



**Rensselaer**  
School of Engineering

# Materials Science & Engineering

Class of 2022  
Advising Handbook

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## Department of Materials Science & Engineering

<http://mse.rpi.edu/>

Materials Science and Engineering is an interdisciplinary branch of engineering that investigates the performance and properties of materials through manipulation of matter at the atomic and molecular length scales. This discipline has helped to define the technological sophistication of human history as discoveries of new materials enable new technologies that help to improve our day-to-day lives. This rich tradition of discovery continues to this day through our research in metals, semiconductors, ceramics, polymers, composites, biomaterials, materials for energy, and nanomaterials.

As a materials engineer you will help to discover and synthesize materials for applications across all industries. The materials that surround us and help us to live healthy lives, work safely, and travel are products of our ability to manipulate matter at the atomic scale.

At the core of our discipline we understand and leverage the interrelationship between material structure, processing, properties and performance. Understanding this relationship allows a materials engineer to design and synthesize new materials for new and improved applications.

The U.S. Department of Labor (<http://www.bls.gov/>) provides information on the various fields of engineering and statistics concerning salary and job outlooks.

[Nature of the Work](#)

[National estimates for Materials Engineers](#)

[Geographic profile for Materials Engineers](#)

[Employment Statistics for Engineering Field](#)

## Contact List for MSE

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### General Links:

Advising and Learning Assistance Center: <https://info.rpi.edu/advising-learning-assistance/>

Center for Career and Professional Development (CCPD): <http://www.rpi.edu/dept/cdc/>

Co-Op / Internships: <http://www.rpi.edu/dept/cdc/students/experience/coop/index.html>

Course Catalog: <http://www.rpi.edu/academics/catalog/>

Registrar Forms: <http://srfs.rpi.edu/update.do?catcenterkey=29>

Student Handbook: <http://doso.rpi.edu/setup.do>

Student Information System: <http://sis.rpi.edu/>

## Educational Objectives

While certain objectives of an undergraduate education in engineering are common to all programs, there are subtle but important differences that require some subset of objectives specific to ensuring that all graduates have specialized technical knowledge in their chosen field. Graduates of the materials engineering baccalaureate program who remain within their field, as graduate students or professionals, will have within a few years of their graduation:

1. Used their broad knowledge of all classes of materials, and their background in mathematics and science, to contribute effectively to the solution of engineering problems, including problems involving design.
2. Demonstrated expertise in understanding the interdependence of the structure, properties, processing, and performance of materials and have utilized this interdependence in their professional activities.
3. Demonstrated themselves capable of dealing with emerging and continuing engineering problems and their societal consequences.
4. Demonstrated themselves effective in working with multi-disciplinary teams and in communicating clearly and convincingly in a variety of contexts.
5. Demonstrated the capacity for continued learning and an enthusiasm for engagement in such learning.

## Responsibilities

“We are at the very beginning of time for the human race. It is not unreasonable that we grapple with problems. But there are tens of thousands of years in the future. Our responsibility is to do what we can, learn what we can, improve the solutions, and pass them on.” **Richard Feynman (1918 - 1988)**

### Student's responsibilities

- To know their advisor's office hours and advising schedule.
- To make an appointment and prepare for registration advising by reviewing the Catalog, Class-Hour Schedule, and Degree Works worksheet.
- To formulate questions regarding curriculum, course selections, career options, etc.
- To be aware of their academic and personal needs and to seek assistance when needed.
- To understand that the role of their advisor is to advise them, not to make decisions for them. Each student needs to realize that it's his or her education at stake, and that, with advisement, *they* are ultimately responsible for making any final decisions.

### Advisor

- To be accessible to students throughout the year at posted office hours. If an advisor will be away from campus for an extended period of time, he or she should post the names and office locations of alternate advisors outside their offices, so that students will have other advising resources.
- To set aside designated times for registration advising and individual discussions.
- To be knowledgeable about current curriculum requirements, academic policies and procedures, referrals and resources on campus, and career opportunities in the major field.
- To guide students through academic programs that will complement their personal, educational, and professional interests.

## Bachelor's Degree

The bachelor's degree is awarded to students who have pursued successfully, as evaluated by the faculty, a plan of study that encompasses several disciplines. Each plan of study has at least two objectives: first, to reach a pre-professional standing or fundamental mastery in a selected discipline; second, to develop some grounding in knowledge found in liberally educated persons, an appreciation of technology and science, and an openness to ongoing learning.

The requirements of each baccalaureate program are outlined as follows:

- The number of courses and credit hours is prescribed by each curriculum. Minimum requirements are 124 credit hours for science and for humanities and social sciences majors, 124 for management, **128 for engineering**, and 168 for the professional degree in the School of Architecture.
- The minimum grade point average (GPA) is **2.0**.
- To receive a baccalaureate degree, a student must have been admitted to the curriculum corresponding to the degree, must have satisfied the curriculum requirements, and must be enrolled in that curriculum at the time the degree is granted.
- The course content in physical, life, and engineering sciences must total a minimum of **24 credit hours**, including **at least eight credit hours of mathematics**. For information on additional requirements see the School of Science section of this catalog.
- The course content in humanities and social sciences must total a minimum of **24 credit hours**, including at least eight credit hours in the humanities and eight credit hours in the social sciences. For information on additional requirements see the School of Humanities, Arts, and Social Sciences section of this catalog.
- Every student is required to take at least two communication-intensive courses. At least one of these must be in the students' major and at least one of the courses must be writing-intensive and taught in the School of Humanities, Arts, and Social Sciences. Courses used to fill the communication-intensive requirement may not be taken as Pass/No Credit.
- The minimum course concentration in the area of the selected discipline is prescribed by each curriculum but cannot be less than **30 credit hours**.
- At least **24 credit hours** are to be elective, of which no less than **12 credit hours** are unrestricted electives.
- The student must be registered full-time for a minimum of four semesters. Two semesters of part-time study at Rensselaer will be considered equivalent to one semester of full-time study. In addition, the student must complete a minimum of **64 credit hours** at Rensselaer, all of which will be applied to the baccalaureate degree. If a transfer student elects to study abroad or enroll in the co-op program, no more than 12 such credits may apply to the 64 needed for the bachelor's degree. The student's Plan of Study at Rensselaer must include at least **16 credits** of courses above the 1000 level in the major field, or in an approved concentration.

## **Academic Information and Regulations**

The Institute requires a degree candidate to earn the last 30 credits in courses completed on this campus or through a program formally recognized by the Institute. Transfer courses are limited to two courses or eight credits counting toward the student's last 30 credits and require approval of the director of the Advising and Learning Assistance Center.

Baccalaureate candidates must have passed all of the prescribed academic work and have satisfied the fee requirements. Candidates must also be in good academic and disciplinary standing. Undergraduate students on probation at the time of completion of course work may be required to meet certain stipulations for removal from probation. However, such requirements may be waived for those students whose cumulative GPAs satisfy the baccalaureate degree requirements. In general, a term's work with grades of not less than C will be required in programs arranged by the Committee on Academic Standing. The director of the Advising and Learning Assistance Center will state requirements to the students in writing.

Degree candidates must be registered during the semester in which they intend to graduate and must file a degree application with the registrar by the dates specified in the academic calendar. Students who previously applied for graduation but did not complete all their requirements on time must submit a new application specifying the new date of graduation.

### **Double Degrees**

A student may become a candidate for a second baccalaureate degree when he or she has completed: (1) the equivalent of at least two terms (30 credit hours) of additional work beyond the requirements of a single degree, and (2) the courses in the department in which the student is registered and such other courses as are required for the second degree. From the MSE department's perspective, students considering a Double Degree may want to instead consider a Master's degree. The ability to obtain a graduate level degree by taking 30 credits beyond the Bachelor's degree should be seriously considered rather than taking 30 additional credits and still ending up with a Bachelor's degree.

