BACHELOR OF SCIENCE

in

MATERIALS SCIENCE & ENGINEERING[1]

a guide to the undergraduate degree program

School of Materials Engineering
Purdue University

- -

Last Updated
October 18, 2016

You Can't Make It Without Materials

[1] The overwhelming majority of this helpful manual was written by Prof. Elliott Slamovich and has been updated recently to reflect recent changes in the MSE program.

INTRODUCTION

The purpose of this manual is to provide one source to address most of the questions that arise on a regular basis regarding policies and procedures in the School of Materials Engineering. The first section outlines the procedures that all of you will follow as you develop and implement your Plan of Study, ranging from the proposed sequence in which you take your courses to how you may petition for exceptions from standard procedures and requirements. The second section summarizes opportunities available to you beyond the standard curriculum including the Co-Op program, Student Societies, Study Abroad, Independent Research and our Honors program. While your coursework is very important, your experiences and the people you meet outside of the classroom by doing research, participating in student society activities or spending a semester in another country will have a major influence on how you think, and the career path that you choose. We strongly encourage you to take advantage of these opportunities.

Sincerely,

David Johnson, Undergraduate Committee Chair

Members of Undergraduate Committee: Prof. Elliott Slamovich, Prof. Robert Spitzer, Prof. Carlos Martinez, Prof. Kendra Erk, Prof. Shiram Ramanathan, Christopher Owen, Prof. Mukerrem Cakmak, Prof. Maria Okuniewski, Prof. Xinghang Zhang, Prof. Ernesto Marinero, Prof. Jeffery Youngblood, and Vicki Cline (Academic Advisor for MSE) .

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SECTION 1. PROCEDURES AND POLICIES

1.1. ACADEMIC AND PROFESSIONAL CONDUCT

1.1.1. Academic Dishonesty

The Purdue University Student Conduct Code is detailed in Section III-B of the Purdue University Regulations. The complete Conduct Code is available on the Office of the Dean of Students webpage. Section III-B-2 outlines misconduct subject to disciplinary penalties, and Section III-B-2a reproduced below defines academic dishonesty:

"… Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty. The commitment of the acts of cheating, lying, stealing, and deceit in any of their diverse forms (such as the use of ghost-written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest".

Given the availability of material on the web, plagiarism on writing assignments is a particular problem, in part because most students do not understand what constitutes plagiarism. The Purdue Online Writing Lab (OWL) (http://owl.english.purdue.edu/owl/) has a link "Avoiding Plagiarism" under the "Research and Citation" link that contains definitions of plagiarism as well as proper citation practices.

1.1.2. Engineering Professional Ethics

Since most of you will be practicing Engineers in a few years you should become familiar with Engineering Ethics. The Code below was adopted by the Accreditation Board for Engineering and Technology in 1977 and is posted on our website.

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:
I. using their knowledge and skill for the enhancement of human welfare;
II. being honest and impartial, and servicing with fidelity the public, their employers and clients;
III. striving to increase the competence and prestige of the engineering profession; and
IV. supporting the professional and technical societies of their disciplines.

The Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional maters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.
7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

Other engineering societies have their own ethical codes. An excellent resource to learn more about engineering ethics is the website onlineethics.org.

1.2. UNDERGRADUATE DEGREE PROGRAM REQUIREMENTS

The degree requirements for a B.S. MSE from the School of Materials Engineering at Purdue University are summarized below. The following sections will take you through the process of assembling your Plan of Study to satisfy the degree requirements.

Minimum Degree Requirements for Materials Engineering (B.S.MSE)

1. Satisfy the requirements of the First Year Engineering program.
2. Satisfy the Core course sequence in Engineering, Mathematics, and Physical Sciences.
3. Satisfy the College of Engineering General Education Program (24 credit hours). This requirement has two components:
   - Foundation Learning Outcomes: select from courses approved by the Undergraduate Curriculum Council for the pertinent learning outcomes.
   - Programmatic Requirement: select from courses approved as approved by the School of Materials Engineering.
4. Have at least 18 credit hours of Technical Electives, at least 12 of which are Materials-specific, as designated by the School of Materials Engineering.
5. Have at least 126 credits total.
6. Minimum average GPA of 2.0 in MSE 200 and 300 level courses.

GPA Requirements

In addition to satisfying all of the curriculum requirements and having a Graduation Index of at least 2.0, graduation with a B.S.MSE degree also requires an average GPA of at least 2.00 for all 200- and 300-level MSE courses.

Pass/Not-Pass Option

Of the courses used to satisfy the minimum graduation requirements, the pass/not-pass option may be applied only to General Education courses.

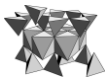
Exception to Normal Published Requirements

Exception to any and all normal published requirements for graduation requires approval by petition to the Undergraduate Committee of the School of Materials Engineering. The process for petitioning is described in section 1.6.

Transfer Credit

All students transferring into the School of Materials Engineering, whether from another university or another program within Purdue, are required to meet with the Vicki Cline to plan their petition for transferring credit and to develop a Plan of Study.

Students may also transfer credit earned from other universities during the summer or from universities attended during Study Abroad. It is best to seek prior approval for transfer credit under these circumstances because a petition may be required (section 1.6). Approval for courses that count towards the Foundational Learning Outcomes (section 1.4.3.1) is made at the University level and not by the School of Materials Engineering.



Minimum Degree Requirements
For Materials Engineering

Credit Hours Required for Graduation: 126

Courses	*Credit Hours*
Mathematics and Physical Sciences	
Calculus: MA 16500,16600, 26100, 26500, and 26600	**18**
Chemistry: CHM 11500, 11600, 25700	**12**
Physics: PHYS 17200, 24100, 25200	**8**
General Education Program	
Foundational Learning Outcomes:	
(Courses approved by the Undergraduate Curriculum Council)	
Written Communication/Information Literacy: ENGL 10600 or equiv.	**3**
Oral Communication: COM 11400	**3**
Humanities	**3**
Behavior/Social Science	**3**
Science, Technology, & Society	**3**
General Education Electives: Electives are selected from approved lists with MSE faculty guidance subject to the programmatic requirements of the College of Engineering General Education Program.	**9**
Seminars	
MSE 39000 (semesters 3-8)	**0**
Core Engineering Courses	
ENGR 13100, 13200 or ENGR 14100 and 14200	**4**
MSE Core: 23000, 23500, 25000, 26000, 27000, 33000, 33500, 34000, 36700, 37000, 38200, 43000, 44000, and 44500. Integrated MSE courses, including year-long, industry-sponsored senior design projects, on the structure, properties, processing, and performance of engineering materials.	**42**
Technical Electives	**18**
A plan of study is designed with the help of a faculty advisor to meet each individual student's professional goals. At least 12 of the 18 credits must be approved materials-specific courses; the remaining 6 credits may be selected from an approved list of courses, including other academic disciplines.	

Minimum Degree Requirements Worksheet

PURDUE UNIVERSITY

Materials Engineering

College of Engineering

code-BS-MSE
126 Credits for Graduation
Students must have a graduation index of 2.0
Student must have a minimum average GPA of 2.0 in MSE 200 and 300 level courses.

Materials Engineering Major Courses (42 credits) (https://engineering.purdue.edu/MSE/Academics/Undergrad/undergrad_manual.pdf)

Required MSE Courses (42 credits)

____ (3) MSE 23000- Structure and Properties of Materials
____ (3) MSE 23500 – Materials Properties Lab
____ (3) MSE 25000- Physical Properties in Eng. Systems
____ (3) MSE 26000- Thermodynamics of Materials
____ (3) MSE 27000- Bonding and Crystallography
____ (3) MSE 33000 – Proc. and Props. of Materials
____ (3) MSE 33500 – Material Characterization Lab
____ (3) MSE 34000 – Transport Phenomena
____ (3) MSE 36700 – Materials Processing Lab
____ (3) MSE 37000 – Elec, Opt, Mag Props. of Materials
____ (3) MSE 38200 - Mechanical Response of Materials
____ (0) MSE 39000 – Seminar (taken each semester)
____ (3) MSE 43000 – Materials Processing and Design I
____ (3) MSE 44000 – Materials Processing And Design II
____ (3) MSE 44500 – Materials Engineering Systems Analysis

MSE technical Electives (18 credits) *(See the MSE undergraduate manual for an approved list)*

_____ (3) Technical Elective I
_____ (3) Technical Elective II
_____ (3) Technical Elective III
_____ (3) Technical Elective IV
_____ (3) Technical Elective V or Support Area Elective I
_____ (3) Technical Elective VI or Support Area Elective II

Other Departmental /Program Course Requirements (66 credits)

General Engineering Requirements (4 credits)

_____(2) ENGR 13100/14100 (honors) - Transforming Ideas to Innovation I
_____(2) ENGR 13200/14200 (honors)- Transforming Ideas to Innovation II

Mathematics Requirements (18 credits).

