



DREXEL UNIVERSITY  
College of  
**Engineering**  
*Mechanical Engineering and Mechanics*



DREXEL UNIVERSITY MECHANICAL  
ENGINEERING AND MECHANICS

# STRATEGIC PLAN

2022 - 2027

# TABLE OF CONTENTS

|  |    |
|--|----|
| A Message from the Department Head .....   | 3  |
| Mission / Vision / Core Values .....   | 4  |
| Guiding Principles .....   | 5  |
| Strategic Goals .....  | 6  |
| I. Create boundaryless learning environments that build empowered, resilient students .....                    | 7  |
| ▶ Forge a trailblazing, adaptive, and engaging undergraduate program   |    |
| ▶ Invest in student governance and student organizations   |    |
| ▶ Re-invigorate our graduate programs  |    |
| ▶ Build and program the MEM Collaboratory and Learning Factory (LeaF)  |    |
| II. Develop a focused research agenda and enhance our research impact .....                                    | 9  |
| ▶ Attract, mentor, and support a diverse group of exceptional researchers                                      |    |
| ▶ Create and maintain an inventory of the department’s research capacity                                       |    |
| ▶ Grow PhD enrollment  |    |
| ▶ Build relationships with entities that will amplify department research                                      |    |
| ▶ Host mechanical engineering salons   |    |
| III. Strengthen the department’s outreach, networks, and talent pipeline .....                                 | 10 |
| ▶ Form and activate advisory groups and networks that will advance MEM’s Goals and Mission                     |    |
| ▶ Ensure consistent communications and messaging   |    |
| ▶ Diversify participation in the study and practice of mechanical engineering                                  |    |
| ▶ Establish formal mechanisms for mentoring faculty and professional staff                                     |    |
| IV. Promote a departmental culture of shared governance built on inclusion, collaboration, and fairness .....  | 12 |
| ▶ Define faculty workload holistically and analytically and share its parameters transparently and collegially |    |
| ▶ Nurture a collaborative approach to continuous pedagogical improvement and assessment                        |    |
| ▶ Get to know our students better  |    |
| ▶ Empower MEM professional staff   |    |
| ▶ Create a diverse, inclusive, and equitable MEM community   |    |
| Strategic Planning Committee .....   | 14 |

# A MESSAGE FROM THE DEPARTMENT HEAD

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The Department of Mechanical Engineering and Mechanics (MEM) holds a place among the top mechanical engineering programs of our nation. It is my honor to lead our MEM community and to share with you our new strategic plan.

This plan describes MEM's collective mission, vision, and core values and lays out four high-level goals and specific strategies and initiatives to achieve them. It is the culmination of more than a year of conversations, analyses and collaborative efforts among our faculty, staff, students, alumni, and friends. I am proud of the work we have done together and deeply grateful to all the stakeholders who have engaged in this process.

The strategic planning process heightened our understanding of the unprecedented circumstances that mechanical engineering education finds itself in today. It is one of the oldest engineering disciplines, yet its tools are increasingly essential to novel applications in such areas as energy-efficient systems, advanced manufacturing, personalized medicine, ubiquitous sensing and computing, and other emerging fields. With this expansion of cross-disciplinary inquiry, a question has emerged: How will we responsibly advance the frontiers of what machines can do?

This question demands that we explore how mechanical engineering education should prepare students to confront society's greatest challenges—climate change, diseases without national boundaries, widespread human wellness and a high quality of life to go with increased longevity. It also asks us to confront important ethical issues, such as how to build equity, justice, and sustainability into our inventions, and even to

consider: just because we can build something, is it wise to?

The strategic planning process was also an essential means of self-assessment. It forced us to wrestle with immediate challenges—enrollment, faculty retention, scarce and scattered space, and too-high student-faculty ratios. It necessitated our confronting frankly a complicated departmental culture. And ultimately it asked us to rethink MEM's vision, mission, and core values in light of our responses to all of these concerns.

This plan, which harmonizes with the College of Engineering and Drexel 2030 plans, is our response to the challenges facing our discipline and our department. It will guide our programs and curricula, hiring and professional development, governance and decision-making, resource allocation, and communications. And it will be a living document that we revisit regularly and adapt to new challenges and opportunities. Through it we will deliver on our mission and build toward our vision of a thriving MEM where we collaborate and innovate together.