### **Dual Majors**

Undergraduate students who fulfill all the degree requirements for two curricula and who have met the conditions below will have completed a dual major. They will receive one diploma noting both majors. Students must note that not all majors can be successfully combined to create a dual major which will allow the student to graduate in eight semesters. (1) The student must designate a first-named and second-named major in writing at least one semester prior to graduation, and have the appropriate department(s) approve this designation prior to filing the dual major form with the registrar. (2) Each student will be assigned an adviser in each department who will monitor progress towards degrees in that department. (3) The degree clearance officer in each department will certify that the student has met the degree requirements in that department (4) The 24-credit-hour mathematics/science requirement and the 24-credit-hour humanities and social sciences requirement will satisfy the Institute requirements for both majors.

## H&SS and PD II – Policies for Engineering Students

Engineering students at Rensselaer are required to successfully complete

- 20 credits of HASS (Humanities, Arts, and Social Sciences)
- 2 credits of PD II (Professional Development II)

as well as

- 1 credit of PD I (typically as part of ENGR-2050 Introduction to Engineering Design, or alternatively as ENGR-1010 Professional Development I if ENGR-2050 transferred in as less than a 4 credit course)
- 1 credit of ENGR-4010 PD III

for a total of 24 credits to fulfill the HASS Core requirement.

### ENGINEERING STUDENTS SHALL DISTRIBUTE THE 20 CREDITS OF HASS AS FOLLOWS.

- A minimum of 8 credits of Humanities/Arts (see table below)
- A minimum of 8 credits of Social Science (see table below)
- At least 4 credits must be 4000+ level
- No more than 3 courses(12 credits total) at the 1000 level (but note depth sequence and CI restriction below)
- No more than 4 credits can come from 1 credit courses (e.g. music ensemble)
- No more than 2 courses (8 credits total) can be from transfer courses (including AP/IB and study abroad classes)
- No more than 8 credits can be from Pass/No credit courses (note depth sequence and CI restriction below)

<b>HUMANITIES:</b>	<b>SOCIAL SCIENCE:</b>
<b>ARTS</b> (ARTS, MUSIC)	<b>COGS</b> (COGNITIVE SCIENCE)
<b>COMM</b> (COMMUNICATION & MEDIA)	<b>ECON</b> (ECONOMICS)
<b>LANG</b> (LANGUAGE)	<b>PSYC</b> (PSYCHOLOGY)
<b>LITR</b> (LITERATURE)	<b>STSS</b> (ANTHROPOLOGY)
<b>PHIL</b> (PHILOSOPHY)	<b>STSS</b> (SOCIOLOGY)
<b>STSH</b> (HISTORY)	<b>STSS</b> (SCIENCE & TECHNOLOGY)
<b>STSH</b> (SCIENCE & TECHNOLOGY)	
<b>WRIT</b> (WRITING)	
<b>IHSS</b> (INTERDISCIPLINARY HASS)	<b>IHSS</b> (INTERDISCIPLINARY HASS)

A depth sequence of two courses, each of  $\geq 4$  credits, from the same area code (ARTS, COGS, etc., but not including IHSS) where a minimum of one course ( $\geq 4$  credits) is at an advanced level (2000+), and no courses are taken on a Pass/No Credit basis. STSS and STSH count as the same area code.

In addition, students are required to take at least one HASS course that is “CI” (Communications Intensive – a list of these courses is available from a link on the SIS home page, and here: [http://srfs.rpi.edu/update.do?artcenterkey=208&setappvar=page\(1\)](http://srfs.rpi.edu/update.do?artcenterkey=208&setappvar=page(1))). This course may not be taken on a Pass/No Credit basis. This CI course is not required to be part of the 24 credits of HASS Core; that is, it may instead be an HASS CI course taken as a free elective

Enrolled Rensselaer students wishing to take an HASS course for credit at another accredited institution must obtain prior approval for the course from the HASS Manager of Student Services. Applicants must furnish a syllabus (preferred) or the catalog description of the

proposed course and a completed copy of Rensselaer's Transfer Credit Approval form to the HASS Manager of Student Services to apply for approval.

Cross-listed STSS/STSH courses can be switched (between H and SS) after the course is taken by making a request to the Assistant Registrar.

Through careful planning and course selection, students may fulfill more than one requirement with a single course. For example, a 4000 level CI course can cover both the CI requirement and the 4000 level requirement. Another example is a 4000 level course that can satisfy the depth requirement as long as it shares the same prefix as another course at a lower level. If that course is communications intensive it can also be used to satisfy the CI requirement, thus fulfilling three requirements with a single course. However, even though a single course may be used to fulfill more than one requirement, Engineering students **MUST STILL** have 20 credits of HASS overall.

**THE 2-CREDITS OF PD II SHALL BE SATISFIED AS FOLLOWS:**

STSS -496# (number to be assigned each semester) course specifically titled PD2 Tech Issues and Solutions, will satisfy the PD II requirement.

A 4-credit PD II alternate course at any level (2000-4000) can be substituted for the 2-credit course. A list of these PD II alternate courses is available from a link on the SIS home page, and here: <http://registrar.rpi.edu/update.do?artcenterkey=325>.

A course used to satisfy the PD II requirement may **not** be taken on a Pass/No Credit basis.

In general, the PD II alternate course will be split as follows:

- two credits allocated to satisfy PD II
- the remaining credits allocated to free elective (or “Not Applied” to the degree if free elective credits have been completed)

With restrictions, the credits of a PD II alternate that are not allocated to PD II may be used to fulfill the 20-credits of HASS. These credits:

- **cannot** count toward the 4000 requirement,
- **cannot** count toward the depth requirement,

However,

- they can count toward the overall 20 credits of HASS,
- they can count toward the H and SS 8-credit minimums,
- they can count toward the HASS “CI” requirement.

If a student transfers in a course that is in name and course number equivalent to a PD II alternate it counts as that named HASS course, but it does **not** transfer in its status as a PD II alternate. The student would still be responsible for taking PD II or a PD II alternate at Rensselaer.

In the rare case that a student transfers in a course with Professional Development II content nearly identical to that of STSS -496# (number to be assigned each semester) course specifically titled PD2 Tech Issues and Solutions, they may furnish a syllabus of the transfer course and a completed copy of Rensselaer's Transfer Credit Approval form to the Associate Dean of Engineering to apply for approval. Note that some courses in the Study Abroad

program automatically satisfy the PD II requirement, as indicated in the transfer equivalency guide.

The School of Humanities, Arts, and Social Sciences (HASS) Associate Dean of Academic Affairs is: **Mike Kalsher** (kalshm@rpi.edu, Sage 4302)

The Assistant Registrar is: **Kim Herkert** (herkek@rpi.edu, Academy Hall 2713)

The Associate Dean of Engineering is: **Kurt Anderson** (anderk5@rpi.edu, JEC 3018)

### Need an Extra Credit?

**Q:** What if I'm short 1-2 credits in H&SS?

**A:** Use a 4-credit PD II alternate, with 2 credits to PD II, 1-2 credits to H&SS as needed, and any remaining credits to free elective (or "Not Applied" if you have filled all of your free elective credits)

**Q:** What if I'm short 1-2 credits in Free Electives?

**A:** Use a 4-credit PD II alternate, with 2 credits to PD II and 2 credits to free elective

**Q:** Am I really free to choose my free electives?

**A:** There are some nominal restrictions for "free" electives. To count as a free elective, one credit classes must be either

- from the School of Engineering, or
- graded classes (though you can take these on a Pass/No Credit basis),

and

- ROTC courses (USAF, USAR, USNA) must not total more than six credits

One credit classes that are graded Satisfactory / Unsatisfactory (S/U) that are not in the School of Engineering may **not** be used as free electives. For example, PHYS-1010 A Passion for Physics is a 1-credit S/U course that will not count as a free elective.