____(4/5) MA 16500/16100 - Analytic Geometry And Calculus I (satisfies Quantitative Reasoning Selective for core)
____(4/5) MA 16600/16200 - Analytic Geometry And Calculus II
____ (4) MA 26100 - Multivariate Calculus
_____(3) MA 26500 - Linear Algebra
_____(3) MA 26600 - Ordinary Differential Equations

Alternative sequence to MA 265/266 is MA 26200 followed by either MA 30300 or MA 35100

Science Requirements (20 credits)

____(4) CHM 11500/13600 (honors) - General Chemistry I (satisfies Science Selective for core)
____(4) CHM 11600/13600 (honors) – General Chemistry II
____ (4) CHM 25700 - Organic Chemistry
____(4) PHYS 17200 – Modern Mechanics (satisfies Science Selective for core)
____ (3/4) PHYS 24100/27200- Electricity and Optics
____ (1) PHYS 25200 - Elec. And Optics Lab

PHYS 25200 may be replaced by another 1-cr hour science laboratory as listed in the MSE undergraduate manual
PHYS 27200 replaces both PHYS 24100 & PHYS 25200

MSE General Education Requirement (24)

Foundation Core (http://www.purdue.edu/provost/initiatives/curriculum/course.html)

_____ (4/3) ENGL 1060 Engl. Composition or equivalent *(satisfies Information Literacy and Written Communications Selectives)*
_____ (3) COM 11400 – Fundamentals of Speech *(satisfies Oral Communication for core)*
_____ (3) G.E. I – (satisfies Human Cultures Humanities for core)
_____ (3) G.E. II – (satisfies Human Culture Behavioral/Social Science for core)
_____ (3) G.E. III – (satisfies Science, Technology & Society Selective for core)

MSE General Education Electives *(See the MSE undergraduate manual for an approved list)*

_____ (3) G.E IV
_____ (3) G.E. V
_____ (3)G.E. VI

University Core Requirements (included above) (http://www.purdue.edu/provost/initiatives/curriculum/course.html)

Human Cultures Humanities	☐ _____	*Science, Technology & Society Selective*	☐ _____
Human Cultures Behavioral/Social Science	☐ _____	*Written Communication*	☐ _____
Information Literacy	☐ _____	*Oral Communication*	☐ _____
Science Selective	☐ _____	*Quantitative Reasoning*	☐ _____
Science Selective	☐ _____		

The student is ultimately responsible for knowing and completing all degree requirements.
Degree Works is knowledge source for specific requirements and completion

1.3. MSE PROGRAM ACCREDITATION

The degree program offered through the School of Materials Engineering is accredited by ABET, Inc., an organization that uses a peer review process to ensure educational quality. Quoting from their website: "ABET accreditation is assurance that a college or university program meets the quality standards established by the profession for which it prepares its students". Accreditation is voluntary, and all of Purdue's Engineering programs are ABET accredited. This means that our program (along with all of the Purdue Engineering programs) is reviewed every six years to determine if we meet the established criteria for accreditation. There are eight criteria that must be satisfied for accreditation, below are brief descriptions of Criteria 2 and 3 that have the greatest impact on your undergraduate curriculum.

1.3.1. Criterion 2. Program Educational Objectives

Program Education Objectives are: "broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve". In the Spring of 2012 the Undergraduate Committee developed the following new set of Objectives that were approved by all of the MSE faculty. These Objectives are listed in the following text.

The degree program in Materials Engineering will provide the educational experiences to produce graduates with the knowledge and skills to excel in materials science and engineering related positions or to pursue graduate study. Within a few years after graduating, our students will:

1. Be successful in top graduate schools and/or in materials science & engineering or other professional positions.
2. Contribute their Materials Engineering expertise effectively as members of engineering teams.
3. Demonstrate professional skills including continued professional development, participation in professional societies and organizations, and engagement in leadership positions.

Our success in achieving these Objectives is evaluated primarily by surveying our alumni. We also receive input from our Advisory Committee consisting of individuals in business, industry and academia, and from you during your senior exit surveys and interviews. We use the input to help make decisions about curriculum changes that would better achieve our Objectives.

1.3.2. Criterion 3. Program Outcomes and Assessment

Program outcomes describe the skill set students are expected possess by the time of graduation. Program outcomes must facilitate attainment of the program education objectives described above. Graduates of the Undergraduate program in the School of Materials Engineering at Purdue University will have:

1. an ability to apply knowledge of mathematics, science, and engineering to problems in materials engineering.
2. an ability to design and conduct experiments, as well as to develop engineering judgment through the analysis and interpretation of data.

3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. an ability to function on multi-disciplinary teams.
5. an ability to identify, formulate, and solve engineering problems, particularly in the context of materials selection and design.
6. an understanding of professional and ethical responsibility.
7. an ability to exhibit effective oral and written communication skills.
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
9. a recognition of the need for, and an ability to engage in life-long learning.
10. a knowledge of contemporary issues, particularly as they relate to materials engineering.
11. an ability to use the techniques, skills, and experimental, computational and data analysis tools necessary for materials engineering practice.

To maintain accreditation, our curriculum must produce these outcomes, and an assessment process must be in place to measure the program's success in achieving its program outcomes. The assessment process must be designed to indicate the degree to which the program outcomes are achieved, and the assessment process must be used to develop the program through the exposure of program weaknesses and subsequent addressing of identified weaknesses. The assessment process generally includes evaluation of student work including exam performance, laboratory reports, individual and group written assignments and oral presentations, and results from student and alumni surveys.

1.4. Components of the Materials Engineering Degree Program

Links to all of the courses described below may be found in the Purdue Course Catalog, and a version of the content below with active links is available in the Undergraduate section of the MSE website. The major components of the MSE degree program are described below and summarized graphically in Figure 1.1.

1.4.1. Mathematics and Physical Sciences

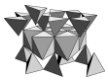
A firm grasp of mathematics, chemistry and physics facilitates understanding the concepts presented in your Engineering Core Courses. Mathematics courses include Analytical Geometry and Calculus (MA 16500 and MA 16600), Multivariate Calculus (MA 26100), Linear Algebra (MA 26500) and Ordinary Differential Equations (MA 26600). Chemistry courses begin with two semesters of General Chemistry (CHM 11500 and 11600) followed by a course focusing on Organic Chemistry (CHM 25700). Physics courses cover Mechanics (PHYS 17200), and Electricity and Optics (PHYS 24100 and PHYS 25200).

	Freshman Fall	**Freshman Spring**	**Soph. Fall**	**Soph. Spring**	**Junior Fall**	**Junior Spring**	**Senior Fall**	**Senior Spring**
General Education	ENGL 106	COM 114 or Gen Ed		3 Credits	3 Credits	3 Credits	3 Credits	6 Credits
Math & Physical Science	CHM 115 MA 165	CHM 116 PHY 172 MA 166	PHYS 241 MA 261 MA 265	MA 266 PHYS 252	CHM 257			
Engineering Core	ENGR 131	ENGR 132						
Materials Core			MSE 230 MSE 235 MSE 390	MSE 250 MSE 260 MSE 270 MSE 390	MSE 335 MSE 340 MSE 370 MSE 390	MSE 330 MSE 367 MSE 382 MSE 390	MSE 430 MSE 445 MSE 390	MSE 440 MSE 390
Technical Electives						3 Credits	9 Credits	6 Credits

Figure 1.1: Summary of the MSE degree program courses. Note that only MSE 230 is offered both Fall and Spring semesters.

1.4.2. Materials Engineering Core Courses

The core MSE sequence begins with a general introduction into the Structure and Properties of Materials (MSE 230) and a laboratory course investigating the properties of materials (MSE 235). The second semester of the sophomore year sets a foundation of MSE fundamentals covering mechanics (MSE 250); thermodynamics (MSE 260), bonding, crystallography and statistical mechanics (MSE 270). The junior year has the highest concentration of materials courses covering Transport Phenomena (MSE 340), Electrical, Optical and Magnetic Properties of Materials (MSE 370), the Mechanical Response of Materials (MSE 382) and Properties and Processing of Materials (MSE 330). The junior year also features two laboratory courses, the first emphasizing Materials Characterization Methods (MSE 335) while the second focuses on Materials Processing (MSE 367). The senior design sequence (MSE 430 and 440) includes a yearlong group project in which students choose from a variety of industry-sponsored design projects. Senior design is complemented by Materials Engineering Systems Analysis (MSE 445), that increases the representation of design elements in the curriculum. Every semester you are expected to participate in the Materials Engineering Seminar (MSE 390). Activities in MSE 390 include alumni and other visitors from industry discussing career opportunities, planning for outreach activities, and social events. Also, MSE 390 is the best place to learn about new internship and scholarship opportunities.



