APPROVED
COMMISSION ON UNDERGRADUATE
STUDIES AND POLICIES

COLLEGE OF ENGINEERING
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING
DEGREE: **BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND ENGINEERING**
MAJOR: MATERIALS SCIENCE AND ENGINEERING
FOR STUDENTS ENTERING UNDER UG CATALOG 2021-2022
CREDITS REQUIRED FOR GRADUATION: 125

FALL SEMESTER FIRST YEAR	Credits	SPRING SEMESTER FIRST YEAR	Credits
CHEM 1035 General Chemistry Co: MATH 1225	3	ENGL 1106[3] First-Year Writing *Pre: ENGL 1105*	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1	MATH 1226[3] Calculus of a Single Variable *Pre: MATH 1225*	4
ENGL 1105[3] First-Year Writing	3	PHYS 2305[3] Found of Physics I w/lab *Pre: MATH 1225; Co: MATH 1226*	4
MATH 1225[3] Calculus of a Single Variable **(C-)** *Pre: Math Ready*	4	ENGE 1216[3] Foundations of Engineering **(C-)** *Pre: ENGE 1215*	2
ENGE 1215[3] Foundations of Engineering **(C-)**	2	MATH 1114 Elementary Linear Algebra	2
TOTAL	**13**	**TOTAL**	**15**

FALL SEMESTER SECOND YEAR	Credits	SPRING SEMESTER SECOND YEAR	Credits
MATH 2204 Intro Multivariable Calculus *Pre: MATH 1226*	3	CHEM 1036 General Chemistry *Pre: CHEM 1035*	3
PHYS 2306[3] Foundations of Physics I w/lab *Pre: MATH 1226, PHYS 2305*	4	MATH 2214[3] Intro Diff Equations *Pre: (1114 or 2114 or 2114H or 2405H), 1226*	3
ESM 2104 Statics *Pre: MATH 1226 Co: MATH 2204 or MATH 2204H or MATH 2224 or MATH 2406H*	3	ESM 2204 Mechanics of Deformable Bodies *Pre: (2104 or 2114), (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H)*	3
ISE 2214 Manufacturing Processes Lab	1	MSE 2054[1] Fund of Materials Science *Pre: 2044*	3[S]
MSE 2044[1] Fund of Materials Eng **(C)** *Pre: CHEM 1035, Co: PHYS 2305*	4[F,S]	MSE 2114[2] Math Programming MSE I *Pre: 2044*	1[S]
MSE 2884[3] Matls Engr Professional Dev I	1[F]	MSE 3314[1] Materials Lab I *Pre: 2044*	1[S]
		Pathways[3] (2, 3, 6a, or 7)	3
TOTAL	**16**	**TOTAL**	**17**

FALL SEMESTER THIRD YEAR	Credits	SPRING SEMESTER THIRD YEAR	Credits
ECON 2005[3] or ECON 2006[3] Principles of Economics (Pathway 3)	3	MSE 3044[1] Transport Phenomena MSE *Pre: 2044, MATH 2214*	3[S]
MSE 3114[2] Math Programming MSE II *Pre: 2114*	1[F]	MSE 3054 (ESM 3054) Mech Behavior of Materials *Pre: ESM 2204, (MSE 2034 or MSE 2044 or MSE 3094 or AOE 3094 or CEE 3684)*	3[F,S]
MSE 3134[1] Crystallography and Crystal Structures *Pre: 2044 (C)*	3[F]	MSE 3064 (ESM 3064) Mech Behavior Matls Lab *Co: 3054*	1[F,S]
MSE 4034[1] Thermo of Materials *Pre: 2044*; Co:*CHEM 1036*	3[F]	MSE 3884[3] Matls Engr Professional Dev II *Pre: junior standing, 2884*	1[S]
MSE 4424[1] Materials Lab II *Pre: 2044*	1[F]	MSE 4644 Materials Design Experiments *Pre: 3314 or 4424*	3[S]
Physical Materials Course[2]	3	Physical Materials Course[2]	3
Physical Materials Course[2]	3	Technical Elective from list	3
TOTAL	**17**		**17**

