

The logo features the letters "ISU" in white, oriented vertically on a black rectangular background. To the right of this background, the text "2020 VISION" is displayed in a large, bold, black sans-serif font. Below "2020 VISION", the text "Department of Materials Science and Engineering" is written in a smaller, black sans-serif font.

# 2020 VISION

## Department of Materials Science and Engineering

The MSE Department at Iowa State University is committed to being a recognized center of knowledge, experience, ingenuity, and leadership that is unique in scope and unsurpassed in dedication to its students and other constituents. Through discovery, innovation, education, and engagement, we aim to improve the human condition and prospects for sustainable prosperity in Iowa, the United States, and beyond. So dedicated, we accept and embrace the following responsibilities as being central to our collective mission.

### ***Learning, Teaching, Dissemination, and Integration of Knowledge***

The MSE Department is committed to being a forward-focused organization, promoting the exploration of new ideas through free and innovative thinking. Accordingly, we will strive to maintain an academic environment that fosters excellence in learning and teaching, widespread dissemination of knowledge, and the effective integration of scientific research into education, industry, and commerce. By maintaining a rigorous and engaging curriculum with an emphasis on interdisciplinary practices and global awareness, we focus our efforts on maximizing student success, growing and diversifying engineering talent, and broadening student development. Through integration of classroom and laboratory instruction with other experience-based components, we will continue to push the boundaries between academics and practice, developing new ways to partner with industrial collaborators to cross-fertilize both arenas with new ideas and enthusiasm.

### ***Research, Development, Discovery, and Innovation***

Through scientific research and technological development, the MSE Department at Iowa State University will strive to be an active and original source of new knowledge and capability. To this end, we firmly value the full scope of potential contributions, spanning from fundamental scientific discovery to the development of new technologies and engineering practices. Aimed at maximizing the impact of our research on the human condition, we recognize the need for focusing efforts toward discovery, innovation, and implementation in selected theme areas, where we are best positioned to make societal contributions that are meaningful, positive, and lasting. Further, we recognize that meeting the most critical research challenges is most effectively accomplished with a diverse and interdisciplinary faculty and student body.

### ***Engagement, Collaboration, and Partnership***

We embrace our role as a "global conduit," connecting ISU and Iowa-based constituents to the broad-based community of world-wide activity in materials-related areas of science, technology, and commerce. As such, we understand that the ISU MSE department not only serves as an original source of new knowledge and capability, but also as one node in a vast and diverse network of interconnected knowledge producers and consumers, consisting of industrial partners, academic collaborators, and numerous scientific and technological agencies, consortia, and societies. In addition to serving in this role, we are dedicated to utilizing these connections in both education and research to enhance learning environments, develop new experiential opportunities for students, create new lines of access to education through innovative course delivery methods, and to foster leadership and global awareness in our students and faculty.

### ***Outreach and Service***

As a state-facilitated institution of higher learning we embrace our responsibility and view as a privilege our important role in the education of all of Iowa's citizens. While our most direct function lies in the on-site practice of higher education through course-based instruction and research, we recognize that our responsibilities extend far beyond the walls of our institution. Accordingly, through extension practices and outreach programs, targeting K-12 and community college students, we are committed to having a profound and positive influence on the science and technology-related education of current and future leaders of industry and commerce.

Our policies, practices, and objectives will continue to reflect dedication to those specific constituents, to whom, by virtue of charter or contract, our service is expressly committed. These include the students of Iowa State University, other units within the College of Engineering and Iowa State University, the citizens of Iowa, Iowa industry and commerce, other industrial and commercial sponsors, Iowa public schools and teachers, and numerous U.S. federal agencies and sponsors.

Pursuant to our mission and within the framework of these core responsibilities, we believe that effective research programs in areas such as energy, climate, food, health, education, infrastructure, defense, transportation, manufacturing, and communication are critical to sustainable prosperity. Within these areas, we view the role of Materials Science and Engineering as central and are dedicated to working toward solutions to the most critical problems. Indeed, as posed in the College of Engineering 2050 Challenge, our charge is "...to build and restore, create and transform... To meet the demands of a new age." Thus, by virtue of the statement of values and mission provided here, the "MSE 2020 Vision" embraces the 2050 Challenge and is committed to developing and implementing effective strategies and practices to answer this call.

# MSE Implementation Plan (2010-2011)

This Implementation Plan is intended to outline those specific actions which are necessary to satisfy the principal objectives identified in the MSE Strategic Plan and to identify relevant subgoals, assessment metrics, and procedures to evaluate departmental progress toward these goals.

Each principal objective is followed by a set of actions, essential to fulfilling our mission, as stated in the “2020 Vision.” This is followed by a set of metrics, intended to represent the most important measurable quantities to be used for assessing progress toward meeting each stated principal objective. It is also intended that all of the metrics identified in this plan will be compiled annually and used as an overall indicator of performance for the MSE Department.

## **1. Deliver to our undergraduate students a forward-focused education of the highest possible caliber.**

### **Subgoals:**

1. Develop a “curriculum of the future,” with a well-defined expected skill set for Mat E BS graduates, reflecting an appropriate balance between fundamental sciences and engineering practice.
2. Establish regular long-term policies and practices for maintaining course relevance and quality.
3. Maintain an aggressive program in new course development.
4. Establish formal and informal practices for integrating contemporary research challenges and practices into undergraduate education.
5. Continue the growth in quality, diversity, and quantity of students earning materials engineering degrees.
6. Introduce specific curricular components to promote social and global awareness in undergraduate students.