### Options for 1 credit free electives

- independent study (1 credit  $\approx$  3 hours/week  $\Rightarrow$   $\sim$  45 hours of work)
- undergraduate research project (when taken for credit)
- School of Engineering courses, such as
  - CHME-1010 Introduction to Chemical Engineering
  - CIVL-1100 Introduction to Civil and Environmental Engineering
  - CIVL-1200 Engineering Graphics for Civil Engineers
  - ENGR-1300 Engineering Processes (if not required for your major)
  - ENGR-1700 Intro to Better World Engineering
  - ISYE-1100 Introduction to Industrial and Systems Engineering
  - MANE-1100 Introduction to Nuclear Engineering
  - MANE-1090 Introduction to Mechanics Hardware and Software
  - MTLE-1200 Introduction to Materials Engineering
- School of Science courses
  - ISCI-4510 Origins of Life Seminar (requires Junior standing or higher)
- HASS courses
  - ARTS-2300 Rensselaer Orchestra
  - ARTS-2310 Rensselaer Concert Choir
  - ARTS-2360 Roots of Africa Music Ensemble
- ROTC courses (USAF, USAR, USNA, up to six credits maximum)
- most one-credit topics courses (see <http://srfs.rpi.edu/update.do?artcenterkey=305>)

<b>Checklist for HASS Core Requirements</b>		
	<b>Yes</b>	<b>No</b>
<b>Distribution Requirement</b>		
<b>Have you completed the Humanities distribution requirement?</b> (Minimum of 8 credits in courses with a Humanities and/or IHSS departmental prefix) <b>NOTE:</b> PD2 or alternative PD2 cannot be used		
<b>Have you completed the Social Sciences distribution requirement?</b> (Minimum of 8 credits in courses with a Social Science and/or IHSS departmental prefix) <b>NOTE:</b> PD2 or alternative PD2 cannot be used		
<b>Depth Requirement</b>		
<b>Have you completed two 4-credit HASS courses with the same departmental prefix, one of which is above the 1000 level?</b> Example COMM 1510 and COMM 2210 <b>NOTE:</b> Pass/No credit is not allowed Can be two courses at the 2000 level.		
<b>Communication Intensive (CI) Requirement</b>		
<b>Have you completed at least one HASS course designated as CI?</b> Courses designated as CI are listed online at <a href="https://sis/rpi.edu">https://sis/rpi.edu</a> <b>NOTE:</b> Transfer credit and Pass/No Credit are not typically allowed.		
<b>4000 Level Requirement</b>		
<b>Have you completed at least one 4 credit HASS course at the 4000 level?</b>		
<b>Restrictions: Are you meeting....</b>		
<b>A maximum of three 1000 level courses may be applied to the HASS Core</b>		
<b>A maximum of eight transfer/AP/IB credits may be counted towards the HASS core</b>		
<b>A maximum of two courses may be taken Pass/No Credit</b>		
<b>Have you completed a total of 24 credits of HASS courses?</b> <b>NOTE:</b> Engineering is 22 and Architecture is 20		
<b>If you have answered all of the questions with “Yes”, then you have met the HASS Core Requirements</b>		

# The Arch

<https://info.rpi.edu/the-arch>

The Arch is a unique approach for student development and growth that prepares students to meet the multifaceted challenges of the 21st century. The Arch will augment academic and experiential programs, and provide an even more robust-and transformative-educational experience for undergraduate students.

Students in the Class of 2022 will be required to participate in the Arch program in summer 2020. There is an [exception process](#) for athletes, ROTC, and a few other select cases.

The Arch is a restructuring of the Rensselaer academic calendar. It creates additional opportunities for experiential learning that complement curricular and co-curricular offerings at Rensselaer.

Rising juniors will attend a full summer semester, The Arch, between their sophomore and junior years. Juniors then spend a semester away during either the fall or spring semester of their junior year, still only taking 8 semesters to graduate.

This will allow students to take advantage of the numerous experiential learning activities available off campus, including international travel, internships, co-ops, research opportunities, and engagement in community service projects.

## Academic Semester Experience

YEAR	FALL	SPRING	SUMMER
Freshman	Required	Required	Optional
Sophomore	Required	Required	Required
Junior	*	*	Optional
Senior	Required	Required	Graduate

\* option for an "away" semester

# Materials Science & Engineering Curriculum Checklist      Class of 2022

Fall Semester				Spring Semester			
<b>FIRST YEAR</b>							
CHEM 1100	Chemistry I	4		ENGR 1600	Materials Science <sup>1</sup>	4	
ENGR 1100	Intro. to Engineering Analysis	4		MATH 1020	Calculus II	4	
MATH 1010	Calculus I	4		PHYS 1100	Physics I	4	
MTLE 1200	Intro to Materials Science <sup>2</sup>	1			Hum., Arts or Soc. Sci. Elective	4	
	Hum., Arts or Soc. Sci. Elective	4					
<b>SECOND YEAR</b>							
ENGR 1200	Engineering Graphics & CAD <sup>3</sup>	1		CSCI 1190	Beginning C Progrmg for Engs	1	
MATH 2400	Intro. to Differential Equations	4		ENGR 2050	Intro to Engineering Design	4	
MTLE 2100	Structure of Engineering Materials <sup>1</sup>	4		ENGR 2250	Thermal and Fluids Eng. I	4	
PHYS 1200	Physics II	4		MTLE 4200	Electrical & Optical Prop of Mtls	4	
	Hum., Arts or Soc. Sci. Elective	4			Science Elective	4	
<b>Arch Semester*</b>				<b>THIRD YEAR</b>			
ENGR 2600	Modeling & Analysis of Uncertainty	3		MTLE 4100	Thermodynamics of Materials	4	
MTLE 2500	Materials Laboratory Skills	1		MTLE 4910	Materials Selection	3	
MTLE 4250	Mechanical Props of Materials	4			Professional Development II <sup>4</sup>	2	
	Restricted Elective	4			Free Elective I	4	
	Hum., Arts or Soc. Sci. Elective	4			Hum., Arts or Soc. Sci. Elective	4	
<b>FOURTH YEAR</b>							
ENGR 4010	Professional Development III	1		MTLE 4400	Materials Synthesis & Processes	4	
MTLE 4150	Kinetics in Materials Sys.	4		MTLE 4920	Multidisciplinary Capstone Design <sup>1</sup>	3	
MTLE 4500	Computational Materials Design	3			Materials Elective II	3	
	Materials Elective I <sup>1</sup>	3			Free Elective III	4	
	Free Elective II <sup>1</sup>	4					

## 129 credits minimum

### RESTRICTED ELECTIVES (4 Credits Each)

ECSE 2010 - Electric Circuits

ENGR 2300 - Electronic Instrumentation

ENGR 2530 - Strength of Materials

ENGR 2090 - Engineering Dynamics

ENGR 2350 - Embedded Control

BMED 2540 - Biomechanics<sup>5</sup>

### MATERIALS ELECTIVES (3 Credits Each)

MTLE 4030 – Glass Science

MTLE 4310 – Corrosion

MTLE 4440 – Thin Films

MTLE 4470 – Biology in Materials Science

MTLE 4720 – Applied Mathematical Methods in Materials

MTLE 4050 – Introduction to Polymers

MTLE 4430 – Fundamentals Alloy Systems

MTLE 4460 – Materials for Energy

MTLE 4520 – Materials Extreme Cond.