Jonathan E. Spanier,  
Professor and Head





# MISSION

The Department of Mechanical Engineering and Mechanics will be a vibrant and inclusive academic community of choice for diverse students and scholars – one that welcomes and supports those underrepresented in our field into programs distinctive for integrated and collaborative education, inquiry fueled by curiosity-inspired modeling, design, and manufacturing; and the successful application of MEM discoveries and innovations to address humanity's most pressing challenges.

# VISION

The Department of Mechanical Engineering and Mechanics engages students and faculty from around the world in integrated teaching & learning, research, and service that empowers them to solve complex societal problems with technical skills, creativity, and empathy.

# CORE VALUES

**Integrity** | Ensuring ethical behavior and accountability in all of our pursuits and interactions.

**Agility** | Pursuit of the personal and professional growth, adaptability and persistence necessary to thrive in a constantly changing educational and innovation landscape.

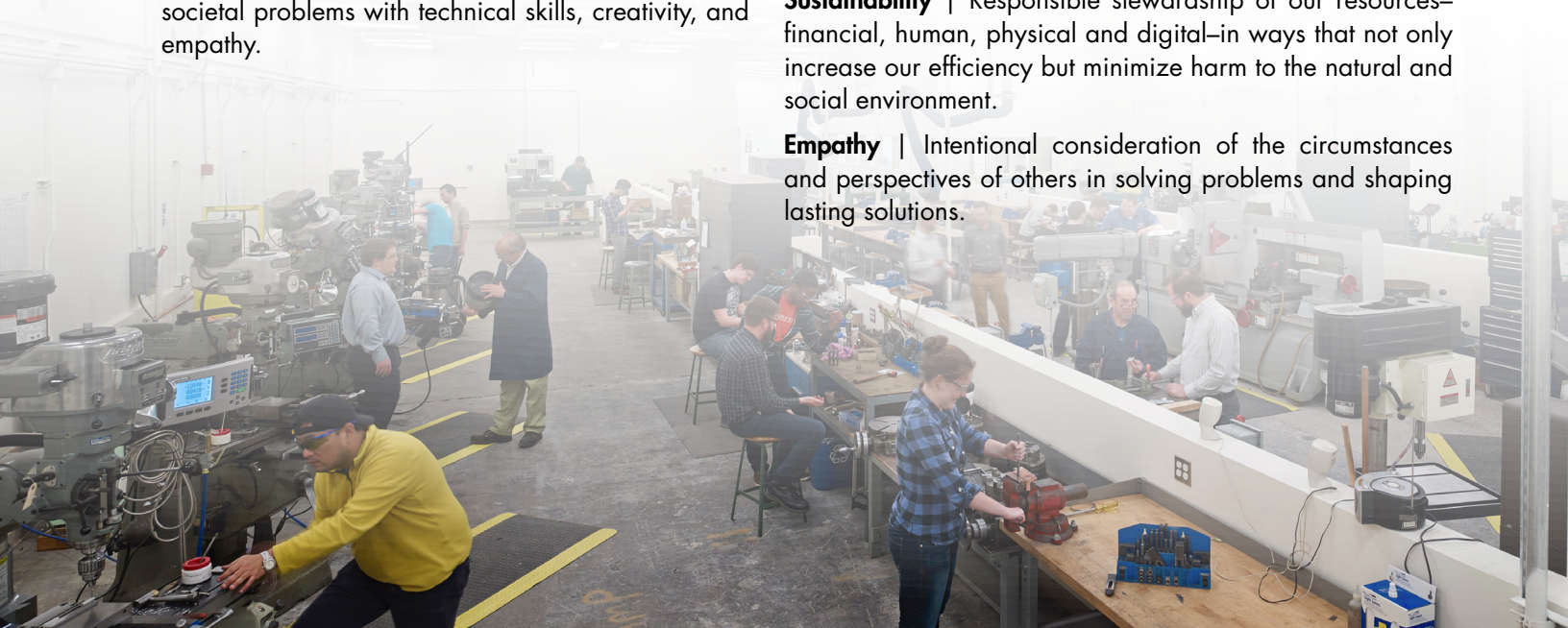
**Technical Excellence** | Striving for the highest level of achievement in engineering and proliferation of practical and theoretical knowledge to guide the next generation of innovative problem solvers.