### **Metrics:**

1. Number of BS graduates placed in top 10 graduate schools annually.
2. Number of BS graduates placed in top-ranked companies.
3. Number of undergraduate students enrolled from out-of-state, annually.
4. US News and World Report – annual ranking of the Department.
5. Percentage of each graduating class that participated in an “enrichment” program (international study/work, industrial experience, research experience).
6. Percentage of each BS graduating class that are women and underrepresented minority students.
7. Percentage of each BS graduating class placed in industry or graduate schools.
8. Percentage of students who are members of EWB, ESF, and other organizations promoting global awareness, annually.

## **2. Build and maintain a world-class graduate education program that offers a diverse set of educational opportunities for advanced study in Materials Science and Engineering.**

- Prepare our Ph.D. graduates to compete, succeed, and make significant career contributions in research and education.
- Attract the highest caliber of graduate students, enhancing the ability of faculty to fund and execute impactful research programs.
- Provide a means of outreach and extension to industry.
- Promote unconventional graduate education in MSE (distance education and alternative degrees/certificates), providing new sources of revenue to the Department.
- Enhance the national visibility of the Department through the scope of achievement of our graduates.

### **Subgoals:**

1. Develop an excellent and highly-rated graduate curriculum.
2. Attract the highest quality graduate applicants.
3. Improve the rate of acceptance of admission offers.
4. Offer increased opportunities for graduate teaching assistantships.

5. Develop a non-thesis Masters of Engineering program for distance education, and other (self-supporting or revenue generating) nontraditional educational opportunities.

**Metrics:**

1. Number of applicants and enrolled students from domestic and top foreign universities.
2. Average GRE scores of incoming graduate class.
3. Average “applicant objective score.”
4. Number of “standing” GRA/GTA positions.
5. US News and World Report – annual ranking of the MSE graduate program.
6. Placement of graduates in academia, national laboratories, and industry.
7. Percentage of women and underrepresented minority students receiving graduate degrees.

**3. Increase the visibility and impact of MSE research by promoting and supporting the development of *Strategic Themes of Excellence*.**

- Enable us to provide more far-reaching world-class educational opportunities for our students and other constituents.
- Attract the highest caliber students and faculty.
- Promote student and faculty collaboration.
- Generate resources for strategic initiatives.
- Increase efficiency (output per research dollar).

**Subgoals:**

1. Establish policies and practices to support and incentivize the development of new strategic theme areas.
2. Promote the strategic collective acquisition of world-class research facilities.
3. Establish a long-term plan for developing discretionary departmental resources that can be strategically targeted toward established or emerging themes.

**Metrics:**

1. Number of publications, citations, invited talks per faculty per year.
2. Total research expenditure per faculty per year.
3. Number of PhD graduates placed in academic positions (faculty and postdoctoral positions), national laboratories, and industry upon graduation per year.
4. Number of proposal review panels served on by faculty per year.
5. Percentage of women and underrepresented minority students receiving graduate degrees.

**4. Attract, develop, and retain a world-class diverse faculty for research and education.**

- Increase the national and international visibility of the Department, improving our standing and competitiveness in attracting resources for research and education.
- Attract top-caliber students for undergraduate study, graduate study, and postdoctoral research.
- Facilitate the development of Strategic Themes of Excellence and associated research facilities.

**Subgoals:**

1. Promote an environment of excellence, collaboration, and inclusiveness among MSE faculty.
2. Embrace initiatives that improve diversity and work-life balance.
3. Establish an effective program for faculty development at all career stages.
4. Promote faculty awards on national and international levels.
5. Develop a well-recognized department identity or “branding.”

**Metrics:**

1. Number of publications, citations, invited talks per faculty per year.
2. Total research expenditure per faculty per year.
3. Number of review panels and society positions served on by faculty per year.
4. Faculty awards, honors, and academy appointments.
5. Percentage of female and underrepresented groups among the faculty.

## 5. Establish and maintain an active and visible program in outreach and extension.

- Maintain relevance in the MatE and MSE curricula with the outcomes of:
  - Providing our students with the general scientific knowledge and specific technical skill sets required for them to compete and succeed, making real contributions to society.
  - Providing industry with a highly capable work force, well equipped to solve current and future technological and industrial challenges.
- Facilitate scientific dissemination, technology transfer, and even direct utilization of research outcomes in engineering applications.
- Stimulate use-inspired innovation, technological development, and fundamental scientific research.
- Identify new avenues for industrially-funded research and graduate student support.
- Promote our advanced degree programs and distance education opportunities to the regional community.
- Increase in number and scope the employment opportunities for our graduates, at all levels.
- Increase awareness of the discipline of Materials Engineering among potential undergraduate enrollees.
- Promote a sense of pride and ownership towards MSE and ISU in general among Iowa companies and citizens.
- Help to improve STEM education at the K-12 level.

### Subgoals:

1. Establish and maintain a network of MSE/industrial collaborators.
2. Increase industrial involvement in curricula, research, and facility development.
3. Develop new approaches for extension.
4. Maintain a network of MSE/K-12 collaborators.
5. Develop new curricular content for improved K-12 STEM education.

### Metrics:

1. Interactions with industry:
  - a. Research collaborations (number and expenditures);
  - b. Number of presentations at industries or by industrial partners at ISU;
  - c. Number of advanced degrees received by industrial staff;
  - d. Number of advisory board memberships at industrial partners or by industrial partners at ISU;
  - e. Number of student internships;
  - f. Number of students permanently hired by industry;
  - g. Number of student design projects sponsored by industrial partners;
  - h. Number of industries employing patents developed in the MSE Department.
2. Interactions with K-12 schools:
  - a. Number of K-12 school presentations by faculty and students of MSE;
  - b. Number of MSE-developed, in-class activities used in K-12 classrooms;
  - c. Number of K-12 partners in MSE-based outreach programs;
  - d. Number of STEM lessons developed and used in K-12 classrooms.