1.4.3. College of Engineering General Education Program

Students must satisfy the College of Engineering General Education Program. This requirement has two components: Foundation Learning Outcomes and MSE Programmatic Requirements.

The Foundational Learning Outcomes and Programmatic Requirements are listed below. For the combined set of classes (sections1.4.3.1 and 1.4.3.2) the following requirements apply:

- Students must earn a C^{-} or better in courses that satisfy Foundational Learning Outcomes.
- At least six credit hours must be at the 30000 level or above, or from courses with a required prerequisite in the same department.
- No more than 6 credit hours from the Colleges of Engineering, Science, and Technology.

1.4.3.1 Foundational Learning Outcomes

Students must select from a list of courses maintained by the Office of the Provost as part of Purdue's Undergraduate Outcomes-based Core Curriculum to satisfy the all six Foundational Learning Outcomes. These are described at:
http://www.purdue.edu/provost/students/s-initiatives/curriculum/coreCurriculum.html

During the First-Year Engineering (FYE) program the first 3 Foundational Learning Outcomes are satisfied by ENGL 10600 (or equivalent) and COM 11400 (or equivalent). To satisfy the remaining Foundational Learning Outcomes, students in the MSE are required to take 3 credit hours from each as summarized in the following list:

1) Written Communication and (satisfied by ENGL 10600 during FYE)
2) Information Literacy (also satisfied by ENGL 10600 during FYE)
3) Oral Communication (satisfied by COM 11400 during FYE)
4) Humanities (3 credit hours, MSE requirement)
5) Behavior/Social Science (3 credit hours, MSE requirement)
6) Science, Technology, & Society (3 credit hours, MSE requirement)

A list of approved courses is maintained at:
http://www.purdue.edu/provost/initiatives/curriculum/course.html

Note: courses taken by students in First Year Engineering that satisfy the Foundational Learning Outcomes but are not directly listed in the MSE Plan of Study will count as either an MSE Support Area Elective or as an MSE General Education Elective.

1.4.3.2 MSE Programmatic Requirements (9 credit hours)

A summary of the General Education Program for the School of Materials Engineering along with a list of approved courses is provided below. The faculty view courses in the arts, humanities and social science as an integral part of one's Engineering Education. The rationale for this view is described in the preamble to the General Education Program stating:

"Humanities and social sciences courses encompass the breadth of human experience and culture, both past and present, including individual behavior, social and political structures, aesthetic values, modes and dynamics of communication, philosophical and ethical thought, and cognitive processes. Such courses are an integral part of all engineering curricula which complements technical and professional content by enabling engineering students to appreciate the world in which they live and work, and to contribute as both educated members of society and aware, ethical professionals. Humanities and social sciences courses also provide a framework for rational inquiry, critical evaluation, judgment and decisions when dealing with issues that are non-quantifiable, ambiguous, or controversial. Of equal importance, they offer opportunities for engineering students to develop interests and insights that guide, enrich and expand their personal lives." We encourage you to make the most of this program by taking courses that are both interesting and challenging.

MSE General Education Courses

SOCIAL SCIENCES	
AGEC	250, 296, 340, 406, 410, 415, 423, 450
ANTH	100, 105, 201*, 203, 204, 205, 250, 303, 312*, 320, 335, 336, 341, 350, 368, 379,380*, 390, 392, 404, 414, 415, 420, 425, 435, 436, 460, 473, 478, 479
ASAM*	24000 (intro), 34000 (Up)
ASL	101, 102, 201, 202, 280
AUS	115, 309, 401, 419
AUSL	227, 368, 381
HDFS (cdfs)	201, 210, 211, 255, 301, 311, 312, 315, 325, 411, 424, 430, 432, 434
COM	102*, 204, 210, 212, 224, 240, 250, 251, 253, 256, 303, 312, 314, 316, 318, 320, 324, 325, 329, 330, 351, 352, 368, 372, 374, 376, 381, 412, 414, 416, 424, 435,491
CSR	342*
ECON	251, 252, 340, 352, 355, 361, 365, 368, 370, 375, 380, 385, 422, 456, 461, 466,470,471
POL	101, 120, 130, 141, 190, 200, 221, 222, 223, 230, 231, 232, 235, 237, 290,300, 301, 303, 304, 314, 320, 322, 323, 326, 327, 338, 342, 344, 345, 347,348, 350, 351, 352, 353, 360, 364, 370, 371, 372, 373, 380, 410, 411, 412,413, 415, 416, 417, 418, 419, 423, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 444, 445, 446, 447, 449, 452, 453,454, 455, 456, 460, 461, 462, 463, 493
PSY	120, 121, 200, 213, 220, 235, 236, 239, 240, 241, 242, 250, 251,272, 285, 310,311, 314, 333, 335, 336, 337, 338, 339, 350, 360, 361, 364, 365, 366, 367,368, 370, 372, 380, 388, 391, 392, 415, 420, 425, 426, 428, 440, 442, 443,444, 450, 463, 464, 473, 475, 476, 484, 485, 493
SOC	100, 220, 310, 312, 316, 324, 328, 334, 338, 339, 340, 341, 342, 350, 367, 368,374, 391, 402, 411, 416, 419, 420, 421, 425, 426, 429, 450, 454, 474, 475, 493

HUMANITIES	
A&D	105, **106, 113,** 125, **200, 205, 206,** 207, **213, 214,** 215, 216, 217, **221,** 226, 227, **230, 235,** 242, **245, 246, 250,** 255, **259, 262,** 265, 266, 270, 271, **275, 276, 307, 311, 312, 314, 316, 327, 330, 332, 333, 341, 342, 350, 351, 353, 357, 358, 359, 362, 363, 365, 366, 368, 369, 370, 371, 376, 380, 381, 382, 383, 384, 385, 390, 391, 395, 398, 400, 421, 442, 450, 451, 452, 454, 455, 458, 462, 468, 470, 475, 476, 485, 490, 492**
ARAB	101, **102, 201, 202, 301, 302**
ASAM*	24000*, **34000***
CHNS	101, **102, 107,201, 202, 220,** 230, 241, 280, 285, **301, 302, 305, 313, 341, 342, 490, 493 (101&102=107)**
CLCS	230, 237, **330, 331,333*, 335, 336, 337, 338*, 339*, 385**
DANC	101, 102, 103, 130, **140, 201, 202, 203, 240, 241,** 250, **301, 302**
ENGL	201, 227, 230, 231, 232, 233, 234, 235, 237, 238, 239, 240, 241, 250, 257, 258, 262, 264, 266, 267, 276, 279, **304*, 305, 327, 331, 333, 335, 337, 350, 351, 352, 356, 358, 360, 361, 362, 364, 365, 366, 368, 372, 373, 374, 375, 376, 377, 379, 381, 382, 383, 386, 387, 396, 406, 407, 409, 411, 412, 413, 414, 441, 442, 444, 455, 460, 462, 463, 466, 468, 469, 470**
LC (fll)	101, **102, 201, 202,** 230, 233, 235, 239, 261, 331, 361, **368, 371, 490**
FR	101, **102, 103, 112, 201, 202, 211, 212,** 230, 231, **241, 260, 280, 301, 302, 330, 341, 342, 361, 362, 380, 394, 396, 401, 402, 443, 480**
GER	101, **102, 103, 112, 201, 202, 211, 212,** 230, 231, **241, 260, 280, 301, 302, 323, 330, 341, 342, 360, 385, 401, 402, 441, 442, 446, 480, 483**
GREK	101, **102, 201, 202, 344, 446, 490**
HEBR	101, **102, 201, 202**
HIST	102, 103, 104, 105, 151, 152, 228, 229, 240, 241, 243, 245, 271, 272, 290,**302*, 303, 304, 307, 312, 317, 318, 320, 322, 323, 324, 326, 327, 328, 329, 330,331, 332, 333, 334, 335, 337, 339, 340, 341, 342, 343, 344, 345, 349, 350, 351,352, 353, 355, 356, 357, 358, 359, 360, 361, 362, 365, 366, 368, 371, 372, 376, 377, 381, 382, 383, 385, 386, 387, 391, 392*, 395*,396, 398, 399, 402, 403, 404, 405, 406, 407, 408, 409, 412, 414, 415, 416, 417, 419, 420, 427, 438, 439, 440, 441, 443, 450, 460, 461, 463, 465, 467, 468, 469, 471, 472, 473, 475, 492, 493, 494, 497, 595***
IDIS	220, 260, 271, 280, **330, 370, 371, 371F, 372, 373, 375, 376, 378, 380, 381, 420, 460, 473, 480, 481, 482, 483, 490, 490B**
ITAL	101, **102, 105, 112, 201, 202, 211, 212,** 231, **241, 260,** 301, **302,** 330, **335, 341, 342, 394**
JPNS	101, **102, 201, 202,** 230, **241,** 280, **301, 302, 341, 342, 361, 362, 363, 401, 402, 480, 490**
LATN	101, **102, 201, 202, 343, 344, 345, 346, 442, 443, 444, 445, 446, 490, 492**
MUS	**250, 361, 362, 363, 364, 371, 372, 373, 374, 375, 377, 378, 490**
PHIL	110, 111,114*,120*, 150*, 206, 219, 221, 225, 240, 242, 260, 270, 275, 280, 290, **293, 301, 302, 303, 304, 306, 319, 330, 331, 402, 406, 411, 421, 425, 430, 431, 432, 435, 465, 490, 493**
PTGS	101, **102, 105, 112, 201, 202, 211, 212**
RUSS	101, **102,** 111, **112, 201, 202, 211, 212, 223,** 230, 231, 232, 233, 234, 236, 237, **241,** 281, 289, **301, 302, 330, 341, 342, 361, 362, 401, 402, 480**
SPAN	101, **102, 103,** 112, **201, 202, 211, 212, 230,** 231, 235, **241, 260, 280, 301, 302, 330, 335, 341, 342, 361, 362, 401, 402, 480, 481, 482**
THTR	133*,168, 201, 202, **213, 233,** 260, **323, 333, 334, 336, 380, 413, 433, 434, 440, 480**
WGSS	28000*
NS*	214*, **413***
AFT*	**351*, 361*, 471*, 481***

