

COLLEGE OF ENGINEERING  
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING  
**BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND ENGINEERING**  
FOR STUDENTS GRADUATING IN CALENDAR YEAR 2021  
126 CREDITS REQUIRED FOR GRADUATION

**APPROVED**  
University Registrar

FALL SEMESTER FRESHMAN 2017		Credits	SPRING SEMESTER FRESHMAN 2018		Credits
CHEM 1035 General Chemistry		3	ENGL 1106 First-Year Writing <i>Pre: ENGL 1105</i>		3
CHEM 1045 General Chemistry Lab <i>Co: CHEM 1035</i>		1	MATH 1226 Calculus of a Single Variable <i>Pre: MATH 1225 (C-)</i>		4
ENGL 1105 First-Year Writing		3	PHYS 2305 Found of Physics I w/lab <i>Pre: MATH 1225; Co: MATH 1226</i>		4
MATH 1225 Calculus of a Single Variable (C-) <i>Pre: Math Ready</i>		4	ENGE 1216 Foundations of Engineering (C-) <i>Pre: ENGE 1215</i>		2
CLE (Area 2, 3 or 7)		3	MATH 1114 Elementary Linear Algebra		2
ENGE 1215 Foundations of Engineering (C-)		2			
<b>TOTAL</b>		<b>16</b>	<b>TOTAL</b>		<b>15</b>
FALL SEMESTER SOPHOMORE 2018		Credits	SPRING SEMESTER SOPHOMORE 2019		Credits
MATH 2204 Intro Multivariable Calculus <i>Pre: MATH 1226</i>		3	CHEM 1036 General Chemistry II <i>Pre: CHEM 1035</i>		3
PHYS 2306 Foundations of Physics I w/lab <i>Pre: MATH 1226, PHYS 2305</i>		4	MATH 2214 Differential Equations <i>Pre: MATH 1114 or MATH 2114</i>		3
ESM 2104 Statics <i>Co: MATH 2204</i>		3	ESM 2204 Mech of Deformable Bodies <i>Pre: ESM 2104, MATH 2204</i>		3
ISE 2214 Manufacturing Processes Lab <i>Pre: ENGE 1216</i>		1	MSE 2054 Fund of Materials Science <i>Pre: 2044 (C)</i>		3 <sup>[S]</sup>
MSE 2044 Fund of Materials Eng (C) <i>Pre: CHEM 1035, Co: PHYS 2305</i>		4 <sup>[F,S]</sup>	MSE 2114 Math Methods in MSE I <i>Pre: 2044 (C)</i>		1 <sup>[S]</sup>
MSE 2884 Materials Eng Prof Dev		1 <sup>[F]</sup>	MSE 3314 Materials Lab I <i>Pre: 2044 (C)</i>		1 <sup>[S]</sup>
			CLE (Area 6)		1
<b>TOTAL</b>		<b>16</b>	<b>TOTAL</b>		<b>15</b>
FALL SEMESTER JUNIOR 2019		Credits	SPRING SEMESTER JUNIOR 2020		Credits
CLE (Area 3) ECON 2005 Principles of Economics		3	MSE 3044 Transport Phenomena MSE <i>Pre: 2044 (C), MATH 2214</i>		3 <sup>[S]</sup>
MSE 3114 Math Methods in MSE II <i>Pre: 2114</i>		1 <sup>[F]</sup>	MSE 3054 Mech Beh of Materials <i>Pre: 2044 or 3094 or 2034 or AOE 3094 or CEE3684; ESM 2204</i>		3 <sup>[F,S]</sup>
MSE 3134 Crystallography and Crystal Structures <i>Pre: 2044(C)</i>		3 <sup>[F]</sup>	MSE 3064 Mech Beh Lab <i>Co: 3054</i>		1 <sup>[F,S]</sup>
MSE 4034 Thermo of Materials <i>Pre: 2044 (C); Co: CHEM 1036</i>		3 <sup>[F]</sup>	MSE 3884 Materials Eng Prof Dev II <i>Pre: junior standing, 2884</i>		1 <sup>[S]</sup>
MSE 4424 Materials Lab II <i>Pre: 2044 (C)</i>		1 <sup>[F]</sup>	MSE 4644 Mat Optimization Des Exp <i>Pre: 3314 or 4424</i>		3 <sup>[S]</sup>
Physical Materials Course		3	Physical Materials Course		3
Physical Materials Course		3	Technical Elective from list		3
<b>TOTAL</b>		<b>17</b>	<b>TOTAL</b>		<b>17</b>
FALL SEMESTER SENIOR 2020		Credits	SPRING SEMESTER SENIOR 2021		Credits
MSE 4055 Mat Select & Design <i>Pre: 3044, 3054, 2 of (3204, 4414, 4554)</i>		3 <sup>[F]</sup>	MSE 4076 Senior Project Lab II <i>Pre: 4075 Co: 4086,</i>		2 <sup>[S]</sup>
MSE 4075 Senior Project Lab I <i>Pre: 4644 Co: 4055, 4085</i>		1 <sup>[F]</sup>	MSE 4086 Senior Project Recitation II <i>Pre: 4085 Co: 4076</i>		1 <sup>[S]</sup>
MSE 4085 Senior Project Recitation I <i>Pre: senior standing, 3884 Co: 4075 or 4095H</i>		2 <sup>[F]</sup>	Physical Materials Class		3
Technical Elective from list		3	Technical Elective from list		3
Technical Elective from list		3	CLE (Area 2, 3, or 7)		3
CLE (Area 2, 3, or 7)		3	CLE (Area 2, 3, or 7)		3
<b>TOTAL</b>		<b>15</b>	<b>TOTAL</b>		<b>15</b>