**Diversity, equity and inclusion** | Commitment to building a community of diverse personal backgrounds, experiences, and viewpoints—one that welcomes and respects these differences as essential for effective inquiry, learning, and growth, and treats all of its members with fairness and justice.

**Community** | A collegial departmental culture that supports meaningful interaction and collaboration among students, faculty and staff and across traditional academic career boundaries.

**Sustainability** | Responsible stewardship of our resources—financial, human, physical and digital—in ways that not only increase our efficiency but minimize harm to the natural and social environment.

**Empathy** | Intentional consideration of the circumstances and perspectives of others in solving problems and shaping lasting solutions.



# GUIDING PRINCIPLES

**Our strategic goals are rooted in MEM's mission and the following principles:**

Students who are guided by their interests and a sense of purpose are likely to have more rewarding professional and personal outcomes.

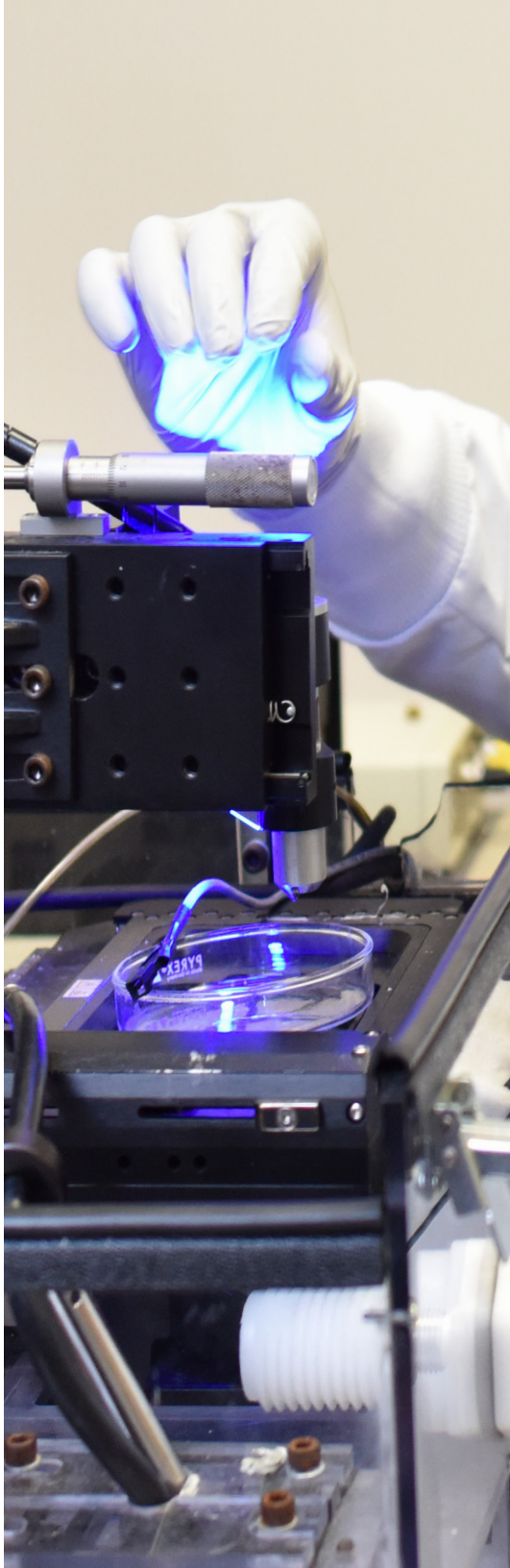
Embracing lifelong and life-wide learning early in one's education helps build flexibility, fearlessness, and curiosity that enhances career prospects even in the face of rapid and often disruptive changes.

Developing resilience requires that we encourage thoughtful risk-taking, and confront the inevitable challenges or failures that arise with curiosity, patient inquiry, and renewed desire to overcome hurdles to achieving our goals.

