.0
11	Leadership	Strategy and Zone to Win
13	Identity	Start-up Founder	Ideal Self and IDEAL Resume
14	Leadership	EML Video and Projects

ASSIGNMENTS

Module	Assignments
13	IDEAL Resume Due & Potential Cubesat Project
14	EML Video and EML Projects Due
1-14	Discussion Board – 1 to 2 Questions Miro Whiteboard Visual Map < 2 Minute Video explanation of Visual Map | Peer Review

IDEAL Resume – Your 2034 resume in a 1 page format
Personal EML Projects – Personal engineering/technical management and leadership projects. Submissions can include writing a Case Study, writing an ASEM journal paper, an EML poster presentation, a cubesat of your design, python coding of competency cube, alignment matrix, SRL calculator, NASA project analysis, etc.

DETAILS

SEE Canvas for course for updated details and schedule. CANVAS is the master syllabus.

Module 1 Topics and Assignments
Expert Leadership

REQUIRED READING

- Connecting to Leadership
    - Read -"Leadership Pipeline: Building Leaders at Every Level" by Ram Charan and Stephen Drotter (CANVAS)
    - Read -"Competencies in the 21st Century" by Richard Boyatzis (CANVAS)
- Connecting to Engineering Management Case Study
    - Read and Analyze -"How Apple is Organized for Innovation" by Joel M. Podolny and Morten T. Hansen. HBR. (CANVAS)

ASSIGNMENTS
Assignment R0: Submit your current resume (whatever form it is in –do not update at this point).
Assignment: Answer all questions in discussion board and participate.
Assignment VM1: Create your first Miro Whiteboard– visually summarizing the readings.
Assignment: Reflection Sentence

Module 2 Topics and Assignments
Changing to be a Leader for Industry 4.0

REQUIRED READING

- Connecting to Leadership
    - Read - 'Intentional Change' by Richard Boyatzis and Annie Mckee. (CANVAS)
- Connecting to Management
    - Read - "A Multidimensional Hierarchical Engineering Competency Model" by Brian Wells. (CANVAS)
- Connecting to Engineering Management Case Study

- o Read and Analyze -"DJI Innovations: Product Development in Start-ups" by Mitchell Tseng and IVY BUCHE. (HBR)

ASSIGNMENTS

Assignment : Answer all questions in discussion board and participate.
Assignment VM2: Create your Miro Whiteboard– visually summarizing the readings.
Assignment: Reflection Sentence

Module 3 Topics and Assignments
Decisions & Automation | REAL Resume

REQUIRED READING

- Connecting to Leadership
  - o Read - "A Leader's Framework for Decision Making" by David Snowden and Mary Boone.(CANVAS)
- Connecting to Engineering Management
  - o Read - "A Model for Types and Levels of Human Interaction with Automation" by Raja Parasuraman, Thomas Sheridan, and Christopher Wickens. (CANVAS)
- Connecting to Engineering Management Case Study
  - o Read and Analyze - "What Went Wrong with Boeing's 737 Max?" by William W. George and Amram Migdal.(HBR)

ASSIGNMENTS

Assignment: Answer all questions in discussion board and participate.
Assignment VM3: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD3: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence

Module 4 Topics and Assignments
Product Development Fundamentals, Decisions & People | REAL Resume

REQUIRED READING

- Connecting to Engineering Management
  - o Read – "Product Development Fundamentals" by Marco Iansiti, et al. (2016) (HBR)
  - o Read – "Are Your Engineers Talking to One Another Whey They Should" by Manuel Sosa, et al. (2007) (CANVAS)
- Connecting to Engineering Management Case Study
  - o Re-read and Analyze - "What Went Wrong with Boeing's 737 Max?" by William W. George and Amram Migdal.(HBR)

ASSIGNMENTS

Assignment : Answer all questions in discussion board and participate.
Assignment VM4: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD4: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence

Module 5 Topics and Assignments
Product Development Fundamentals, Decisions & Systems | REAL Resume

REQUIRED READING
- Connecting to Engineering Management
  - Re-read – "Product Development Fundamentals" by Marco Iansiti, et al. (2016) (HBR)
  - Read– "From TRL to SRL: The Concept of Systems Readiness Levels" by Brian Suaser, et al. (CANVAS)
- Connecting to Engineering Management Case Study
  - Re-read and Analyze - "What Went Wrong with Boeing's 737 Max?" by William W. George and Amram Migdal. (HBR)

ASSIGNMENTS
Assignment : Answer all questions in discussion board and participate.
Assignment VM5: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD5: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence

Module 6 Topics and Assignments
Product Development Fundamentals, Decisions & Process

REQUIRED READING
- Connecting to Engineering Management
  - Re-read – "Product Development Fundamentals" by Marco Iansiti, et al. (2016) (HBR)
  - Read - "CMM versus Agile: Methodology Wars in Software Development" by Robert D. Austin. (HBR)
- Connecting to Engineering Management Case Study
  - Read and Analyze- "Going with the Flow: Agile Development at Dell" by Denis Dennehy, et al. (2021) (HBR)

ASSIGNMENTS
Assignment : Answer all questions in discussion board and participate.
Assignment VM6: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD6: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence

Module 7 Topics and Assignments
Product Development Fundamentals, Decisions & People Revisited

REQUIRED READING
- Connecting to Engineering Management
  - Re-read – "Product Development Fundamentals" by Marco Iansiti, et al. (2016) (HBR)
- Connecting to Leadership
  - Read- "Why Good Leaders Make Bad Decisions" by Andrew Campbell, et al. (2009) (CANVAS)
  - Read - "Adult Development and Organizational Leadership" by Robert Kegan, Lisa Lahey. (HBR)
- Connecting to Engineering Management Case Study
  - Re-read and Analyze- "Going with the Flow: Agile Development at Dell" by Denis Dennehy, et al. (2021) (HBR)

ASSIGNMENTS
Assignment : Answer all questions in discussion board and participate.
Assignment VM7: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD7: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence
Assignment: Real Resume Due

Module 8 Topics and Assignments
Putting it all together – People, Process, Technology, Decisions

REQUIRED READING
- Connecting to Engineering Management Case Studies
  - Re-read and Analyze- "Going with the Flow: Agile Development at Dell" by Denis Dennehy, et al. (2021) (HBR)
- OR a Different Case Study of My Choosing

ASSIGNMENTS
Assignment : Answer all questions in discussion board and participate.
Assignment VM8: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD8: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence

The following topics will be updated based on class performance and interests:

Module 9 Topics and Assignments
Systems Engineering
See Canvas

Module 10 Topics and Assignments
Strategy and the Technology Stack
See Canvas

Module 11 Topics and Assignments
Strategy and the CEO
See Canvas

Module 13 Topics and Assignments
Start-ups Strategy and Disruption| IDEAL Resume

REQUIRED READING
- Connecting to Leadership
  - Read – "Strategy for Start-ups" by Joshua Gans, et al. (2018) (CANVAS)
  - Read – "What is Disruptive Innovation?" by Clayton Christensen, et al. (2015)(CANVAS)

Assignment: Answer all questions in discussion board and participate.
Assignment VM13: Create your Miro Whiteboard– visually summarizing the readings.
Assignment VD13: Record yourself presenting your Miro Whiteboard < 2 minutes| Peer Review
Assignment: Reflection Sentence
Assignment: Ideal Resume Due