Engineering Faculty Document No. 71-20
March 27, 2020

TO: The Faculty of the College of Engineering
FROM: The Faculty of the School of Materials Engineering
SUBJECT: New MS Concentration – Professional Masters

The Faculty of the School of Materials Engineering has approved the following new concentration. This action is now submitted to the Engineering Faculty with a recommendation for approval.

Professional Masters Concentration
See attached description

Head, School of Materials Engineering

Materials Engineering

Title of Concentration: Professional Masters in Materials Engineering

Statement of the Mission

The mission of the Professional Master's Concentration in Materials Engineering is to provide advanced technical education combined with mentorship and additional professional development opportunities in key areas of interest in the industrial sectors of regional, national, and international importance. The need for this concentration comes from discussions with the Purdue MSE External Advisory Board and other leading industrial professionals.

The target audience will be:

- Current Purdue BS students wishing to undertake graduate studies, improve their skills, and increase their employability in key industry sectors.
- Domestic and international students at other institutions who, upon graduating, wish to receive a Professional Master's concentration from Purdue to gain a professional degree from a top U.S. Engineering College to improve their skills and increase their employability in key industry sectors.
- Practicing engineers wishing to return for additional technical depth to improve their career path
- STEM undergraduates from other disciplines who need to increase their technical knowledge of materials. Notably, the MSE PhD program has about 50% of our students from non-MSE background. Due to the relatively specialized nature of the discipline, many colleges and universities do not offer MSE as a major.
- Students interested in only pursuing a master's degree with no interest in continuing on in a PhD program.

Our intent is for the Professional Concentration to be completed within one academic year (fall, spring, summer). Students can participate in the program part-time and thus take longer to complete the degree. Some students may opt to take a semester off from coursework to pursue an internship or other professional experience. Each full cohort will begin in the fall semester of each academic year. Students may begin spring/summer semester on a case by case basis.

The Professional Master's concentration will allow for up to 12 credits outside of MSE, including courses in business/leadership/entrepreneurship/communication etc., which are traditionally not permitted on research-based plans of study. The Professional Master's will require at least 18 credits of MSE courses, of these courses, 9 credits of MSE courses should have a topical emphasis determined by the student in consultation with their faculty advisor (i.e. materials processing, materials characterization, physical metallurgy, computational materials, etc.). The topical emphasis is defined by the student, there are not predetermined categories as these selections are intended to reflect the specific career goals of the student. If students elect to take Independent Study projects, these will need to be related to the topical emphasis.

Research Focus

The Professional Master's concentration will not have a thesis/research component and will not have direct articulation to the Ph.D., program. This degree is not a pathway to Ph.D. Students

who wish to apply to the PhD program may do so at the completion of the Professional Master's and will be required to submit a separate graduate application. However, students are encouraged to seek out independent study projects that enhance their professional development and are aligned with long-term career goals.

Core and technical courses

Total course hours in the plan of study = 30

Required Courses: All students will be required to take a 3 credit "Fundamentals of MSE" course which is exclusive to professional master's students and will be offered each fall semester. Two semesters of a zero-credit seminar course will be required. The preferred seminar is MSE 691, which is exclusive to Professional MS students, however, students can petition to take alternative seminar courses (i.e. the Engineering Management Seminar) to fulfill this requirement if needed.

Students will be required to apply 6 credits of "Industrial Practice" Electives on their plan of study, which include but are not limited to the following:

CE 59700 – Advanced Project Management and Analysis
IE 53000 – Quality Control
IE 57000 – Manufacturing Process Engineering
MSE 59700 – Lean Manufacturing
MSE 59700S – Commercial Metallurgical Processing
MSE 59900 – Independent Study (Design Project, up to 6 credits total are allowable)

Students are permitted (but not required) to apply 12 credits of "Professional Breadth" Electives on their plan of study, which include but are not limited to the following:

ABE 59100 – Understanding Federal Science Policy and Funding
CE 52400 – Legal Aspects in Engineering Practice
ENGL 42100 – Technical Writing
IE 54500 – Engineering Economic Analysis
MGMT 56200 – Project Management
MGMT 60000 – Accounting for Managers
MGMT 66000 – Operations Management

The remaining courses are expected to be 500 and 600 level courses from the MSE course catalog or from science or engineering disciplines. A minimum of 18 credits must be in MSE courses. A list of acceptable courses for each of the above categories will be maintained by the MSE graduate committee, published online, and reviewed on an annual basis.

Sample plans of study can be found in Appendix A.

Participating faculty:

Professional Master's Coordinator: John Howarter (Associate Professor of MSE)

Committee for the Professional Master's concentration: Dave Bahr (Professor and Head of MSE), Eric Kvam (Professor of MSE), Xinghang Zhang (Professor of MSE and Chair of Graduate Admission Committee), Rosemary Son (Graduate Program Admin for MSE)

Expected number of students

Initially we would expect 10-15 students. Over time, we would expect this to increase to 25-30.

Learning Outcomes

The graduate pursuing this professional concentration will be able to:

- Demonstrate increased technical depth within materials engineering.
- Make sound engineering decisions based on technical data.
- Communicate, negotiate, and lead within local, regional, national, and global engineering enterprises.
- Demonstrate awareness of broader implications (social, economics, technical, ethical, and business aspects) of materials engineering.

Appendix A

Sample Professional Master's Plan of Study A
12 months to completion; plan of study with MSE topical emphasis on "industrial processing of materials".

Fall Semester

(3) ^MSE 53000	Fundamentals of Materials Engineering for Industrial Practice
(3) MSE 54800	Deposition Processing
(3) *MSE 59700S	Commercial Metallurgical Processing
(3) MSE 51200	Powder Processing
(0) ^MSE 69100	Seminar

Spring Semester

(3) MSE 51000	Microstructural Characterization Techniques
(3) MSE 56000	Production of Inorganic Materials
(3) MSE 59700	Polymer Synthesis
(3) MSE 53600	Solidification of Castings
(0) ^MSE 69100	Seminar

Summer Semester
(6) *MSE 59900 Independent Study (Design Project)

Sample Professional Master's Plan of Study B
Plan features a summer off for external internship and four courses that are outside of MSE dept.
MSE topical emphasis on "lean manufacturing".

Fall Semester

(3) ^MSE 53000	Fundamentals of Materials Engineering for Industrial Practice
(3) #IE 54500	Engineering Economic Analysis
(3) STAT 51100	Statistical Methods
(3) *MSE 59900	Independent Study (Design Project)
(0) ^MSE 69100	Seminar

Spring Semester

(3) *MSE 59700L	Lean Manufacturing
(3) #MGMT 56200	Project Management
(3) *MSE 59900	Independent Study (Design Project)
(0) ^MSE 69100	Seminar

Summer Semester – Off Campus Internship

Fall Semester

(3) MSE 54700	Intro to Surface Science
(3) MSE 55000	Physical Properties of Crystals
(3) #MGMT 66000	Intro to Operations Management
(0) ^MSE 69100	Seminar

^ Required Core Course; may operate under a temporary number initially
* Industrial Practice Elective (minimum 6 credits required)
# Professional Breadth Elective (12 credits maximum allowed)