MTLE 4960 – Topics in Materials Engineering

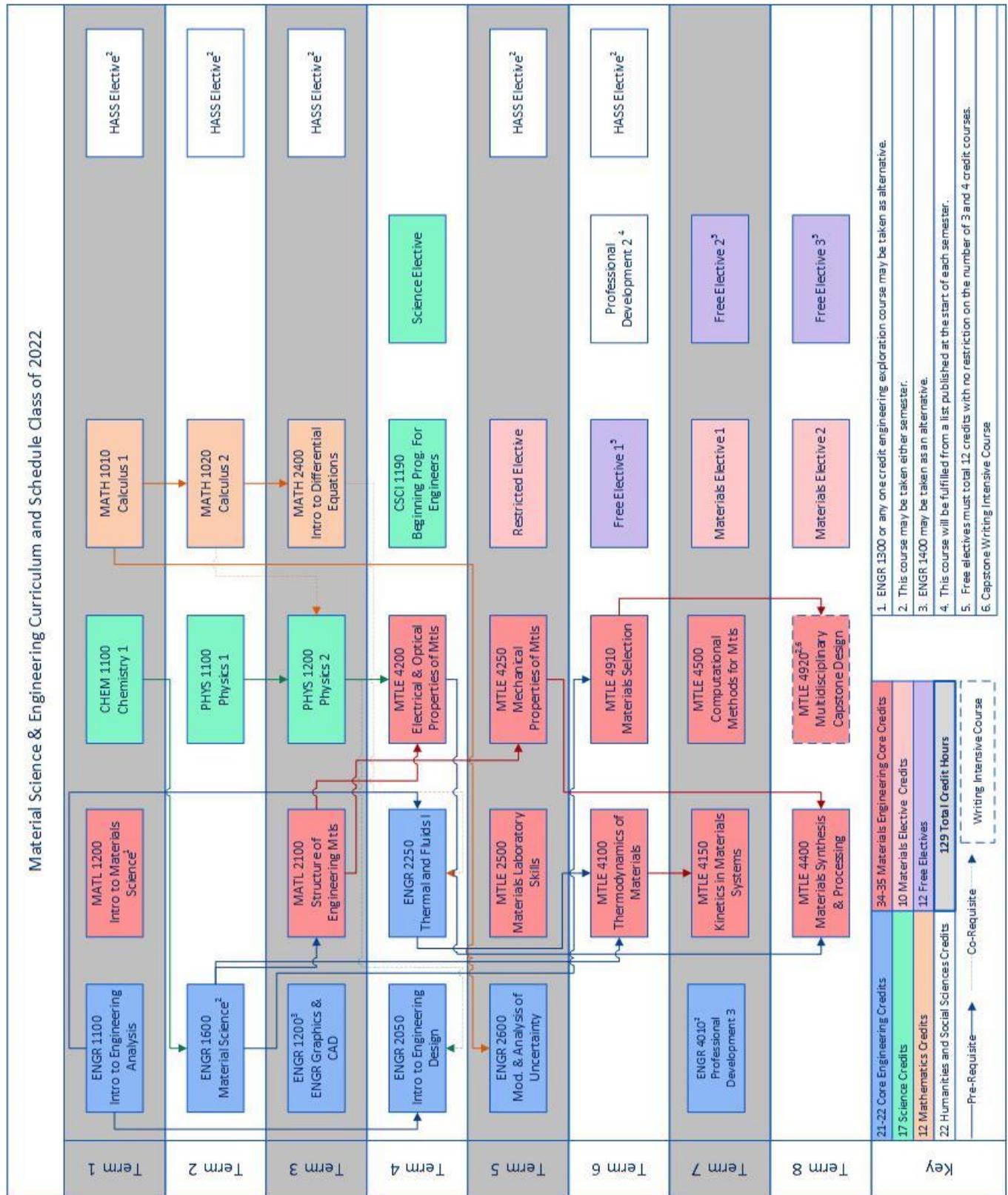
*Note: The courses in the Materials Electives list may be substituted with any MTLE 4000- or 6000-level course. In order to take a 6000-level course, students may be required to obtain formal approval from the Office of Graduate Education, as specified in the course catalog. The free electives must total at least 12 credits.*

1. This course can be taken in either semester.
2. May be replaced by ENGR 1300 or another engineering exploration course.
3. May be replaced by ENGR 1400.
4. This course will be fulfilled from a list published at the start of each semester.
5. This restricted elective option is available to dual MTLE/BMED majors only.

\*Students who are officially exempt from the Arch will take these courses in the fall semester. ENGR 1300 will replace MTLE 2500. Students should speak with their advisor, as other substitutions may be needed.

Note this checklist is to be used as a guide to developing the registration plan for Materials Science & Engineering students. It is not a replacement for the Rensselaer Course Catalog.

# Curriculum Schedule



## **Biomaterials Track in Materials Science & Engineering**

This track is for students who desire a degree in Materials Science and Engineering who have specific interest in materials for biological and biomedical application.

### **Science Elective (Choose One)**

**BIOL 2120 Introduction to Cell and Molecular Biology** - essential course to help students understand cell structure and function.

**CHEM 2250 Organic Chemistry** (CHEM 1100 and 1200 required) - structure and chemical behavior of organic molecules is covered and will provide a solid foundation for understanding polymer behavior in engineering applications.

### **Specialization Electives (Choose Three)**

**BMED 4240 Tissue-Biomaterial Interactions** - course focuses on the biological response to biomaterials. This is essential for students who aim to work on implantable materials.

**BIOL 4750 Cell-Extracellular Matrix Interactions** - course examines the mechanical and biological transduction mechanisms used to link cells into functional units (tissues). The composition and material properties of materials, both natural and manmade, is introduced as a means of controlling cell/tissue function.

**MTLE 4050 Introduction to Polymers** - students will learn the structure of macromolecules (both synthetic and natural) at molecular and microscopic scales and how the structure influences properties. Examples are chosen from synthetic, biocompatible, and natural macromolecules.

**MTLE 4470 Biology in Materials Science** - This course will cover basic principles of biology in the context of materials science including emerging and cutting edge applications of biomaterials science. Topics will be chosen such that the students gain an appreciation of the breadth and impact of biological principles on current topics in materials science.

## Required Courses for a B.S. in Materials Science & Engineering

### **ENGR 1600 Materials Science**

Introduction to “real” (defect-containing) solids, and equilibria and kinetic processes in solids. Macroscopic properties, such as mechanical strength and electrical conductivity, are dominated by structure and bonding, and the course continuously emphasizes this connection. Each of the materials classes (metals, ceramics, semiconductors, and polymers) is discussed in detail in this context.

Prerequisite: CHEM 1100.

Fall and Spring terms annually. **5 contact hours, 4 credit hours**

### **MTLE 2100 Structure of Engineering Materials**

The first course in Materials Science and Engineering. Structures of metals, ceramics, and polymers and experimental techniques for their determination are discussed. Laboratory experience is included.

Prerequisite: ENGR 1600 or equivalent.

Fall and Spring term annually. **4 credit hours**

### **MTLE 2500 Materials Laboratory Skills**

Introduction to some experimental methods used to fabricate and measure the structure and properties of materials. Thermal and mechanical processing and properties are emphasized. Specimen preparation, examination by light optical microscopy, report writing and measurement systems analysis are covered.

Summer term annually. **1 credit hours**

### **MTLE 4100 Thermodynamics of Materials**

Rigorous development of classical thermodynamics as applied to prediction of materials properties. Nonideal gases, solutions, phase equilibria, chemical equilibria, defects.

Prerequisites: ENGR 2250, CHEM 1100, ENGR 1600 or equivalent.

Fall term annually. **4 credit hours**

### **MTLE 4150 Kinetics in Materials Systems**

Kinetic processes in materials. Overview of kinetics in relation to equilibrium thermodynamics, atomistics and mathematics of diffusion, phase transformations, and microstructural evolution.

All materials classes, including metals and alloys, ionic and intermetallic compounds, glasses, semiconductors, and polymers, will be considered in terms of similarities and differences. Includes laboratory component.

Prerequisites: MTLE 4100, CHEM 1100, ENGR 1600.

Spring term annually. **4 credit hours**

### **MTLE 4200 Electrical and Optical Properties of Materials**

Electronic and optical properties of metals, dielectrics, semiconductors, and organic molecular solids. Introduction to quantum mechanics. Lattice vibrations, magnetism, energy bands in solids. Free and nearly free electron models. Effect of electronic structure on interatomic bonding. Semiconductors and their devices.

Prerequisites: ENGR 1600, MTLE 2100, PHYS 1200.

Fall term annually. **4 credit hours**

### **MTLE 4250 Mechanical Properties of Materials**

This is a required departmental course, but is also appropriate for biomedical engineers and other engineering disciplines as an elective. This course teaches the mechanical properties of metals, ceramics, and polymers from both the macroscopic and atomistic or micromechanical viewpoints. An introduction to three-dimensional stresses and strains. Elastic behavior, plastic behavior, strengthening mechanisms, fracture, creep, and fatigue are all addressed. Includes laboratory component.