1.4.4. Technical Electives

Eighteen credit hours of Technical Electives must be selected from lists of courses approved by the faculty of the School of Materials Engineering. At least 12 of the 18 credit hours are to be selected from the approved list of materials-related courses below. Up to 6 credit hours can be chosen from the list of Support Area Electives. We encourage you to develop a theme in your Technical Elective Program based on your career interests, whether you intend to take a position in industry or continue your studies as a graduate student. If you would like help developing your Technical Elective Program this please feel free to consult your faculty advisor.

Approved Technical Elective courses are listed below. Prerequisites are provided in *italics*. Detailed descriptions of MSE courses are available in the Undergraduate section of the MSE website. Most of these courses are not offered in a given semester. Therefore, each semester before registration a link to the Approved Technical Electives list is available in the Undergraduate section of the MSE website. This list highlights the courses offered during the next semester and their descriptions, and courses tentatively planned for the semester after. The list of courses offered in a given semester and their descriptions is also available outside of the academic advisor's (i.e. Vicki's) office. The faculty instructors for technical electives present an outline of their courses in MSE 390 a week or two before registration.

Descriptions of courses in other departments may be found on their respective web pages or the Purdue University Course catalog. The list below is revised periodically by the MSE faculty. *Other courses may be acceptable, subject to approval by petition to the Undergraduate Committee*.

APPROVED TECHNICAL ELECTIVES

MSE COURSES

MSE 49700	Ethics in Engineering Practice (Support are elective)
MSE 49700	Industrial Ecol & Life Cycle Analysis
MSE 49900	Independent Research (3 credits max. per semester, 6 credits max. overall)
MSE 50200	Defects in Solids
MSE 50500	Modeling and Simulation of Materials Processing (*MSE 340*)
MSE 50800	Phase Transformations in Solids
MSE 51000	Microstructural Characterization Techniques
MSE 51200	Powder Processing
MSE 52200	Rate Phenomena in Process Metallurgy *(MSE 260/340)*
MSE 52300	Physical Ceramics
MSE 52500	Structure, Property Relationships of Engineering Polymers
MSE 52700	Introduction to Biomaterials
MSE 53100	Quantitative Analysis of Microstructure
MSE 53600	Solidification Processing *(MSE 260/340)*
MSE 54000	High Temperature Alloys (*offered infrequently*)
MSE 54700	Introduction to Surface Science
MSE 54800	Deposition Processing of Thin Films and Coatings
MSE 55000	Properties of Solids
MSE 55500	Deformation Mechanisms in Crystal Solids *(MSE 382)*
MSE 55600	Fracture of Materials (*offered infrequently*) *(MSE 382)*
MSE 55700	Deformation Processing
MSE 55900	Phase Equilibria in Multicomponent Systems *(MSE 260)*
MSE 56000	Production of Inorganic Materials *(MSE 260)*
MSE 56700	Polymer Synthesis
MSE 57500	Transport Phenomena in Solids
MSE 57600	Corrosion
MSE 59700	Archeology & Materials Science
MSE 59700	Manufactur Advanced Composite Materials
MSE 59700	Characterization of Advanced Composite Materials
MSE 59700	Dynamic Behavior of Materials
MSE 59700	Simulation
MSE 59700	Intro to Materials Science of Rechargeable Batteries

MSE 59700 Modeling / Intro to Computational Materials Science
MSE 59700 Lean Manufacturing
MSE 59700 Rheology
MSE 59700 Steel & Al: Proc & Properties
MSE 59700 Soft Materials
MSE 59700 Kinetics of Materials
MSE 59700 Chemical Admixtures in Concrete
MSE 59700 Dislocation Dynamics
MSE 59700 Polymer Physics
MSE 59700 Design Global Sustainability
MSE 59700 Design Global Sustainability II
MSE 59700 Solid State Materials
MSE 59700 Sports Technology & Entrepreneurship
MSE 59700 Phys Prop of Crystals
MSE 59700 Modeling & Simulation of Materials

APPROVED COURSES IN OTHER DEPARTMENTS

A&AE 55200 Nondestructive Evaluation of Structures & Materials
A&AE 55300 Elasticity in Aerospace Engineering
A&AE 55400 Fatigue of Structures & Materials
A&AE 55500 Mechanics of Composite Materials *(AAE 553)*
A&AE 55900 Mechanics of Friction and Wear *(AAE 204 and MA 303 or equiv)*
A&AE 59000 Characterization of Advanced Composite Materials
CHE 44200 Chemistry & Engineering of High Polymers
CHE 54300 Polymerization Reaction Engineering and Reactor Analysis *(CHE 348)*
CHE 54400 Structure & Physical Behavior of Polymer Systems *(CHM 262 & 370)*
CHE 59700 Organic Electronic Materials & Devices
EE 30500 Semiconductor Devices
EE 55700 Integrated Circuit Fab Lab
IPPH 56200 Introduction to Pharmaceutical Manufacturing Processes
ME 41300 Noise Control
ME 47300 Engineer Design Modem Materials
ME 50700 Laser Processing
ME 55400 Patents, Licensing and Tech Entrepreneurship *(1 credit hour course)*
ME 55500 Composites & Polymer Processing
ME 55900 Micromechanics of Materials
ME 59700/ PHYS 57000 Fundamental Atomic Force Microscopy
ME 59700 Environmental Sustainability Design & Manufacturing
NUCL 47000/49700Fuel Cell Engineering
PHYS 545 Solid State Physics
PHYS 547 Physics of Semiconductor Devices
PHYS 597 Propulsion Design ,Build , Test
PHYS 597 Phys Chemistry & Nanomaterials
PHYS 597 Phys & Material Science of Semiconductor Nanostructures

1.4.5. Support Area Electives

The list of Support Area Electives below is divided into three categories: Communication, Mathematics and Basic Science, and Engineering Support. These courses are not directly related to Materials Engineering, but will help you improve you written or oral communication skills (e.g., Speech Writing and Analysis) or provide greater depth to topics touched on in MSE courses (e.g., Statistics). Up to 6 credit hours of your Technical Elective Program may be satisfied using Support Area Electives. The Support Area Electives list is also available in the Undergraduate section of the MSE website, or outside of Vicki's office

Communication:

AGEC 33100	Principles of Selling in Agricultural Business
COM 25200	Journalistic Writing
COM 31400	Advanced Public Speaking
COM 32500	Interviewing – Principle and Practice
COM 35800	Newspaper Reporting
COM 41400	Speech Writing and Analysis
COM 45300	Reporting of Science News
COM 45500	Advocacy Journalism
ENGL 30400	Advanced Composition
ENGL 39100	Composition for English Teachers
ENGL 40600	Review Writing
ENGL 40900	Introduction to Fiction Writing
ENGL 42000	Business Writing
ENGL 42100	Technical Writing
PSY 27200	Industrial Organizational Psychology
Foreign Language	#Any level 201 or higher