**General Information about Checksheet:** Superscripted annotation [F,S,SI,SII] in Credits column indicates that a course is known to be offered in terms other than when shown. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with their department.

**Curriculum for Liberal Education (CLE)**

Consult the CLE Alphabetical Listing at: <http://www.cle.prov.vt.edu/guides/alpha.html>, CLE courses need to be completed prior to graduation

CLE Area 1: Writing and Discourse (6 hrs)	ENGL 1105	(3)	ENGL 1106	(3)
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		(3)		(3)
CLE Area 3: Society & Human Behavior electives (6 hrs) <sup>1</sup>	ECON 2005	(3)		(3)
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	PHYS 2305	(4)	PHYS 2306	(4)
CLE Area 5: Quantitative and Symbolic Reasoning (8 hrs)	MATH 1225	(4)	MATH 1226	(4)
CLE Area 6: Creativity & Aesthetic Experience elective (1 hr) <sup>1</sup>				(1)
CLE Area 7: Global Issues Elective (3 hrs)				(3)

If a CLE course is double-counted to satisfy two different CLE areas, a free elective(s) must be taken to maintain a minimum of 126 credits.

**Electives:** The MSE degree requires 12 credits technical electives from list. Technical Electives must be taken for a grade (Pass/Fail is not acceptable).

**Change of Major Requirements:** : Please see <http://www.enge.vt.edu/undergraduate-changing-majors.html>

**Foreign Language Requirements:** Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

**Satisfactory Progress Towards Degree:** University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The MSE Department fully supports this policy. Specific expectations for satisfactory progress for Engineering Science and Mechanics majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (<http://www.undergradcatalog.registrar.vt.edu/1617/academic-policies.html#22><http://www.undergradcatalog.registrar.vt.edu/1617/academic-policies.html#22>)
- Maintain an in-major GPA of 2.0 or better and an overall GPA of 2.0 or better. (In-major GPA is calculated using all courses taken under the MSE designator)
- Students may not earn a semester GPA less than 2.0 in any 2 consecutive semesters
- Students must complete a minimum of 9 credits per semester satisfying the MSE checksheet,
- A grade of C or better in MSE 2044 is required as a prerequisite for all MSE courses, and
- Students are allowed to take MSE 2044 a maximum of two times in their attempt to achieve a grade of C or better.

**Statement of Hidden Prerequisites:** Pre-requisites for each course are listed after the course title. The (letter grade) notation, such as (C-), indicates the minimum grade students must earn in the pre-requisite course. There are no hidden pre-requisites in the program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current pre-requisites.

**Graduation Requirements:** Each student must complete at least 126 semester credit hours with a minimum overall GPA of 2.00 and a minimum in-major GPA of 2.00. In-major GPA is calculated using all courses taken under the MSE designator.