Prerequisites: ENGR 1600, MTLE 2100.

Spring term annually. **4 credit hours**

### **MTLE 4400 Materials Synthesis and Processing**

This course covers materials processing in the area of metals, polymers, ceramics and electronic materials. Some processes covered include casting, molding, deformation processing, additive processing and joining methods. Design and analysis of experiments and process modeling are emphasized. Includes laboratories.

Prerequisites: MTLE 4200, MTLE 4150, MTLE 4250.

Spring term annually. **4 credit hours**

### **MTLE 4500 Computational Methods for Materials Design**

This course will provide the background and a set of examples of how computational methods can be applied to design of materials with desired structure and properties. The methods will span multi-length and time scales, including first-principles approaches, molecular dynamics simulations, stochastic methods for optimization and sampling, and computational thermodynamics. Lectures will be complemented by computer labs with hands-on exercises using publicly available or commercial software packages.

Undergraduates must have Junior standing or permission of the instructor.

Spring term annually. **3 credit hours**

### **MTLE 4910 Materials Selection**

This class covers basic materials selection concepts and the underlying structure-property-process-performance interaction. Engineering materials, structures and properties, principles and process of materials selection, generation of materials performances indices, assessment and optimization of performance, processing routes and manufacturing issues, role of reverse engineering and failure analysis in design are covered. Materials selection against yielding, fracture, flexure, buckling, fatigue, creep, corrosion, and wear are addressed. Decomposition of engineering problems into functional, geometric and materials constraints are emphasized. Materials selection based on simple and complex or conflicting constraints will be developed. Students will perform written assignments and oral presentations to develop communication skills. Enrollment for MS&E majors is restricted to juniors, seniors or graduates.

Prerequisites: CHEM 1100 and ENGR 1600 or ENGR 2010.

Spring term annually. **3 credit hours**

### **MTLE 4920 Multidisciplinary Capstone Design**

A capstone design experience that engages students from biomedical, computer systems, electrical, industrial, materials, and mechanical engineering on teams in an open-ended engineering design problem in preparation for professional practice. With the guidance of a multidisciplinary team of faculty members and instructional support staff, students apply knowledge and skills from prior coursework. This is a communication intensive course. Prerequisite: satisfactory completion of MTLE 4910.

Fall and Spring terms annually. **3 credit hours**

# Registration

**When:** Registration for the Spring semester generally occurs in early November. Registration for the Fall semester occurs the preceding Spring, usually in early April. Exact dates are included in the [Academic Calendar](#).

**How:** Use the [Student Information System \(SIS\)](#) to register for your courses.

**Where:** There are no assigned rooms for registration. You can register for your classes using any computer with Internet access.

## Time tickets

As a student here at Rensselaer, you are issued a "time ticket," which assigns you a specific window of time during which you may register for the next semester. Your time ticket will be sent to your RPI email address, 2 - 3 weeks before registration.

Your registration time is assigned based on the number of credit hours you have **earned** as a student. The table to the right shows the range of earned credit hours associated with each class. Please note that classes which are still in progress or courses which have been graded as "incomplete" do *not* count towards earned credits, nor do transferred courses and Advanced Placement (AP) credit.

School of Engineering	
Freshman	0 - 30
Sophomore	31 - 60
Junior	61 - 95
Senior	96 - 128

You should receive your time ticket via e-mail approximately four weeks prior to the scheduled registration period. In addition to making the registration assignment, this e-mail message notifies you of any existing holds which may prevent you from registering if you do not resolve them.

## Degree Works

Your Degree Works worksheet is a planning and advising tool -- available only to undergraduate students -- that allows you to track the progress you're making toward your Bachelor's Degree. You can access Degree Works via the main menu of the [Student Information System \(SIS\)](#).

## Registration at consortium colleges

It is possible to register for courses, at no additional tuition charge, at [other colleges and universities](#) in the Capital Region. Here are some pointers to keep in mind if you think you might be interested in cross-registering at one of the participating colleges:

- Courses taken at one of the consortium colleges will appear on your student record in the same manner as courses taken at Rensselaer, and thus carry term and cumulative hours, and grade points.
- Tuition cost for courses taken at one of these colleges is covered by the tuition charge at Rensselaer and is subject to the same regulations that apply for courses taken at Rensselaer. However, **you** are responsible for any additional charges such as lab fees, activity fees, and so on.
- You must be a full-time student.
- You may take no more than half of your academic credits at a consortium college in any semester.
- You **cannot** cross register for courses offered at Rensselaer.

- If you are a graduate student, your cross-registration course should appear on an approved Plan of Study prior to your enrolling in a course taught at a consortium college. It is important to remember that the Office of Graduate Education reserves the right not to accept the course toward a degree program if it was not listed on an approved Plan of Study.

The form required to cross register at consortium colleges can be found at [CROSS REGISTRATION FORM](#)

You can obtain additional information on cross-registration at consortium colleges from the Registrar's Office, located on the 2000 level of Academy Hall.

## FAQs

### **What do I do if a class I want to register for is full?**

Meet with the instructor of the course and request to be admitted to the course for any course other than those designated ENGR. If the class is a core/required course every effort will be made to accommodate the request. If this is an elective course you may be asked to take it in a subsequent semester. Note that for Core Engineering courses (ENGR prefix) there will be an electronic waitlist available at the time of registration, which is capped at ten students per section.

### **How do I add/drop a course?**

You may use the [Student Information System \(SIS\)](#) to add or drop courses. Generally speaking, from the beginning of the semester, you will have **two weeks to add** courses and **eight weeks to drop** them. Please refer to the Academic Calendar for specific add and drop deadline dates.

If you wish to petition to add or drop classes after the published deadline, you may do so using a [Late Add/Drop Form](#). Please note that after the instructor's signature, the form must also be approved by the Advising and Learning Assistance Center.

## The HUB

<http://eng.rpi.edu/students/hub>

The School of Engineering Advising Hub is the primary source of academic advising for all engineering students during their first three semesters at RPI. Beginning with the fourth semesters engineering students will be assigned a faculty advisor from their major. The Hub is located in the Ansell lounge on the third floor of the Jonsson Engineering Center (JEC) and is staffed by experienced advisors who will offer academic assistance for all engineering majors. Hub advisors assist students in establishing a foundation for academic success through student responsibility and planning. The Hub is a resource for all advising purposes including:

- Semester course planning
- Clear Student Advising Meeting (SAM) holds
- Major/minor declaration or changes
- Form approvals
- Registrar Protocol
- The Arch planning
- HASS and other course requirements

The Advising Hub will offer academic support to students through the end of the fall semester of their sophomore year. At that time, students will transition to a faculty advisor specific to the student's major. The faculty advisor will then contribute to the student's academic success by offering valuable perspective on internships, research and job prospects in addition to graduation requirements.

The Advising Hub hours are Monday, Tuesday, Thursday, and Friday 9am-4pm, by appointment. Walk-in Wednesdays offer 20 minute meetings with no appointment necessary.

## Professional / Student Societies

**Alpha Sigma Mu** - Faculty Advisor: G. Ramanath, MRC 111

Alpha Sigma Mu International Professional Honor Society is dedicated to encouraging and recognizing excellence in the materials engineering field. Members consist of students, alumni, and other professionals who have demonstrated exceptional academic and professional accomplishments. Student members are selected on the basis of scholastic standing, character and leadership. Through Chapter involvement, students develop lifelong skills that prepare them for leadership positions in industry and academia. Members are much better prepared for the post-college world and are valuable and attractive to employers.

**Material Advantage** – Faculty Advisor: Daniel Lewis, MRC 110

Material Advantage is a student program specifically created for undergraduate and graduate students enrolled in Materials Science & Engineering and other technical engineering programs at universities around the world. Material Advantage Chapters give you a much-needed edge in the global job market and the knowledge, experience and networking you need to begin your career successfully. You are also provided a single low-cost membership that provides access to the materials science and engineering professional's most preeminent societies including ACERS, AIST, ASM, and TMS.