Engineering Support:

AAE 25100	Introduction to Aerospace Design
AAE 37200	Jet Propulsion Power Plants
AAE 53500	Propulsion Design, Build, Test
BME 55100	Tissue Engineering
CE 52400	Legal Aspects in Engineering Practice
EAS 37500	Fossil Fuels & Society (EAS will become EAPS – Fall 2013)
ECE 17000	EPICS for Freshmen – 3 hrs total
ECE 49500	Entrepreneurship
EPICS	EPICS – 2 semesters required (EPCS 201-202, 301-302, 401-2)
ECE 20100	Linear Circuit Analysis
ECE 20200	Linear Circuit Analysis II
ECE 20700	Electronic Measurement Techniques
EEE 300/CE 55900	Environmental & Ecological Systems
IE 33000	Probability & Statistics for Engineers II
IE 34300	Engineering Cost Analysis
ME 27400	Basic Mechanics II
ME 49200	Technology & Values

MGMT	(courses 3XX or greater are acceptable; however, may require MGMT 200 as a prerequisite)
MSE 48900	Ethics in Engineering Practice
MSE 49700	Manufacturing and Assembly
MSE 49700	Matls Engr System Analysis
NUCL 56300	Direct Energy Conversion
OBHR 30000	Mgmt of Human Resources (under MGMT)

Mathematics and Basic Sciences

BIOL 23000	The Biology of the Living Cell (old BIOL 295E) taught Fall only	
CHM 26200	Organic Chemistry	
CHM 26300	Organic Chemistry Lab	
CHM 26400	Organic Chemistry Lab	
CHM 37300	Physical Chemistry	
CHM 37400	Physical Chemistry	
EAS 24300	Earth Materials	(EAS will become EAPS Fall 2013)
EAS 37500	Fossil Fuels & Society (old EAS 391)	(EAS will become EAPS Fall 2013)
IPPH 56200	Intro to Pharmaceutical Manufacturing Process	
MA 30300	Diff. Eqs. and Partial Diff. Eqs. for Eng. and the Sciences	
MA 30400	Diff. Eqs. and Analysis of Nonlinear Systems for Eng. and the Sciences	
MA 36200	Topics in Vector Calculus	
MA 41000	Elements of Vector Calculus	
PHYS 33000	Intermediate Electricity & Magnetism	
PHYS 34200	Modern Physics	
PHYS 55000	Quantum Mechanics	
STAT 31100	Introductory Probability	
STAT 350 /51100	Statistical Methods (equivalent courses)	
STAT 51200	Applied Regression Analysis	
STAT 51300	Statistical Quality Control	
STAT 51400	Design of Experiment	
STAT 51600	Basic Probability and Applications	

Support Electives <u>cannot</u> be taken pass/no pass, or satisfied by exam or test out.

Other courses may be acceptable, subject to approval by petition to the Undergraduate Committee.

#200 level or higher. These courses appear on BOTH General Education and Support Elective Lists. <u>However, they can be taken to fulfill only ONE requirement.</u> THESE COURSES ARE EXCEPTIONS. OTHER GENERAL EDUCATION COURSES <u>ARE NOT</u> PERMITTED AS SUPPORT ELECTIVES.

1.4.6. Open Electives

As mentioned in section 1.2 there exist circumstances where you have satisfied the MSE program requirements without reaching the required 126 credits required for graduation. In these cases students may complete any Purdue courses to meet the minimum 126-credit total. Further, there are no rules against exceeding the 126-credit minimum with courses of your choosing.

1.5. ASSEMBLING YOUR PLAN OF STUDY

All students must maintain a written plan of study for their MSE degree program and have it approved each semester before registration. Ideally, you will follow the "Recommended Plan of Study Sequence" as shown in Table 1.1; however, alternative sequences are acceptable, especially in cases where students are involved in the Co-Op (section 2.1) or Study Abroad (section 2.3) programs. The most up to date forms needed for registration are available MSE 390 Blackboard site, or will be distributed via e-mail.

Sophomores should meet with Prof. Spitzer to develop a Plan of Study. If you have identified any general education or technical electives you plan to take in the future please indicate this on your plan of study. Following your sophomore year you will be assigned to another faculty member until you graduate.

Juniors are also assigned a specific faculty advisor, with whom they are to meet with an updated plan of study and an updated plan for their technical electives. Junior students registering for their senior year should review their academic history to determine they have fulfilled the requirement of an average 2.0 GPA for all MSE 200 and 300 courses. If the GPA for stated courses is below 2.0, then action should be taken to repeat necessary course(s) in the senior year to raise the GPA for that requirement to the minimum of 2.0 or greater.

Seniors Graduating seniors must also have approval from a faculty advisor, and should ensure that their final semester plan of study will meet all the requirements for graduation.

When you arrive for your academic counseling session you should bring hard copies of three forms: 1. Your Plan of Study, 2. Your Materials Engineering Graduating Checklist and 3. Your Next Semester's Registration Form. These forms are available on the MSE 390 Blackboard or will be distributed via e-mail. **We require** that you keep forms 1 and 2 electronically so that updates can be made quickly. Remember that any mistakes made that affect your graduation are your responsibility. If you are unable to access these forms through MSE 390, email vicline@purdue.edu.

After faculty advisor approval of your plan of study, he or she will sign the registration form. Next, return the completed Registration Form for the upcoming semester to Vicki Cline for the access code required to register.

1.5.1 Planning Ahead

If you are considering an alternative Plan of Study Sequence due to Co-Op, Study Abroad or any other reason, you need to be aware that MSE 335 and 367 are all prerequisites for MSE 430, the first semester of our senior design sequence. Not fulfilling these prerequisites could delay your graduation date. For Co-Op students, alternative sequences are mapped out in section 2.1. For those of you considering Study Abroad, the alternate sequence depends on your host institution. The Undergraduate Committee will be happy to work with you to develop a Plan of Study to facilitate your participation in Study Abroad (see section 2.3). For all other students considering alternative sequences (e.g., due to internships, etc.), it is very important to work with your faculty advisor to prepare an acceptable Plan of Study.

Plan of Study for the B.S. MSE Degree

Freshman Year

First Semester

(4) MA 16500 (Analytic Geometry And Calculus I)
(4) CHM 11500 (General Chemistry I) (or CHM 13600 Honors)
(4/3) ENGL 10600 or equivalent (English Composition)
(2) ENGR 13100 or 1 (Transforming Ideas to Innovation I)
or ENGR 14100 (Honors version)

(14 or 13)

Second Semester

(4) MA 16600 (Analytic Geometry And Calculus II)
(4) CHM 11600 (General Chemistry II) (or CHM 13600)
(4) PHYS 17200 (Modern Mechanics)
(3) COM 11400 (Fundamentals of Speech)
(2) ENGR 13200 (Transforming Ideas to Innovation II)
or ENGR 14200 (Honors version)
(17)

Sophomore Year

Third Semester

(3) MSE 23000 (Structure and Properties of Materials)
Pre-CHM 11500, MA 16500
(3) MSE 23500 (Materials Properties Laboratory)
Pre-CHM 11500, MA 16500, Co-MSE 23000
(4) MA 26100 (Multivariate Calculus)
(3) PHYS 24100 (Electricity and Optics)+
(3) MA 26500 (Linear Algebra)
(0) MSE 39000 (Seminar)
(16)

Fourth Semester

(3) MSE 25000 (Physical Properties in Eng. Systems)
Pre-PHYS 17200, Co-MSE 23000, Co-MA 26500 (or MA 26200)
(3) MSE 26000 (Thermodynamics of Materials)
Pre-MA 26100, Co-MSE 23000 Co-CHM 11600 (or CHM 13600)
(3) MSE 27000 (Atomistic Materials Science)
Pre-MA 26100, Co-MA 26500 (or MA 26200), Co-MSE 23000
(3) MA 26600 (Ordinary Differential Equations)
(1) PHYS 25200 (Elec. And Optics Lab)
(3) General Education Elective
(0) MSE 39000 (Seminar)
(16)

Junior Year

Fifth Semester

(3) MSE 33500 (Materials Characterization Laboratory)
Pre-MSE 23500
(3) MSE 34000 (Transport Phenomena)
Pre-MA 26600 (or MA 26200)
(3) MSE 37000 (Elec,Opt, and Mag. Props. of Materials)
Pre-MSE 23000, MSE 27000, PHYS 24100 (or PHYS 27200)
(4) CHM 25700 (Organic Chemistry)
(3) General Education Elective
(0) MSE 39000 (Seminar)
(16)