The best learning occurs not only with the accretion of individual knowledge but through progressively deeper cycles of engagement with a problem or case in collaboration with colleagues and peers.

Integrating foundational coursework with ongoing exposure to real-world problems through cooperative education and other means amplifies both classroom and experiential learning.

To ensure MEM's long-term strength and impact, we must invest as individuals and as a departmental in building and sustaining a vibrant, collegial community of diverse backgrounds and experiences.



# STRATEGIC GOALS

Create boundaryless learning environments that build empowered, resilient students

Develop a focused research agenda and enhance our research impact

Strengthen the department's outreach, networks, and talent pipeline

Promote a departmental culture of shared governance built on inclusion, collaboration, and fairness

# GOAL ONE

## Create Boundaryless Learning Environments that Build Empowered, Resilient Students

### FORGE A TRAILBLAZING, ADAPTIVE, AND ENGAGING UNDERGRADUATE PROGRAM

In partnership with the Office of the Dean, and by leveraging campus resources and networks, MEM will work with students to design personalized curricula that align their individual interests and goals with the necessary competencies, coursework, projects, and experiences to achieve them. These purpose-centric, project-based learning missions that students follow and adapt throughout their undergraduate journey will be MEM's hallmark approach to mechanical engineering education. We will support this by:

- ▶ **Redesigning our undergraduate curriculum** around the key competencies of contemporary mechanical engineering and MEM students' interests and learning missions, enriching these with other essential and emerging competencies, such as data science, AI, digital platforms, engineering ethics, advanced manufacturing and process control automation, and environmental sustainability.
- ▶ **Streamlining the department's foundational course requirements** in order to create the latitude for students to pursue individual learning missions beginning early in their engineering studies, promote academic progress, and create cohorts around related areas of student interest.
- ▶ **Increasing project-based learning opportunities** in areas related to common student learning interests, using such avenues as engineering and entrepreneurship competitions, maker spaces, problems provided by our industry partners, and projects built into MEM courses.
- ▶ **Fostering and growing long-term industry partnerships** to accelerate continuous curricular innovation and support student learning missions.
- ▶ **Examining how we assess student learning and success**, and modifying and devising new measures.



Endress+Hauser CEO Matthias Altendorf visits Drexel MEM



## INVEST IN STUDENT GOVERNANCE AND STUDENT ORGANIZATIONS

- ▶ **Launch a student-led MEM peer-tutoring program** in partnership with Pi Tau Sigma and the ASME, and pilot a cognitive tutoring initiative, for example, one using Cognitive Tutoring Author Tools (CTAT).
- ▶ **Increase personal outreach to current and prospective MEM students** by peers, professional staff, and faculty at all levels through activities such as recruitment, early-stage academic and career mentoring, undergraduate research and exposure to entrepreneurship. Make outreach a fundamental element of department culture and a means for increasing empathy, connections, and community among all members of MEM.
- ▶ **Provide reliable funding for events that build community**; celebrate student academic, service, and leadership achievements; and showcase exceptional accomplishments in pedagogy, mentoring, and research by students and junior scholars.
- ▶ **Form a student academic advisory group** that provides the MEM Advisory Council and department head with information, advice, and recommendations on student attitudes, needs, and expectations.

## RE-INVIGORATE OUR GRADUATE PROGRAMS

- ▶ **Expose students to the full spectrum of MEM research and build departmental community** by identifying program-wide learning objectives and outcomes for each, establishing a mentoring network, and developing a team-taught graduate core curriculum.
- ▶ **Increase personal outreach to current and prospective MEM students by peers, professional staff, and faculty at all levels** by establishing a lab rotation for all entering full-time master's students as well as a mentored first-year teaching assistantship and service experiences for all entering full-time PhD students.
- ▶ **Raise the minimum PhD stipend** so that it is aligned with those of our peer and aspirant institutions; **enhance recruitment of outstanding women and underrepresented-minority PhD students**; and **create supplemental funding targeted to raise MEM's competitiveness** for the most desirable doctoral students.