**ACerS - The American Ceramic Society** - ACerS serves the informational, educational, and professional needs of the global ceramics community. The members comprise a wide variety of individuals and interest groups including engineers, scientists, researchers, manufacturers, plant personnel, educators, students, marketing and sales professionals, and others in related materials disciplines.

**AIST - Association for Iron & Steel Technology** - The Association for Iron & Steel Technology (AIST) is a non-profit organization that advances the technical development, production, processing and application of iron and steel. AIST membership is comprised of over 15,000 individuals worldwide and includes iron and steel producers, suppliers, academics and students.

**ASM International** - ASM International is Everything Material®. We are the society dedicated to serving the materials science and engineering profession. Through our network of 36,000 members worldwide, ASM provides authoritative information and knowledge on materials and processes, from the structural to the nanoscale.

**TMS - The Minerals, Metals and Materials Society** - The Minerals, Metals & Materials Society (TMS) is a rare professional organization that encompasses the entire range of materials and engineering, from minerals processing and primary metals production to basic research and the advanced applications of materials.

**Society of Plastics Engineers (SPE)** – Faculty Advisor: Rahmi Ozisik, MRC 205

The objective of the Society is to promote the scientific and engineering knowledge relating to plastics. By spreading knowledge, strengthening skills and promoting plastics the Society of Plastics Engineers (SPE) helps people and companies in the plastics industry succeed. SPE is the only place where people from all parts of the industry can come together around important issues and technologies.

## Undergraduate Research Program (URP)

<https://info.rpi.edu/undergraduate-research>

URP application: <https://info.rpi.edu/undergraduate-research/undergraduate-research-program-academic-year/#Apply>

Rensselaer has a very strong Undergraduate Research Program. This is a program that allows students to work in a professor's laboratory for credit or cash. On average, we have 30% of the class taking advantage of these opportunities during their Rensselaer career.

Some examples of projects students have been involved in include:

- Strengthen Glass via Ion-Exchange
- Placement of cancer epithelial cells onto substrates
- Nanostructure Synthesis of Energy Materials
- Fuel Cells and Electrode Coating Development

The program offers many advantages and the opportunity to:

- work on a project whose impact could be worldwide and can lead to patents and/or grants
- apply knowledge gained in the classroom to actual problems and research situations
- network with faculty beyond the classroom, opening the door to other opportunities
- gain critical leadership, team-building and critical thinking skills
- publish as an undergraduate
- receive course credit in a more dynamic way or supplement your income

### How to find a project

Most URP projects are found through direct contact with the faculty member supervising the research. Most undergraduates find projects from faculty members from whom they have taken classes. A good place to start your search is to determine a faculty member with whom you may want to work on a project. Check their website to investigate their field of research. If it sounds interesting, approach them about a possible URP project. Also, you may want to talk to students that have already done a URP project. Ask them about their experience. Some events of the Materials Advantage group are good places to connect to more advanced students.

### What if I have my own idea for a project?

You may work with a faculty member on an existing research project or on a project based on your own ideas. If you want to pursue your own project, find a faculty advisor who may be interested in your topic since you will be required to have a project advisor.

### For credit or funding?

You can earn from one to four credit hours per semester for your participation in the URP. The number of credit hours you earn is negotiable between you and your faculty sponsor. If you choose this option you and your sponsor need to:

- Determine how many credit hours you will earn
- Decide exactly what is expected of you, such as your time commitment, the type of work to be submitted, etc.
- Agree on how your grade will be determined

In the past, students who have participated in the URP for pay have earned up to \$3,000 per semester. The majority of participants earn \$400 per semester.

URP funding comes from two sources:

- Your sponsoring faculty member or department
- The Office of Undergraduate Education

The faculty sponsor or department is responsible for the financial support of your research. In addition, the Office of Undergraduate Education pays URP participants a maximum of \$400 per semester in the form of matching funds.

Most projects expect eight to twelve hours of work per week.

The URP application should be submitted to the Department Coordinator, Meeli Chew Leith; who:

- Checks the URP Application for completeness
- Fills out your payroll paperwork
- Forwards your application and payroll paperwork to the Office of Undergraduate Education for approval
- Will set up a schedule for reporting your hours. You must submit your hours to the Department Coordinator within the same payroll period that you worked. Please keep in mind that if you work and submit hours that exceed your funding allotment, you will not be paid for those hours. Pay checks are issued every other Friday

<b>Research Areas and Related Faculty</b>												
	Advanced Processing & Synthesis	Composites	Computational Materials	Electrochemistry of Materials / Corrosion	Electronic Materials	Glasses / Ceramics	Materials/Biology Interface	Materials Characterization	Materials for Energy	Metals	Nanomaterials	Polymeric Materials
Ying Chen			X		X			X			X	
David Duquette	X			X	X					X		
Daniel Gall					X			X	X	X		
Liping Huang			X			X		X	X		X	
Robert Hull	X				X			X			X	
Pawel Keblinski			X		X						X	
Daniel Lewis			X					X			X	
Rahmi Ozisik		X	X								X	X
Edmund Palermo	X						X				X	X
G. Ramanath	X				X			X	X		X	
Richard Siegel		X					X				X	
Jian Shi	X				X				X		X	
Yunfeng Shi			X						X		X	
Ravishankar Sundararaman			X		X				X		X	
Minoru Tomozawa						X						
Chaitanya Ullal											X	X
<b>Joint Faculty Members</b>												
Nikhil Koratkar	X	X		X	X			X	X		X	
E. Bruce Watson						X		X		X		
Vincent Meunier			X		X				X		X	
Jonathan Dordick		X					X				X	X
Christian Wetzel	X				X			X	X		X	

## Guide to Minor in Materials Science & Engineering

In order to earn a Minor in Materials Science and Engineering, you need to take 15 or more credits of courses offered by the Department of Materials Science and Engineering. These must be courses with MTLE designation. As general preparation for these courses, you should have taken ENGR-1600, Materials Science. Courses may not be taken Pass/No credit basis.

A list of suggested courses, together with the normal time students in the Department of Materials Science and Engineering take them, is given on the accompanying page. But, these are only suggestions, and you can choose courses according to your interest and schedule. It is even possible to take some courses out of sequence if you are willing to put in the appropriate effort. Note, however, that some courses in the Department of Materials Science and Engineering are offered once a year, whereas others are offered only every other year.

We think that an excellent program for a Minor in Materials Science and Engineering, giving you a solid foundation, would be to take Structure of Materials, plus any two of the remaining four-credit courses listed below, plus one three-credit course of your choice:

MTLE-2100	Structure of Materials	4 credits
MTLE-4100	Thermodynamics of Materials	4 credits
MTLE-4150	Kinetics in Materials	4 credits
MTLE-4200	Electrical & Optical Properties of Mtls	4 credits
MTLE-4250	Mechanical Properties of Materials	4 credits
MTLE-xxxx		3 credits

The suggested program would allow you to obtain a Minor in Materials Science and Engineering with the minimum number of four courses. However, as we mentioned above, many other combinations of courses are possible, and you should choose according to your interests.

Minor Approval Form: <http://www.rpi.edu/dept/srfs/MINORAPPRVFORM.pdf>

### Suggested courses for Minor in Materials Science & Engineering

Course Nr.	Course	Credits	Offered	Year taken
MTLE-2100	Structure of Materials	4	S every year	sophomore
MTLE-4100	Thermodynamics of Materials	4	F every year	junior
MTLE-4150	Kinetics in Materials Systems	4	S every year	junior
MTLE-4200	Electrical & Optical Properties of Mtls	4	F every year	junior
MTLE-4250	Mechanical Properties of Materials	4	S every year	junior
MTLE-4030	Introduction to Glass Science	3	F every year	
MTLE-4050	Introduction to Polymers	3	F every year	
MTLE-4310	Corrosion	3	S every other	senior
MTLE-4400	Matls Synthesis & Processing	4	F every year	
MTLE-4470	Biology in Materials Science	3	F every other	
MTLE 4500	Computational Methods for Mtls Design	3	S every year	senior
MTLE 49##	Special Topics Courses	3	As needed	

## International Programs

<https://info.rpi.edu/international-programs>

Rensselaer provides international opportunities for undergraduates, including semester-long study abroad and exchange opportunities, short-term and faculty-led international programs, and other international experiences. All students are encouraged to take advantage of an international experience during their undergraduate program.