Sixth Semester

(3) MSE 33000 (Proc. and Props. of Matls.)
Pre-MSE 26000
(3) MSE 36700 (Materials Processing Laboratory)
Pre-MSE 26000
(3) MSE 38200 (Mechanical Response of Materials)
Pre-MSE 25000, MA 26500 (or MA 26200)
(3) Technical Elective
(3) General Education Elective
(0) MSE 39000 (Seminar)
(15)

Senior Year

Seventh Semester

(3) MSE 43000 (Materials Processing and Design I)
Pre-MSE 33500 and 36700
(3) MSE 44500 (Materials Engineering Systems Analysis)
Pre-MSE 33000, 34000, Co-MSE 43000
(6) Technical Electives
(3) General Education Elective
(0) MSE 39000 (Seminar)
(15)

Eighth Semester

(3) MSE 44000 (Materials Processing and Design II)
Pre-MSE 33500, 34000, 37000, 43000
(9) Technical Electives
(6) General Education Electives
(0) MSE 39000 (Seminar)
(18)

Note: "Pre" and "Co" requisites are indicated in small type below all MSE courses

The preferred math sequence includes MA 26500 and MA 26600. An alternate math sequence that consists of MA 26200 followed by either MA 30300 or MA 35100 can be taken.

Plan of Study for the B.S. MSE Degree

Notes:

Students entering the School of Materials Engineering should have completed the sequence of CHM 11500 and 11600 or the sequence of CHM 12300 and 12400 (or CHM 13600).

Eighteen credit hours of general education electives are chosen in accordance with the general education requirements of the Schools of Engineering.

Eighteen credit hours of technical electives must be selected from lists of courses approved by the faculty of the School of Materials Engineering. At least 12 of the 18 hours are to be selected from an approved list of Materials courses. Up to 6 hours can be chosen from a separate list of courses, which includes other Support Areas.

Of the courses used to satisfy the minimum graduation requirements, the pass/not-pass option may be applied only to the 9 credits of unspecified general education electives.

Phys 25200 is a 1-cr hour lab course. It may be replaced by another 1-cr hour stand-alone science lab course such as Chem 25700L (which compliments Chem 25700, a required course for MSE) or Chem 26300. Another possibility is to take PHYS 27200 (Electric And Magnetic Interactions), a 4-cr hour course which will count for PHYS 24100 (3-cr hour) and PHYS 25200 (1-cr hour).

The preferred math sequence includes MA 26500 and MA 26600. Under certain circumstances MA 26200 (Linear Algebra And Differential Equations) and either MA 30300 (Differential Equations and Partial Differential Equations for Engineering and the Sciences) or MA 35100 (Elementary Linear Algebra) may be approved to replace MA 26500 and MA 26600

1.5.2 Updates for the 2016-2017 Academic Year

1) Updates to the MSE Core Courses:

Professor Erk has introduced a new class for the MSE core entitled "Structure & Properties of Organic Materials" that will ultimately replace CHM 25700 in the MSE Plan of Study. The course was reviewed and approved by the Undergraduate Committee and submitted to the faculty for approval at the Faculty Meeting on October 27, 2015. The course was approved and was first offered Spring Semester 2016 as an MSE 49700 technical elective.

Concerning these courses for only the academic year of Fall-2016 and Spring-2017, students have the following options:

1) If a student takes CHM 25700: "Organic Chemistry" (Fall 2016) as listed in the current MSE Plan of Study and then takes MSE 497: "Structure & Properties of Organic Materials" (Spring 2017), then MSE 497 will count as a technical elective.

2) If a student takes MSE 497: "Structure & Properties of Organic Materials" and has not taken CHM 25700: "Organic Chemistry," then MSE 497 replaces CHM 25700.

For the second option, MSE 497 would not count as a technical elective. As there is an 1-hr credit difference between the courses, the student must still satisfy the required 126 credit hours for graduation.

1.6. PETITIONING

Exceptions to any of the published requirements for graduation require approval by petition to the Undergraduate Committee of the School of Materials Engineering. A petition from a student to the Undergraduate Committee is specifically required for the following:

A. Acceptance of credit from Study Abroad programs for courses not receiving prior approval.
B. Approval of Technical, Support Area, or General Education Electives not on current lists.
C. Consideration of any other exceptions to normal graduation requirements.

Petitions are submitted as a memo to the Undergraduate Committee and include the following:

1. A general statement of the request and its rationale.
2. In case B above, a course description and syllabus (if available) for potential addition to the General Education or Technical Electives list.

The Undergraduate Committee will consider each petition and provide a formal written response to the student.

SECTION 2. OPPORTUNITIES

2.1. THE CO-OP PROGRAM

Cooperative Education is a formal plan of education in which a student alternates sessions of full-time work with sessions of full-time study. Purdue's Cooperative Education Program (Co-Op) is a five-year professional development experience, designed to combine practical on-the-job experiences with the classroom training of a four-year college curriculum. It helps students integrate theory and practice, confirm career choices, investigate potential job opportunities, and become better graduates. At the same time, it allows students to earn money and help finance their education. For general information on the Co-Op program please see http://coop.www.ecn.purdue.edu/Coop/.

Note: Anyone interested in the Cooperative Education program should talk with Prof. Eric Kvam, who is the MSE Co-Op advisor, as there have been changes in the program, including fewer Co-Op obligations. For a program with 5 Co-Op sessions there are two plans as noted in Table 2.1 and Table 2.2. These require a 5 year period to complete your degree. Alternately, a program with 3 Co-Op sessions is detailed in Table 2.3. This plan would allow our to complete your degree within a 5 year period.

Table 2.1.: Co-Op Plan of Study Sequence for Fall Start

	Fall	Spring	Summer
Year 1	Chem 115 Engr 131 Engl 106 COM 114 Math 165	Chem 116 Engr 131 First Year or Other Elective (2 cr. needed) Phys 172 Math 166	Math 265 (3) 7 cr Math 261 (4)
Year 2	CO-OP SESSION	MSE 230 (3) 16 credits Math 266 (3) Phys 241 (3) Phys 252 (1) MSE 270 (3) MSE 250 (3) MSE 390 (0)	CO-OP SESSION
Year 3	MSE 235 (3) 16 cr Chem 257 (4) MSE 340 (3) MSE 370 (3) MSE 335 (3) MSE 390 (0)	CO-OP SESSION	Gen. Ed. (3) 6 cr Gen. Ed. (3)
Year 4	CO-OP SESSION	MSE 330 (3) 18 credits MSE 260 (3) MSE 367 (3) MSE 382 (3) Tech. El. (3) Gen. Ed. (3) MSE 390 (0)	CO-OP SESSION
Year 5	MSE 430 (3) 15 credits Tech. El. (3) Tech. El. (3) Gen. Ed. (3) MSE 445 (3) MSE 390 (0)	MSE 440 (3) 18 credits Tech. El. (3) Tech. El. (3) Tech. El. (3) Gen. Ed. (6) – 2 classes MSE 390 (0)	

Table 2.2.: Co-Op Plan of Study Sequence for Spring/Summer Start. The undergraduate committee **does not** recommend a Spring/Summer start for the Co-Op program.

	Fall	Spring	Summer
Year 1	Chem 115 Engr 131 Engl 106 COM 114 Math 165	Chem 116 Engr 132 First Year or Other Elective (2 cr. needed) Phys 172 Math 166	CO-OP SESSION
Year 2	Chem 257 (4) 17 credits Math 261 (4) MA 265 (3) MSE 230 (3) MSE 235 (3) MSE 390 (0)	CO-OP SESSION	6 cr MA 266 (3) Gen. Ed. (3)
Year 3	CO-OP SESSION	MSE 250 (3) 18 cr. MSE 260 (3) MSE 367 (3) MSE 270 (3) Phys 241 (3) Gen. Ed. (3) MSE 390 (0)	CO-OP SESSION
Year 4	MSE 335 (3) 18 credits MSE 340 (3) MSE 370 (3) Tech. El. (3) Tech. El. (3) Gen. Ed. (3) MSE 390 (0)	CO-OP SESSION	Gen. Ed. (3) 6 cr Gen. Ed. (3)
Year 5	MSE 430 (3) 15 credits Tech. El. (3) Tech. El. (3) Tech. El. (3) MSE 445 (3) MSE 390 (0)	MSE 440 (3) 16 credits Tech. El. (3) MSE 382 (3) Gen. Ed. (3) MSE 330 (3) MSE 390 (0) Phys. 252 (1)	