**Additional Checksheet Comments:**

1. Programming elective: Any of the following courses may be substituted for the 2114 & 3114 pair: CS 1044, Intro Prog in C (3c), CS 1064, Intro to Prog in Python (3c), CS 1114, Intro Software Design (3cr); AOE 2074 Computational Methods (2c); BIT 2405, Quantitative Methods (3c); ECE 1574 Engr Prob Solv C++ (3c), ENGE 2514 Intro Engr Labview (2c).
2. Honors students may substitute MSE 4095H/4096H Honors Senior Project Lab for MSE 4075/4076.
3. Physical Materials Courses:
  - o MSE 3204<sup>[F]</sup> Fund Electronic Materials Pre: 2054, PHYS 2306
  - o MSE 3304<sup>[F,S]</sup> Physical Metallurgy Pre: 2044 (C)
  - o MSE 4414<sup>[F]</sup> Physical Ceramics Pre: 2044 (C)
  - o MSE 4554<sup>[F,S]</sup> Polymer Engineering Pre: 2044 (C), CHEM 1036; co: 4034.
4. ECON 2005: ISE 2014 (2c) can be substituted but an additional 3c area 3 course must be taken
5. MATH 2114 Linear Algebra (3c) may be substituted for MATH 1114 Linear Algebra (2c)
6. Students interested in focusing in the area of polymers are strongly encouraged to take CHEM 1036 Freshman Spring semester and to speak with the MSE undergraduate advisor.



Elective Requirements Effective for Students Graduating in Calendar Year 2021

TECHNICAL ELECTIVES: Twelve (12) credits are required from the list below [1,2]. A minimum of 6 credits must be taken from group 1 and the balance may be taken from group 2. All 12 credits may be satisfied from group 1. Courses must be taken for a grade (Pass/Fail not acceptable). Other courses not listed may be counted with special approval; initiate requests through the MSE Undergraduate Academic Advisor.

**Group 1: Materials Specific Courses (Must choose a minimum of 6 credits) [3,4]**

BIOL 2124	Cell & Mol Biol For Engineers	MSE 4044	Powder Processing
BSE 3494	Advanced Welding Technology	MSE 4164	Princ Matls Corrosion
CHEM 2154	Majors Analytical Chemistry	MSE 4234	Semiconductor Processing
CHEM 2535	Organic Chemistry	MSE 4304	Metals And Alloys
CHEM 2536	Organic Chemistry	MSE 4305	Metal Casting
CHEM 2555	Organic Synthesis And Techniques Lab	MSE 4306	Metal Casting
CHEM 2565	Principles Org Chem	MSE 4384	Nuclear Materials
CHEM 3615	Physical Chemistry	MSE 4574	Biomaterials
CHEM 4534	Organic Chemistry Of Polymers	MSE 4614	Nanomaterials
CHEM 4994	Undergraduate Research In CHEM	MSE 5024	Math Methods In Materials Research
ECE 3054	Electrical Theory	MSE 5124	Materials Opt. Through Designed Exper
ECE 3254	Industrial Electronics	NSEG 3145	Fundamentals Of Nuclear Engr
ECE 4214	Semiconductor Device Fundamentals	NSEG 3146	Fundamentals Of Nuclear Engr
ENGR 3124	Green Engineering	PHYS 3324	Modern Physics
ENGR 4134	Environmental Life Cycle Assessment	PHYS 3355	Intermediate Mechanics
ESM 2304	Dynamics	PHYS 3405	Interned Elec & Mag
ESM 4024	Advanced Mechanical Behavior Of Materials	PHYS 4574	Nanotechnology
ESM 4044	Mechanics Composite Materials	PHYS 4714	Intro to Biophysics
ESM 4105	Engineering Analysis Of Physiologic Systems	STAT 3704	Stat For Eng Apps
ESM 4106	Engineering Analysis Of Physiologic Systems	STAT 4604	Stat Methods For Engr
GEOS 4634	Environmental Geochemistry		
		MSE 3xxx	Any non-required MSE 3xxx [2]
		MSE 4xxx	Any non-required MSE 4xxx [2]
		MSE 5xxx	

**Group 2: Materials Non-Specific Courses [4]**

CHE 4144	Bus & Mktg For Proc Industries
CS 3824	Intro Comp Bio Bioinformatics
GEOS 3504 / MSE 3104	Mineralogy
ISE 2204	Manufacturing Processes
MATH 3214	Calculus Of Several Variables
MATH 4445	Intro To Numer Analysis
MATH 4564	Operational Methods
MATH 4574	Vector/Complex Analysis

[1] Technical elective credit may be earned in study abroad opportunities. Please see your MSE undergraduate academic advisor.

[2] 4974 + 4994 total credit hours limited to a maximum of 6 without prior approval.

[3] MSE 3094 / AOE 3094 may not be taken as a technical elective.

[4] Check course catalog for prerequisite requirements.