## BUILD AND PROGRAM THE MEM COLLABORATORY AND LEARNING FACTORY (LEAF)

MEM Collaboratory and Learning Factory (LeaF): a signature space, "owned" by all members of the department, that will enable boundaryless learning and inquiry, deepen student curiosity and engagement, and lower barriers to academic success. LeaF will be an inspiring, state-of-the-art physical and virtual facility that:

- ▶ Aims to offer an authentic design and manufacturing learning environment
- ▶ Activates project-based instruction
- ▶ Stimulates pedagogical experimentation
- ▶ Encourages formal and informal collaboration



- ▶ Provides a welcoming space for MEM students, professional staff, and faculty; those of other College of Engineering departments; and anyone with interest in mechanical engineering

## GOAL TWO

# Develop a Focused Research Agenda and Enhance our Research Impact

### ATTRACT, MENTOR, AND SUPPORT A DIVERSE GROUP OF EXCEPTIONAL RESEARCHERS

- ▶ **Recruit and invest in faculty** with (a) core knowledge in dynamic systems and controls, thermal and fluid systems, mechanics and materials and (b) research that addresses one or more of the following areas: energy-efficient materials, devices and systems; sustainable manufacturing; and personalized medicine and health.
- ▶ **Emphasize the importance of** capabilities in **data science** and **deep physics-based** and **machine learning-enabling tools**, applicable across numerous fields of study.
- ▶ **Establish and fund early-career research positions** such as postdoctoral and research fellows and comparable roles for highly-skilled technical staff.
- ▶ **Foster and grow long-term industry partnerships** to accelerate continuous curricular innovation and support student learning missions.
- ▶ **Create a rich set of mentoring approaches** that help ensure career success for all MEM researchers, particularly those with backgrounds and experiences different from the majority of current department faculty.

### CREATE AND MAINTAIN AN INVENTORY OF THE DEPARTMENT'S RESEARCH CAPACITY

Create and maintain an inventory of the department's research capacity and map MEM's intellectual capabilities and infrastructure assets to current and emerging research areas.

### GROW PHD ENROLLMENT

Grow PhD enrollment by securing a larger number and broader range of single- and multi-investigator grants.

## **BUILD RELATIONSHIPS WITH ENTITIES THAT WILL AMPLIFY DEPARTMENT RESEARCH**

- ▶ Co-op employers
- ▶ National Laboratories and Defense Laboratories
- ▶ Institutes
- ▶ Industry Partners and Associations
- ▶ Government Agencies

## **HOST MECHANICAL ENGINEERING SALONS**

Host mechanical engineering “salons” in the form of dialogues with thought leaders on how mechanical engineering is addressing problems at the frontier of science, technology and society. Use these as forums to bring together MEM students, alumni, faculty, and staff at different stages of their education and careers; capture their imaginations; and stimulate dialogue on the implications for MEM research and teaching.

# GOAL THREE

## Strengthen the Department’s Outreach, Networks, and Talent Pipeline

### **FORM AND ACTIVATE ADVISORY GROUPS AND NETWORKS THAT WILL ADVANCE MEM’S GOALS AND MISSION**

- ▶ Establish a Departmental External Advisory Board, with members from the private, public, and not-for-profit sectors, to help MEM:
  - Attract and retain diverse student, faculty, and professional staff talent.
  - Identify emerging engineering practices, competencies, and needs.
  - Shape suitable programs and pedagogies in response.
  - Envision the space and infrastructure necessary to enhance teaching and learning and increase our

research competitiveness and impact.

- Build and strengthen the department’s network across the private, public, and not-for-profit sectors.
  - Provide insight into the curriculum for purposes of accreditation.
- ▶ Partner with Institutional Advancement to build a network of women and minority MEM alumni and friends who, with the college’s Diversity, Equity, and Inclusion team, will provide support for the recruitment, retention, and career guidance of greater numbers of women and minority students and faculty.
- ▶ Develop a senior design advisory board composed of members from industry partners that will support professional development and career growth for all MEM Senior Design Students through meaningful and financially supported senior design projects.

## **ENSURE CONSISTENT COMMUNICATIONS AND MESSAGING**

Work in coordination with college and university marketing and communications teams to ensure consistent messaging with content that reinforces our core values and strategic priorities.