Table 2.3.: Three semester Co-Op Plan of Study

	Fall	Spring	Summer
Year 1	MA 16500 (4) 14 credits ECHM 11500 (4) ENGL 10600 (or equivalent) (4/3) ENGR 13100 (2)	MA 16600 (4) 17 credits CHM 11600 (4) PHYS 1720 (4) COM 11400 ENGR 13200	MSE 230 (3) 10 credits MSE 235 (3) MA 26100 (4)
Year 2	CO-OP SESSION	MSE 25000 (3) 17 credits MSE 26000 (3) MSE 27000 (3) PHYS 24100 (3) PHYS 252 (1) MA 262	CO-OP SESSION
Year 3	MSE 33500 (3) 16 credits MSE 34000 (3) MSE 37000 (3) CHM 25700 (4) MA 30300 or MA 351 (3)	. CO-OP SESSION	MSE 33000 (3) 9 credits MSE 36700 (3) Gen. Ed (3)
Year 4	MSE 43000 (3) 18 credits MSE 44500 (3) Tech. El (3) Tech. El. (3) Gen. Ed. (3) Gen. Ed. (3)	MSE 44000 (3) 18 credits Tech El. (3) Tech El. (3) Tech El (3) Gen. Ed. (3) MSE 382 (3)	Tech. El. (3) 9 credits Gen. Ed. (3) Gen. Ed. (3)

127 total credit hours

2.2. INTERNSHIPS AND SUMMER RESEARCH EXPERIENCE

Even if you are not a Co-Op student, it is still important that you experience Materials Engineering outside of the classroom either in an industrial or research setting. Summer is a particularly good time for industrial internships or university or National Laboratory research experience. Vicki Cline can provide information about available industrial internships both in the Lafayette area and beyond. Also, job fairs, especially the Industrial Roundtable during the fall semester, are great settings to make contacts for internship opportunities. When looking for summer research programs at universities, a good place to start is the National Science Foundation's Research Experience for Undergraduates (REU) program that sponsors summer research at universities across the United States. You can search for more information about the REU program at www.nsf.gov. Also, the College of Engineering sponsors a Summer Undergraduate Research Fellowship Program, or SURF, that affords research experience for undergraduates. The program runs from late May through early August; information regarding this program can be found at: https://engineering.purdue.edu/Engr/Research/SURF/. Note that the application dates are early in the spring semester. It is generally best to identify a faculty member with whom you want to work, and to discuss whether they can support you in this program. The program stipend is approximately $3600/summer.

2.3. MATERIALS ENGINEERING STUDY ABROAD (MESA)

In recent years increasing numbers of MSE students have been spending a semester or a year overseas via the Study Abroad Program. You can learn more about Purdue's Study Abroad Program in general by visiting www.studyabroad.purdue.edu. The experiences of many of the Materials Engineering students who participated in Study Abroad may be found in the Study Abroad link in the undergraduate section of the MSE webpage. The purpose of this section is to provide information to help you prepare for Study Abroad. Below are some general comments about Study Abroad followed by information about specific Study Abroad locales.

- **Start your preparations as early as possible!** Typically students take Study Abroad during their junior year, but some go as early as their sophomore year. Virtually all students deviate from the "Recommended Plan of Study Sequence" (section 1.3), so advanced planning is necessary to determine which courses should be taken earlier and which should be delayed. Please remember, you will also need to apply through the Study Abroad Program, and there are deadlines for the various programs in their office. http://www.studyabroad.purdue.edu/
- We feel very strongly that Study Abroad enhances your education, and we would like as many students as possible to take advantage of this opportunity. Therefore, we will help you accommodate your Plan of Study to Study Abroad. The specific changes needed to your Plan of Study depend on your Study Abroad locale. Below is some information; however, each individual case is different so consider the information below as only a start. Visit Vicki Cline or the Undergraduate Committee Chair for help.
- In general, it is easier to satisfy Technical and General Education electives than Core Courses during Study Abroad. This is in part due to relatively few courses equivalent to Core Courses, and in part because acceptable courses at a given university may not be offered on a regular basis. For a given Study Abroad locale there are exceptions to this general rule and they are detailed below.

- Courses from Study Abroad locales must be approved for Purdue credit, beginning with the Office of Study Abroad. Vicki Cline maintains a list of courses that have been previously approved for Study Abroad. Consulting with her before selecting your courses may save you some time and trouble.

2.3.1. Comments About Specific Study Abroad Locales

University of New South Wales – Sydney, Australia

Most students attending UNSW have done so during the spring semester. Courses equivalent to MA 266 and MSE 382 have been available in past years. For students wishing to attend UNSW in their junior year, plan on taking MSE 367 during the spring semester of your sophomore year, MSE 382 at UNSW (if available) and MSE 260 during the spring semester of your senior year. MSE 350 is a prerequisite for MSE 430 (Senior Design); however, we have made exceptions in this case to facilitate Study Abroad. Several courses acceptable as Technical or General Education electives are available at UNSW.

Tohoku University – Sendai, Japan

Study Abroad at Tohoku University may be undertaken for either one semester or for a full year. Courses equivalent to MSE 250 and MSE 260 have been available in past years. Further, students who stayed for a full year completed their Senior Design requirement (MSE 430 and 440) through laboratory research at Tohoku. Several Technical and General Education electives are also available.

Imperial College – London, England

MSE students have attended Imperial College during the spring and summer, taking General Education courses. Courses equivalent to MSE 260, 330 and MSE 370 were available during the spring semester in past years. Also available were several Technical Elective courses.

ETH-Zurich – Zurich, Switzerland and University of Grenoble, Grenoble - France

At both of these institutions students have taken Technical and General Education electives during the spring semester.

Introduction to Intercultural Teamwork in China

Two week program during Maymester involving engineering and liberal arts majors. Emphasizes collaborative strategies with cultural diversity. Students visit three universities and cities such as Beijing, Harbin, Shanghai and Ningbo and collaborating with Chinese peers and visits to industry partners. Program fee is only $3,300; made possible by a significant endowment support. Limit of twenty participants, so apply early!

Royal Institute of Technology (KTH) - Stockholm, Sweden

Students are eligible to enroll in courses for either the fall or spring, preference being given to the fall semester. MSE equivalents for MSE 340 and 330 as well as technical electives are available at this prestigious university with a long history of metallurgical engineering.

Other programs recently chosen by MSE students are:

University of Madrid - Spain
National University of Ireland – Galway
University of Florence – Italy
Global Leadership and Innovation Program – Greece
Karlsruhe University – Germany
University of Grenoble – France

2.4. MSE 499 RESEARCH IN MATERIALS ENGINEERING

MSE 499 provides the opportunity for laboratory and/or library research beyond the scope of the ordinary undergraduate curriculum, working in a research environment under the direct guidance of a faculty member. MSE 499 may be taken for 1, 2 or 3 credits in a given semester, and up to 6 credits of MSE 499 can count towards fulfilling your Technical Elective Program (section 1.4.5). To enroll in MSE 499 your first step is to find a member of the faculty who is willing to supervise your research project. The best way to do this is to review the faculty research interests available on the MSE website and find a match with your own interests. Next you should arrange a meeting with the faculty member to inquire if he/she is willing to act as your research advisor and discuss possible projects. After finding a faculty advisor you should submit a petition to the Undergraduate Chairman for approval of your 499 project. In general, it is preferred that petitions are submitted during the regular registration period; however, you may submit petitions to add MSE 499 to your schedule up to the end of the second week of classes. A petition format is provided in section 2.4.1. below. You will not be able to register for MSE 499 until the Undergraduate Chairman has approved your petition. **Please note that for every credit of MSE 499 you are expected to provide 3 hours per week of available time in your schedule during regular business hours (8 AM – 5 PM) for laboratory or library research**. MSE 499 research performed outside regular business hours must be accommodated by special arrangement and is the exception rather than the rule. **Students taking MSE 499 for 3 credits may substitute 3 of the weekly laboratory hours for a one hour research meeting with their advisor**.

2.4.1. Format for Independent Research Petition

This form is available online at:
https://engineering.purdue.edu/MSE/Academics/Undergrad/index.html

School of Materials Engineering
MSE 499 Independent Research Request

Date:
To: Prof. Johnson, Undergraduate Committee Chair
From:
E-mail address:

RE: Approval for independent research project. (MSE 499)

Faculty Research Advisor:
Number of credit hours:

Title of proposed project: (30 characters or less, a space counts as a character, abbreviations are acceptable)

Number of prior MSE 499 credits (not including the proposed credits):

Approval for _____ semester _____. (e.g, Fall semester 2006)

Background: (completed by student and advisor)

Objective: (completed by student and advisor)

The attached syllabus details the academic and safety requirements of the course and outlines issues related to academic dishonesty and Intellectual property. I have read and agree with the contents of this syllabus:

Student Signature:_____ Date _____

Signature, Advisor: _____ Date _____

MSE 499 Syllabus, Campus Emergency and Academic Dishonesty Information

Title of proposed project:

I. Syllabus

A. Hours: MSE 499 is a lab-class and as such each credit-hour represents 3 hours per week for 15 weeks or 45 hours of actual lab work. Your proposed work schedule must specifically allocate that time.