FALL SEMESTER FOURTH YEAR	Credits	SPRING SEMESTER FOURTH YEAR	Credits
MSE 4055[2] Materials Selection & Design *Pre: 3044, 3054, 2 of (3204,3304 4414, 4554)*	3[F]	MSE 4076[1] Senior Design Laboratory *Pre: 4075 Co: 4086,*	2[S]
MSE 4075[1] Senior Design Laboratory *Pre: 4644 Co: 4055, 4085*	1[F]	MSE 4086[3] Senior Design Recitation *Pre: 4085 Co: 4076 or 4096H*	1[S]
MSE 4085[3] Senior Design Recitation *Pre: senior standing, 3884 Co: 4075 or 4095H*	2[F]	Physical Materials Class[2]	3
Technical Elective from list	3	Technical Elective from list	3
Technical Elective from list	3	Pathways[3] (2, 3, 6a, or 7)	3
Pathways[3] (2, 3, 6a, or 7)	3	Pathways[3] (2, 3, 6a, or 7)	3
TOTAL	**15**	**TOTAL**	**15**

General Information about Checksheet: Superscripted annotation after the course number (1) indicates common degree core, (2) indicates major requirements, and (3) indicates Pathways General Education. Additionally, (F, S, SI, SII) in credits column indication terms when a course is expected to be offered. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with their department.

Pathways to General Education (Pathways)

Consult the pathways courses table: https://www.pathways.prov.vt.edu/about/table.html. Pathways courses need to be completed prior to graduation

Pathways Concept 1: Discourse (6 hrs foundational, 3 hrs advanced)	*Foundational:* **ENGL 1105**	**(3)**	*Foundational:* **ENGL 1106**	**(3)**
	Advanced: ***MSE 2884,3884,4085,4086***			**(3)**
Pathways Concept 2: Critical Thinking in the Humanities (6 hrs)		**(3)**		**(3)**
Pathways Concept 3: Reasoning in the Social Sciences (6 hrs)	**ECON 2005 or ECON 2006**	**(3)**		**(3)**
Pathways Concept 4: Reasoning in the Natural Sciences (8 hrs)	**PHYS 2305**	**(4)**	**PHYS 2306**	**(4)**
Pathways Concept 5: Quantitative and Computational Thinking (11 hrs)	*Foundational:* **MATH 1225**	**(4)**	*Foundational:* **MATH 1226**	**(4)**
	Advanced: **MATH 2214**			**(3)**
Pathways Concept 6: Critique and Practice in Design and the Arts (7 hrs)	*Arts:*			**(3)**
	Design: **ENGE 1215 + ENGE 1216**			**(4)**
Pathways Concept 7*: Critical Analysis of Identity & Equity in the US (3 hrs)				**(3)**

*Pathway 7 should be double counted with either Pathway 2, 3 or 6a to avoid taking any additional credit hours.

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 Materials Science and Engineering majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (https://www.undergradcatalog.registrar.vt.edu/)
- 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: Prerequisites 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 prerequisite course. There are no hidden prerequisites in the program of study. Prerequisites may change from what is indicated. Be sure to consult the timetable for the most current prerequisites.

Graduation Requirements: Each student must complete at least 125 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: The following may be substituted for 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 Comp Methods (2c); BIT 2405, Quant 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:
   - MSE 3204[F,S] Fund Electronic Materials Pre: 2054, PHYS 2306
   - MSE 3304[F,S] Physical Metallurgy Pre: 2044 (C)
   - MSE 4414[F,S] Physical Ceramics Pre: 2044 (C)
   - MSE 4554[F,S] Polymer Engineering Pre: 2044 (C)
4. MATH 2114 Linear Algebra (3c) may be substituted for MATH 1114 Linear Algebra (2c)
5. 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 Entering Under UG Catalog 2021-2022

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 a maximum of 6 credits 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) [3,4,5]