## **DIVERSIFY PARTICIPATION IN THE STUDY AND PRACTICE OF MECHANICAL ENGINEERING**

In coordination with College undergraduate recruitment, we will reach out to a broader pool of potential mechanical engineering students, stimulating their interest during the K-12 years by redefining what it means to be a mechanical engineer as well as what a mechanical engineer looks like, and by positioning mechanical engineering as a gateway to a vast and varied array of careers. We will make the department an essential piece of the pipeline into the study of engineering for diverse students and out, becoming a valued source of diverse and highly capable engineering graduates for academic and professional careers. In this way, we will establish MEM as one of the nation’s premier resources for broadening understanding of and participation in mechanical engineering.

## **ESTABLISH FORMAL MECHANISMS FOR MENTORING FACULTY AND PROFESSIONAL STAFF**

Mechanisms include sources of mentorship, incentives, mentor training, and evaluation of mentoring outcomes.

## GOAL FOUR

# Promote a Departmental Culture of Shared Governance Built on Inclusion, Collaboration, and Fairness

### **DEFINE FACULTY WORKLOAD HOLISTICALLY AND ANALYTICALLY AND SHARE ITS PARAMETERS TRANSPARENTLY AND COLLEGIALLY**

We will undertake an analysis that will (a) identify the workload norms and expectations of similar programs at comparable institutions and (b) consider such factors as the requirements of assigned courses (enrollment, TA support, etc.) faculty expertise, and the expectations of faculty for other departmental instruction, research, and service. We will share the results of such analysis and use them to craft MEM workload definitions and policies in a process that seeks input from all of our faculty members and is aligned with CoE and campus expectations.



An MEM student demonstrates a robotic mobility device

### **NURTURE A COLLABORATIVE APPROACH TO CONTINUOUS PEDAGOGICAL IMPROVEMENT AND ASSESSMENT**

This approach will stimulate and reward the open, collegial, and respectful exchange of ideas and best practices, sharing of course methods and materials, and readiness to participate in peer observation and feedback, from first year through senior design.

### **GET TO KNOW OUR STUDENTS BETTER**

Encouraging informal and collegial interactions among faculty, students, and professional staff. For example, establishing the expectation that all MEM sophomores and first-year graduate students will host a department faculty member for a meal or coffee at the department's expense.