Work Schedule (Be specific, such as: MWF 10:30-1:30):

B. Graduate mentor (per safety committee policy of chain of command in lab environment):

C. Responsibility to Advisor: (weekly meetings, semester report, etc.)

***D.* Grading:** *(To be completed by the faculty advisor)*

II. Campus Emergency Policy

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. ***Any such changes will be communicated directly to you via email.***

III. Academic Dishonesty

A. General Statement. Purdue University Regulations, Part 5, Section III-B-2-a describes the formal policies governing academic dishonesty. Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." A guide providing specific examples, tips, and consequences is available from the Office of the Dean of Students at: http://www.purdue.edu/odos/osrr/academicintegritybrochure.php As discussed in this brochure on *Academic Integrity*, there are many dishonest ways to gain an advantage over another student in an assignment. The goal is not to list these here, but these rules cover any assignment for which the instructor will assign a grade (homework, quizzes, exams, laboratory reports, term paper, etc.). Rather, students should ask themselves this question when working on all class assignments: "*If I use this information, will the completed assignment represent only my efforts?"* If the answer is no, then don't do it. The test is simple. For example, turning in a term paper obtained from a website does not represent your efforts.

The teaching staff for this course will diligently monitor academic dishonesty in all assignments. ***Students found to engage in academic dishonesty are subject to discipline to potentially include: a grade of F for the course***, a permanent letter added to your file, and reporting the incident to the Dean of Students for further action. Two letters in your file will result in an automatic forwarding of the case to the Dean of Students.

B. Course Specific Statement. As this class is research based, there are a variety of dishonest practices that can occur, with consequences as listed above. They include, but are not limited to:

a. In the case of this course, a final written report is required for grade assignment. ***Plagiarism of such report in whole or part constitutes academic dishonesty and will be sanctioned.***

b. In research data and results are generated. While null results or even complete failure of experiments happens routinely, some researchers attempt to gain notoriety by falsifying or creating data. However, this practice is unethical and, in some circumstances, illegal. ***Thus, falsification or "making-up" data and results in whole or part constitutes academic dishonesty and will be sanctioned.***

c. While the work is expected to be the student's own, all data, results and the like do not belong to the student such that they must be provided as asked for, including any lab notebooks, files, etc. Thus, all data, results, notebooks, files, etc are the property of Purdue University as administered by MSE and the Youngblood group. ***Attempts to withhold data, files, notebooks, or reports, or to remove them from the lab constitutes academic dishonesty (as well as theft) and will be sanctioned and, possibly, prosecuted by relevant authorities.***

IV. Safety and Interpersonal Conflict Policy

A. Safety: All safety requirements and rules must be followed. It is the responsibility of the student to know what they are and to obtain the relevant safety training, which will be provided at request. It is the responsibility of the student to know the hazards they are working with and follow all hazard communications, warnings, etc provided. ***Failure to follow safety procedures, follow instructions of professors, staff, or grad students or negligently creating a safety hazard can result in the student being removed from the lab and possible banning from that and other labs.*** Such a result may compromise the ability of the student to perform satisfactorily for the project.

B. Conflict Policy: While it is not expected that all lab members be "friends", it is expected that all students will be amiable, polite, and professional in all interpersonal interactions and follow reasonable instructions from faculty, staff, and grad students. ***Violence, intimidation, excessive argument, pestering, and other anti-social behavior will not be tolerated and can result in the student being removed from the lab and possible banning from that and other labs.***

V. Intellectual Property

Pursuant to Purdue Policy, all Intellectual Property (IP) generated by the student during the 499 class will belong to the student. However, all IP generated prior to, after, or outside of the specific classwork of the student will remain with those relevant inventors. Such issues follow the USPTO legal definition of inventorship, which corresponds to conceptualization, but not implementation of new and useful inventions. Most commonly, ideas for research and application space originate with the faculty and the 499 student works to implement and generate data. Thus, in this arrangement inventorship lies solely with the faculty, although specific cases may vary.

2.5. SOCIETY OF MATERIALS SCIENCE ENGINEERS (SMSE)

The Society of Materials Science Engineers is a student chapter representing the major MSE professional organizations including the Materials Research Society (MRS), the American Ceramic Society (ACerS) and the Minerals, Metals and Materials Society (TMS) and the Iron and Steel Society. Membership in the above national organizations is possible by joining the "Materials Advantage". Joining this single organization, provides a student with official membership all of the four listed national organizations. The student group, SMSE, promotes communication among students in Materials Engineering, holds social events like pizza dinners and pool tournaments, and outreach. For more information please visit the Student Societies link on the Materials Engineering Home page.

2.6. SCHOLARSHIPS AND AWARDS

There is an official application that MUST BE COMPLETED to be considered for a scholarship in MSE. The link will be found on the MSE undergraduate website. The due date for application is a "hard" date and all applications must be submitted by that date with no exceptions. This date is typically in May but may change from year to year. The actual date and relevant information will be presented in MSE 390, and through school-wide e-mail messages.

Undergraduate scholarships fall into three categories. Scholarships and awards exclusively for Purdue MSE students include the John Deere Foundation, the Sopcak Memorial, the Matthew M. Slone Academic Excellence Award, and the John Bray Award. Other companies that award scholarships include U.S. Steel, Alcoa, and Precision Cast Parts. Purdue University also provides a limited number of awards including the Graduating Student Awards. Finally, national societies like the American Society for Metals (ASM) and the Minerals, Metals and Materials Society (TMS) have annual scholarship competitions.

2.7. HONORS PROGRAM

The overall academic criteria for the School of Materials Engineering (MSE) Upper-Division Component of the College of Engineering Honors Program (CoEHP) needed to earn a "BS-MSE with Honors" are described below. These requirements are consistent with EFD 07-09.

ACADEMIC REQUIREMENTS:

1. Eligibility – entry into the MSE Upper-Division Component of the CoEHP is based on minimum overall GPA of 3.7 (or the CoEHP required GPA if it is more restrictive) as well as the ability to complete programmatic requirements by graduation. Students eligible for the program are typically notified by the Engineering Honors Program.
2. Honors Completion – To complete the College of Engineering Honors Program and earn a "BS-MSE degree with Honors," participants must have:

    a) completed the course requirements for a bachelor of science in MSE; and
    b) earned a minimum of 24 honors points, 12 of which are specific to MSE, with the remaining points accumulated from non-MSE honors courses; and
    c) possess an overall GPA of 3.7 (or the CoEHP required GPA if it is more restrictive) at the time of graduation; and

d) completed a significant research or design experience that resulted in a public scholarly activity such as an oral or poster presentation. Note that MSE 430 or MSE 440 cannot count towards meeting this requirement.
e) Also, students must participate in the required sophomore and junior CoEHP Honors Seminar, in addition to any required MSE seminar courses.

3. MSE Specific Honors Points – students must earn a minimum of 12 honors points from MSE approved research/design experiences and coursework. These include:

    a. 3 to 6 credit hours (negotiated with the research advisor) of MSE 499 Undergraduate Research. Students must complete a significant research experience. Following completion of the entire project, their results should be presented as part of a public scholarly activity.
    b. Up to 9 credit hours of any 500-level MSE course. Such courses may be used to satisfy BS-MSE degree requirements or reserved for possible graduate credit.

2.7.1 SUPPLEMENTARY INFORMATION:

4. Participants must maintain a minimum overall GPA of 3.7 (or the CoEHP eligibility GPA if it is more restrictive) to be in good standing. Students falling below the required eligibility GPA will be placed on Honors probation. Students on Honors probation will have one semester (excluding summer sessions) to re-establish their eligibility. Failure to re-establish eligibility will result in the forfeiture of all rights and privileges afforded CoEHP participants. Rights and privileges may be reinstated once eligibility is re-established.
5. The MSE Undergraduate Committee will bring proposed modifications to the MSE honors program, including the minimum GPA criterion, to the MSE faculty for a vote.
6. The effective date of this document is Fall 2011. Students involved in and satisfying MSE Honors requirements prior to this document will be allowed to complete said program using their previously established criteria.