**Academic Requirements and Eligibility** - 3.0 minimum GPA (3.3 for UCL and DTU); Second-semester sophomore status is required for most semester programs; some require junior standing. Short-term programs vary.

**Application procedures and deadlines** - Generally an RPI study abroad application and official transcript as well as an application from the host institution are required. Deadlines vary by program but are typically September for spring and February for fall. You should begin the research process at least one semester prior to the semester of application.

**Fees and Billing** - Students pay regular Rensselaer tuition for semester and full year exchanges and are eligible for all of their financial aid. Faculty-led programs carry an additional program fee based on the length of the program, the destination and what is included. Non-affiliated program participation will not pay regular Rensselaer tuition, but instead will pay the tuition and fees of the host institution/program. Estimated expenses are available on the brochure for each affiliated program. Unless otherwise noted, transportation, housing and other living expenses are paid directly by each student and are not billed by RPI.

**Financial Aid** - With the exception of work-study money, all forms of financial aid can be applied to Rensselaer-affiliated programs. Students must maintain full-time status (the equivalent of 12 Rensselaer credits or above) in order to be eligible for financial aid.

**Grades and Credit** - Full credit is granted for courses completed with a grade of C- or above. All courses must be approved by the relevant academic department in order for the transfer of credit to take place. With the exception of the Architecture programs, grades earned overseas are not factored into the GPA.

It is important for students to work with their advisor when applying to study abroad. Course mapping for selected programs has been completed but this has not been completed for all of the universities involved. Mapping for the engineering focused schools can be found at:

[https://info.rpi.edu/sites/default/files/Exchange%20Program%20Transfer%20Equivalency%20Guide\\_2017.pdf](https://info.rpi.edu/sites/default/files/Exchange%20Program%20Transfer%20Equivalency%20Guide_2017.pdf)

Study Abroad FAQs can be found at:

<https://info.rpi.edu/sites/default/files/RevisedStudyAbroadGuideFall2016.pdf>  
[http://sis.rpi.edu/trfequiv/transfer\\_equiv.pdf](http://sis.rpi.edu/trfequiv/transfer_equiv.pdf)

## Co-Terminal B.S. / M.S. or M.E. Program

Juniors who meet certain requirements can apply for [admission to the graduate program](#).

Student must:

- Have a cumulative GPA of 3.3 or above
- GRE exam is required, unless the student is currently a Materials Science & Engineering major and has GPA of 3.6 or above
- Have completed 90 credits of coursework (including AP credits, transfer credits, and courses in progress)
- A letter of recommendation is required from the student's advisor or another RPI faculty with knowledge about student suitability for the graduate program at RPI.

Students intending to do this in Materials Science & Engineering should be aware of the following:

The M.S. in Materials Science & Engineering requires a thesis. This can count towards 6 of the 30 credits beyond the B.S. required for the M.S. degree. This is a research thesis that will require a significant effort that probably cannot be accomplished in two academic years. Students must be prepared to spend at least one and probably two summers of full time research work. Summer support is not included as part of the program, but students may get support from their research advisor, if he or she has funding available and is willing to use it for this purpose. In the event that time beyond the fifth year is required to complete the M.S. requirements, additional support is not guaranteed but may be provided by the research advisor. Because of the research component, students should choose a research advisor as early as possible, preferably before applying for admission to the program. Students who have already begun undergraduate research will have an advantage; early participation in undergraduate research is strongly advised for students contemplating this option.

The M. Eng. in Materials Science & Engineering does not require a thesis; however a research project worth 3 credits is required. As with the M.S. summer support is not guaranteed.

All graduate students have to take the core coursework that consists of five courses, Advanced Mechanical Properties, Advanced Thermodynamics, Advanced Structure, Advanced Kinetics, and Advanced Electrical Properties. These coursework constitute 18 credit hours. In addition M.S. students need to take two graduate level elective courses either from the School of Science or School of Engineering constituting 6 credit hours. M.E. students need to take three graduate level elective courses either from the SoS or SoE constituting 9 credit hours. No undergraduate level courses can be counted against M.S. or M.E. degree requirements.

Upon admission to the program, students will be regarded as graduate students by the department but will not normally receive departmental financial support. They will not be required to take the placement exams. Students in this program who wish to transfer to the Ph.D. program must apply for it, and will be considered new applicants.

Materials Science & Engineering majors can apply for the co-terminal degree program in another department, getting a B.S. in Materials Science & Engineering and an M.S. in the other discipline if accepted. The M.S. in Applied Science is a possible option that does not require a thesis. Students need to discuss their plans with an advisor from the department from which they plan to obtain the M.S. degree.

## Graduate Program

<b>Areas of Study/Degrees</b>	Materials Science and Engineering: M.S., M.Eng., and Ph.D.	<b>Typical Degree Requirements</b> <b>M.S.</b> 30 credits (24 coursework, 6 thesis) + M.S. thesis <b>M.Eng.</b> 30 credits (27 coursework, 3 research project) <b>Ph.D.</b> 72 credits (27 coursework, 45 thesis) + Ph.D. Thesis
<b>Research Areas</b>	We offer a wide range of disciplines that are sufficiently flexible to accommodate individual interests, but the main research areas of interest are separated into several broad categories:  Advanced Processing and Synthesis Composites Computational Materials Electrochemistry of Materials / Corrosion Electronic Materials Glasses / Ceramics	Materials / Biology Interface Materials Characterization Materials for Energy Metals Nanomaterials Polymeric Materials
<b>Participating Research Centers</b>	Center for Fuel Cell and Hydrogen Research Center for Future Energy Systems Center for Materials, Devices, & Integrated Systems Center for Multiphase Research Center for Computational Innovations	Multiscale Science and Engineering Center National Science Foundation Center for Directed Assembly of Nanostructures Scientific Computation Research Center
<b>Admission</b>	Submit on-line at: <a href="https://admissions.rpi.edu/graduate">https://admissions.rpi.edu/graduate</a> Deadlines are January 1 for Summer and Fall admission and August 15 for Spring admission <b>You'll need:</b> a well-written Statement of Background & Goals; official transcripts from all colleges attended; at least 2 letters of recommendation (preferably from faculty); official GRE scores (general test only) and official TOEFL or IELTS scores (required for all international applicants); non-refundable application fee.	
<b>Financial Aid/Tuition</b>	<b>Most students receive financial aid.</b> Apply for financial aid through the admission application, <i>no separate form is required.</i> Financial aid is available in the form of Fellowships, Teaching Assistantships and Research Assistantships. International students are eligible for all forms of aid except some fellowships that require US citizenship. Awards are made based on merit, not on need, and priority is given to doctoral candidates. Tuition for the 2018-2019 academic year is \$52,550; fees and insurance are \$2,890; Estimated Living expenses are \$14,249 and Estimated Books and Supplies are \$2,950. Total Estimated Cost of Attendance: \$72,639	
<b>Contact Us</b>	Meeli Chew Leith, Administrative Coordinator Materials Science and Engineering Phone: 518-276-6373 Fax: 518-276-8554 Email: <a href="mailto:materials@rpi.edu">materials@rpi.edu</a> <a href="http://mse.rpi.edu/">http://mse.rpi.edu/</a>	

## Frequently Asked Questions

**What classes should I take?** First year classes are generally specified by the curriculum of the school you are enrolled in. For students enrolled in the School of Engineering this includes completing core courses as well as the required courses determined by the institute. Once you have declared a major your advisor will work with you on which courses to take. For those students who have not declared a major several departments offer one credit introductory courses that provide students with the basics of that particular field.