BIOL 2124	Cell & Mol Biol For Engineers
BSE 3494	Advanced Welding Technology
CHEM 2154	Majors Analytical Chemistry
CHEM 2535	Organic Chemistry
CHEM 2536	Organic Chemistry
CHEM 2555	Organic Synthesis and Techniques Lab
CHEM 2565	Principles Org Chem
CHEM 3615	Physical Chemistry
CHEM 4534	Organic Chemistry of Polymers
CHEM 4615	Physical Chemistry for Life Sciences
CHEM 4634	Polymer and Surface Chemistry
CHEM 4994	Undergraduate Research In CHEM
ECE 3054	Electrical Theory
ECE 3254	Industrial Electronics
ECE 3214	Semiconductor Device Fundamentals
ECE 4984	Electronics Packaging
ENGR 3124	Green Engineering
ENGR 4134	Environmental Life Cycle Assessment
ESM 2304	Dynamics
ESM 4024	Advanced Mechanical Behavior of Materials
ESM 4044	Mechanics Composite Materials
ESM 4105	Engineering Analysis of Physiologic Systems
GEOS 4634	Environmental Geochemistry
MSE 4044	Powder Processing
MSE 4164	Princ Matls Corrosion
MSE 4234	Semiconductor Processing
MSE 4304	Metals and Alloys
MSE 4305	Metal Casting
MSE 4306	Metal Casting
MSE 4384	Nuclear Materials
MSE 4574	Biomaterials
MSE 4614	Nanomaterials
MSE 5024	Math Methods in Materials Research
MSE 5124	Materials Opt. Through Designed Exper
NANO 3015	Nano Synth & Characterization
NANO 3016	Nano Synth & Characterization
NSEG 3145	Fundamentals of Nuclear Engr
NSEG 3146	Fundamentals of Nuclear Engr
PHYS 3324	Modern Physics
PHYS 3355	Intermediate Mechanics
PHYS 3405	Interned Elec & Mag
PHYS 4564	Polymer Physics
PHYS 4574	Nanotechnology
PHYS 4714	Intro to Biophysics
SBIO 3444	Sust Biomaterials & Bioenergy
SBIO 4444	Plant Polymers & Biocomposites
MSE 3xxx	Any non-required MSE 3xxx [2]
MSE 4xxx	Any non-required MSE 4xxx [2]
MSE 5xxx	

Group 2: Materials Non-Specific Courses (A maximum of 6 credits may be taken) [4,5]

BSE 4394	Water Supply Sanitation
BMES 2104	Intro Biomedical Engineering
BMES/BMVS 4064	Intro to Med Physiology
CEE 3104	Intro Environ Engr
CEE 3604	Intro Transport Engr
CHE 4144	Bus & Mktg For Proc Industries
CHEM 2545	Organic Chemistry Laboratory
CHEM 2546	Organic Chemistry Laboratory
CHEM 3054	Postconsumer Materials
CHEM 4114	Instrumental Analysis
CS 3824	Intro Comp Bio Bioinformatics
ESM 3234	Fluid Mech I Control Volumes
ESM 3334	Fluid Mech II Diff Analysis
ESM 4106	Engineering Analysis of Physiologic Systems
GEOS 3504 / MSE 3104	Mineralogy
GEOS 4234	Vertebrate Evolution
ISE 2204	Manufacturing Processes
MATH 3054	Prog Math Prob Solving
MATH 3214	Calculus of Several Variables
MATH 4234	Elementary Complex Analysis
MATH 4445	Intro to Numer Analysis
MATH 4564	Operational Methods
MATH 4574	Vector/Complex Analysis
ME 3514	System Dynamics
ME 3524	Mechanical Vibrations
ME 3624	Mechanical Design I
ME 4194	Sustainable Energy Solutions
ME 4624	Finite Element Practice
ME 4994	Undergraduate Research
NSEG 3604	Radiation Detection & Shielding
NSEG 4204	Nuclear Fuel Cycle
PHYS 3655	Intro to Astrophysics
PHYS 3656	Introduction to Astrophysics
PHYS 3704	Thermal Physics
SBIO 3324	Green Building Systems
SBIO 3434	Chem & Conv of Sust Biomatls
STAT 3005	Statistical Methods
STAT 3615	Biological Statistics
STAT 3704	Stat for Eng Apps
STAT 4105	Theoretical Statistics
STAT 4444	Applied Bayesian Statistics
STAT 4604	Stat Methods for Engr
STAT 4705	Statistics for Engr
STAT 4706	Statistics for Engr
STAT 4714	Prop & Stat for EE

[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 the timetable for prerequisite requirements.
[5] Not all courses are 3 credits. Check the course catalog for corresponding credit hours