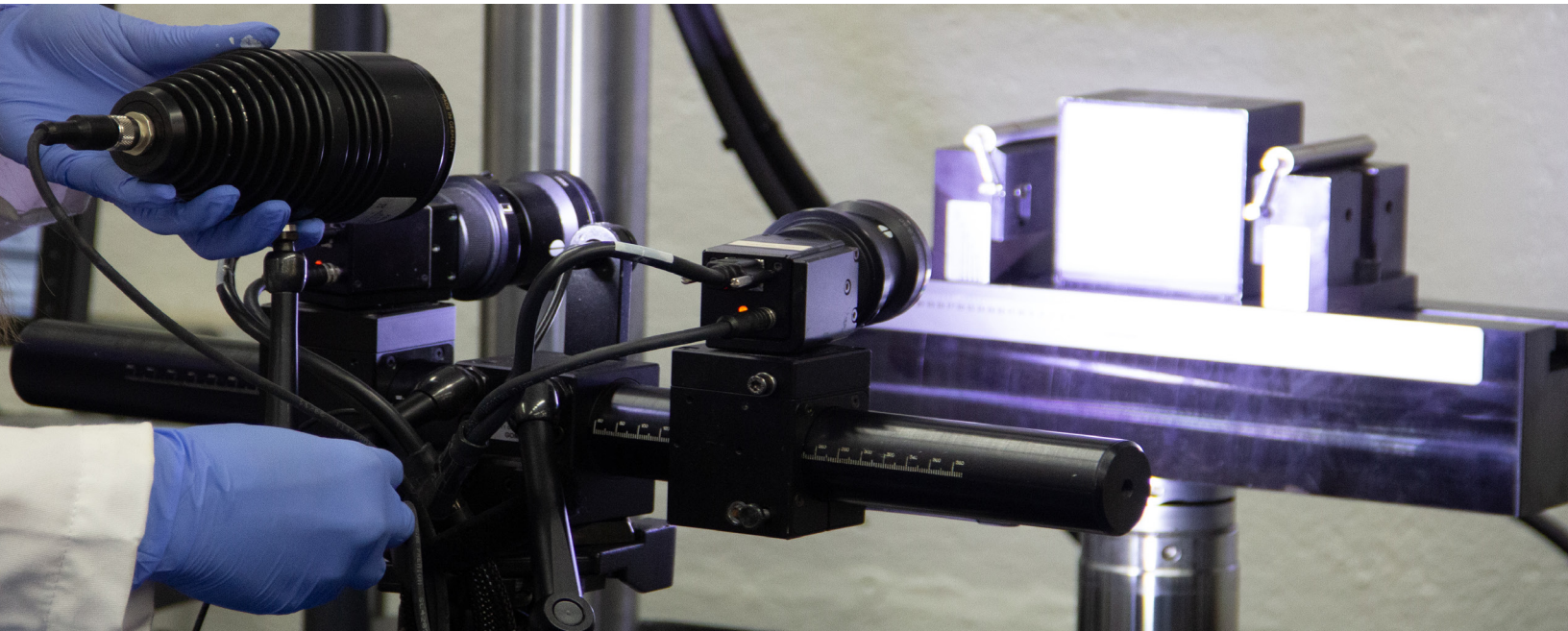
## EMPOWER MEM PROFESSIONAL STAFF

Provide MEM professional and staff with the necessary professional development to work as partners with MEM faculty in activities such as:

- ▶ The planning and administration of course scheduling, enrollment, credit transfers, and related student matters
- ▶ Budgeting and planning
- ▶ The development of improved administrative policies and workflow

## CREATE A DIVERSE, INCLUSIVE, AND EQUITABLE MEM COMMUNITY

- ▶ Members of this community will take individual and collective responsibility for transparent decision-making, collaborative governance, and broad communication, including through participation in college initiatives.
- ▶ Initiate a structured dialogue and ongoing conversations about improving departmental diversity, equity, and inclusion, a frank self-examination that identifies barriers to be overcome and highlights the benefits of change.
- ▶ Recruit, retain and professionally advance more women and underrepresented minority faculty and staff.
- ▶ Establish MEM as the first choice for many more women and underrepresented minority students.
- ▶ Create an MEM council composed of department committee chairs, staff, and students who will meet regularly and serve as a forum for examining, discussing, and advising department leadership on issues of departmental communication, responsiveness, morale, accountability, and cohesiveness.



# STRATEGIC PLANNING COMMITTEE

## OUR CHANGE AGENTS

|                         | Committee | Innovative Education | Research | Culture, Reputation, and Hiring |
|-------------------------|-----------|----------------------|----------|---------------------------------|
| Andrei Jablokow         | Chair     |                      |          |                                 |
| Dimitrios Fafalis       | ✓         | Chair                |          |                                 |
| Antonios Kontsos        | ✓         |                      | Chair    |                                 |
| Emily Bogunovich        | ✓         |                      |          | Chair                           |
| Jennifer Atchison       | ✓         | ✓                    |          |                                 |
| Alexander Fridman       | ✓         |                      | ✓        |                                 |
| Li-Hsin (Leo) Han       | ✓         |                      | ✓        |                                 |
| Matthew McCarthy        | ✓         | ✓                    |          |                                 |
| Ahmad Najafi            | ✓         |                      | ✓        |                                 |
| Wei Sun                 | ✓         |                      | ✓        |                                 |
| Ying Sun*               | ✓         |                      | ✓        |                                 |
| Ajmal Yousuff           | ✓         | ✓                    |          |                                 |
| Sarah Andrieux BS '21   | ✓         | ✓                    |          | ✓                               |
| Ebrahim Maghami         | ✓         |                      |          | ✓                               |
| Rachael Reich<br>BS '17 | ✓         |                      |          | ✓                               |
| Ali Sajwani BS/MS '10   | ✓         | ✓                    |          |                                 |
| Nate Schweizer*         | ✓         |                      |          |                                 |

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Booklet designed by Zovi Khrimian

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Zovi Khrimian - Program Coordinator  
Rayfield Dobbins - Department Lab Manager

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