**What to do to get a minor in Materials or (if the student is MSE major) in another discipline?** In order to earn a minor in Materials Science and Engineering, you need to take 15 or more credits of courses offered by the department with the MTLE designation. As general preparation for these courses, you should have taken ENGR-1600, Materials Science. Minors vary in their requirements from 16 to 20 credit hours, with most having 16 credit hours. A student wishing to develop a minor should consult with his or her advisor for that minor before completing the second course in it. The [minor approval form](#) must be completed and signed by your advisor as well as the department head in the department you will be taking the minor in.

**Can I take a graduate level course as one of my free electives?** Yes, you may take a graduate course as one of your free electives. An [approval form](#) must be completed and submitted to the Dean of Graduate Education before the second week of classes.

**Can I substitute a different class for a required course?** Substitutions for required courses are permitted only with the approval of the heads of the departments concerned and the dean of the school or a designated representative. Where substitutions are granted, written notice must be filed with the registrar.

**Can a program requirement be waived?** Waivers must be approved by the Degree Clearance Officer. Your advisor may recommend that a requirement be waived, but this may not be possible if accreditation issues are involved.

**How do I change my major?** It is important to meet not just with your current advisor but also with the advisor in your prospective department. He or she will help you determine what requirements you will need to meet and whether they involve additional courses or credit hours. The Undergraduate [Change of Major/Change of Status](#) form must be completed and signed by the advisor and/or the curriculum coordinator and turned into the Core Engineering office in JEC 3018.

**What research is there done in your Department?** We offer a wide range of disciplines that are sufficiently flexible to accommodate individual interests. Some examples are biomaterials, computational materials, materials for energy, and nanotechnology.

**How do undergraduates get involved in research? Can they? Do they all?** The best way to get involved in a research project is to approach instructors in classes you have or are taking. Visit their web sites and see what research they are working on to see if it interests you. Even if you cannot find a project that interests you in your major field, you will find that faculty in all of the Institute's schools conduct research and may need undergraduate researchers to assist them.

**How do I get an internship?** [Cooperative Education \(Co-Op\)](#) are managed by the [Center for Career and Professional Development \(CCPD\)](#). An important first step is to officially register in the co-op program. You will then have access to JobLink, the CCPD's on-line recruiting system, where you can link to employers who are looking for co-op students, and read about those whose requirements you meet.

**When should a co-op be taken?** Many courses in the Materials Science and Engineering Department are offered only once a year and some course have to be taken in sequence. Therefore,

students going to Co-op require a careful planning. Probably the best time for students to go to Co-op would be the third year, either fall or spring.

## **The Arch FAQs**

**When will I be expected to participate in the Arch?** Students in the Class of 2022 will be required to participate in the Arch program in summer 2020.

**Does this mean it will take more than four years to graduate?** With the exception of students in the five-year bachelor of architecture program, matriculation to degree completion is not intended to take more than eight terms at Rensselaer. To accelerate your academic progress, and graduate in fewer than eight semesters, you may take classes elsewhere prior to enrollment at Rensselaer, obtain AP/IB credit from high school, take summer courses in subsequent summers, study abroad during the away semester, or some combination of these options.

**Do I have to pay tuition during my "away" semester?** No. The semester away is an opportunity to pursue internships, co-ops, and collaborative research, as well as athletic, entrepreneurial, philanthropic, and community service activities.

**What will I do on my semester "away" from Rensselaer?** You can take advantage of numerous co-curricular and experiential activities available off campus, including international travel, internships, co-ops, research opportunities, and engagement in community service projects.

**Will I have help in finding a co-op or internship?** Students seeking a co-op or internship experience during their "away" semester will have the full resources of the Center for Career and Professional Development available to assist them in their search.

**What if I want to study abroad?** Study abroad has become an integral part of a well-rounded undergraduate experience. The Arch provides additional experiential learning opportunities for students to gain a greater understanding and appreciation of other cultures and customs. This includes short-term and faculty-led international programs, and other international experiences such as internships and service learning.

Formal study abroad through our exchange programs would not be considered an away semester as students' pay Rensselaer tuition.

Students can, however, also pursue study abroad during their away semester through non-affiliated programs. In that case students pay tuition to the host institution.

**Will there be air conditioned residence halls and classrooms for all students during the Arch?** There is an AC plan in place so that all students here for the summer will be in air conditioned residence halls (and air conditioned classrooms and laboratories).

## ***International Students Arch FAQs***

This is a brief overview of FAQs for International Students and the Arch. For more details or questions outside of the FAQs, please contact the [ISSS Office](#) directly.

**Can I participate in the Arch?** Yes, after opting in for the Arch you will need to fill out the ISSS Arch form.

**Can I choose either the fall or spring Semester to take as a break?** Yes, but you will need to choose which term semester you will take as a break during the mid semester of your sophomore year. For example sophomores who would like to be away in the fall would need to decide by early March. You would then decide after notifying ISSS what your plan for the fall break will be.

**For the fall semester as the Arch Semester Away, can I go back to my home country during this time?** Yes, you can. Please make sure the ISSS Arch form is completed, and that you have met with ISSS.

**When I return for the spring semester, after my Arch Semester Away will I need a new I-20?** No, if you have completed the proper paper work with ISSS, you will not need to get a new I-20 if you are returning for classes for the spring semester. If something else is occurring please contact ISSS.

## Co-Terminal FAQ's

**When do I apply?** Co-terminal applications must be submitted before the end of the first semester of the applicants' senior year. Each department has their own application deadline separate from the Office of Graduate Education's deadlines of November 15<sup>th</sup> for spring admission and May 1<sup>st</sup> for fall admission into the Co-Terminal Program. Applicants must have 90 credits (101 credits for B. Arch students) of coursework in progress or earned towards their undergraduate degree.

**Where do I find a Plan of Study?** The Plan of Study is available on-line at the Office of Graduate Education website. <http://gradoffice.rpi.edu/update.do?catcenterkey=20>

**What if the courses I list on the Plan of Study change?** If the courses listed change, an updated plan must be filed with your Department, the Office of Graduate Education, and the Office of the Registrar.

**Do I have to file a FAFSA for my 5th year to continue receiving aid?** Yes - you must file a FAFSA, if you receive need based aid or choose to apply for a graduate level Federal Direct Aid loan. (Please contact the Office of Financial Aid for application deadlines).

**When/how does a student get assigned a graduate adviser?** Co-terminal students will continue to work with their undergraduate adviser until completion of their B.S. degree.

**How many credits will I be eligible to register for?**

During graduate study, students limited to a credit total of 15 credits for the semester.

**Can I become a part-time student in the Co-Terminal Program?** Co-terminal students must remain as full time students and cannot shift to part-time status.

**When do I receive my BS degree? I was supposed to graduate in May, but I will be completing two more semesters to receive my Master's degree under the co-terminal program?** You should file a degree application with the Office of the Registrar for your B.S. degree at the beginning of the semester in which you will have met the degree requirements for the degree. See the academic calendar for deadline information. Upon graduating with your B.S. degree, your primary status/classification will change to graduate.

**Can I use a course for both my undergraduate and graduate degree?** No - credits applied toward satisfying requirements of the undergraduate degree cannot be used to satisfy the requirements for the Master's degree and vice versa.

**I finished my 9th semester but decided not to continue in the Master's program.** You must formally withdraw from the co-terminal program. This is done using the [Graduate Student Request for Change of Status](#) form. The Change of Status form is required at any point that you decide to leave the program. This includes if you decide to leave the program upon completion of your B.S. degree.

**Can I still designate courses as Pass/No Credit?** Co-terminal students are subject to graduate degree program guidelines. Any courses being applied to a graduate degree cannot be taken as Pass/No Credit. Students must earn a grade of C- or better in courses used towards a graduate degree and graduate with a GPA of 3.0 or higher.

**How does the degree application process work for Co-Terminal Students?** Students may participate in commencement when they complete their B.S. degree requirements, and again upon completion of their M.S. degree. To apply for graduation, students must fill out a degree application on the Student Information System (SIS) the semester they intend to graduate. Though Rensselaer students can officially graduate in August, December, or more commonly, May, Rensselaer's commencement ceremony is only held once a year in May. Check the academic calendar for application deadlines.