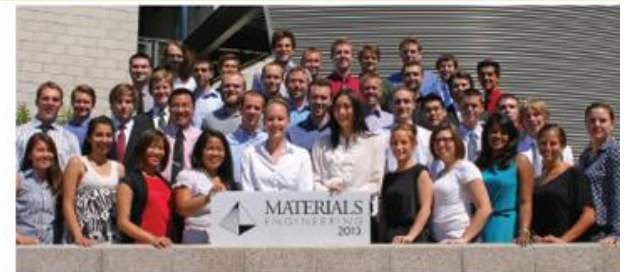


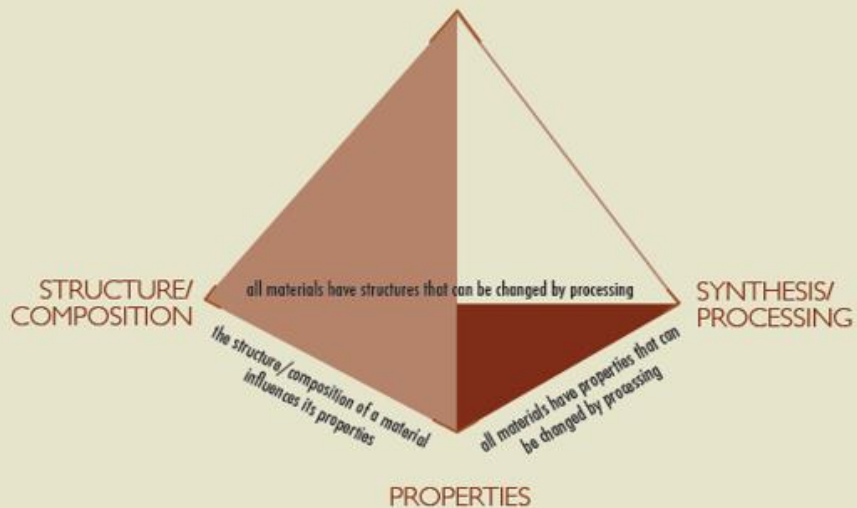
# THE MATERIALS ENGINEERING CURRICULUM



## A User's Guide



A MATERIAL'S PERFORMANCE  
IN A DESIGN APPLICATION



## VISION

(20+ YEAR TIME HORIZON)

To collaboratively overcome the intertwined grand challenges of sustainability and transformative learning through our materials engineering program.

## MISSION

(EVERYDAY)

To be a vibrant, creative and effectual learning community that cultivates the unique capabilities of each individual to thrive in a complex, interconnected and ever-changing world.

# MATERIALS ENGINEERING IN THE 21<sup>ST</sup> CENTURY

## THE GRAND CHALLENGE

### 危机

You see here the Chinese symbol for the word “crisis.” It has two characters, one means “danger,” the other “opportunity.” This character embodies where we are as a species: global economic activity endangers earth’s ability to sustain life; differential access to resources creates suffering and political unrest. Our opportunity as engineers is to apply our creativity, to design products, processes and systems which support human well-being and that are also compatible with sustaining the environmental systems that provide ecological services vital for human survival.

Your grand challenge is to be a contributor to society’s rapid transition to sustainable development. It’s our intention that your materials engineering curriculum enables you to develop the cognitive, social, affective, and psychomotor characteristics needed for this very important mission.

**Your Development as an Engineer**  
Many people believe that getting a degree means taking a bunch of classes, with the idea of filling you up with information. This used to be the case. Engineers used to focus just on the left-brain development math and science. But globalization and

its strain on environmental and social systems have changed the game. A successful citizen in the 21st century will need to develop their whole self—creativity, math, social skills and science.

What we know now about learning (or “development”) is that the learner constructs their knowledge within themselves. To truly learn something, the learner has to engage in building their own understanding.

We have designed your curriculum based on research in educational psychology.

### TAXONOMY OF SIGNIFICANT LEARNING

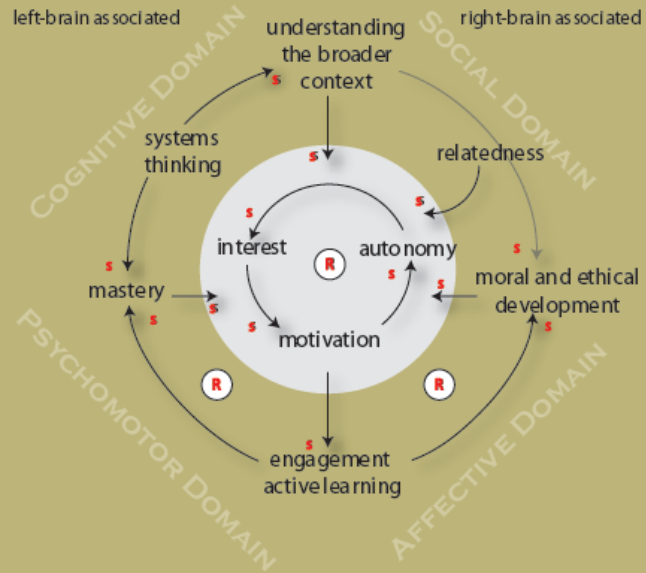
Based on Fink’s Taxonomy.



**From freshmen to senior years, you'll grow in each area of development**

### Four-Domain Development Diagram

Vanasupa, Stolk, Herter (2009). *Journal of Engineering Education*. 98(1): 68-81.



## THREADS THE FABRIC OF THE PROFESSION

There are several threads that run throughout the curriculum. Together, they form the fabric of your materials engineering education.

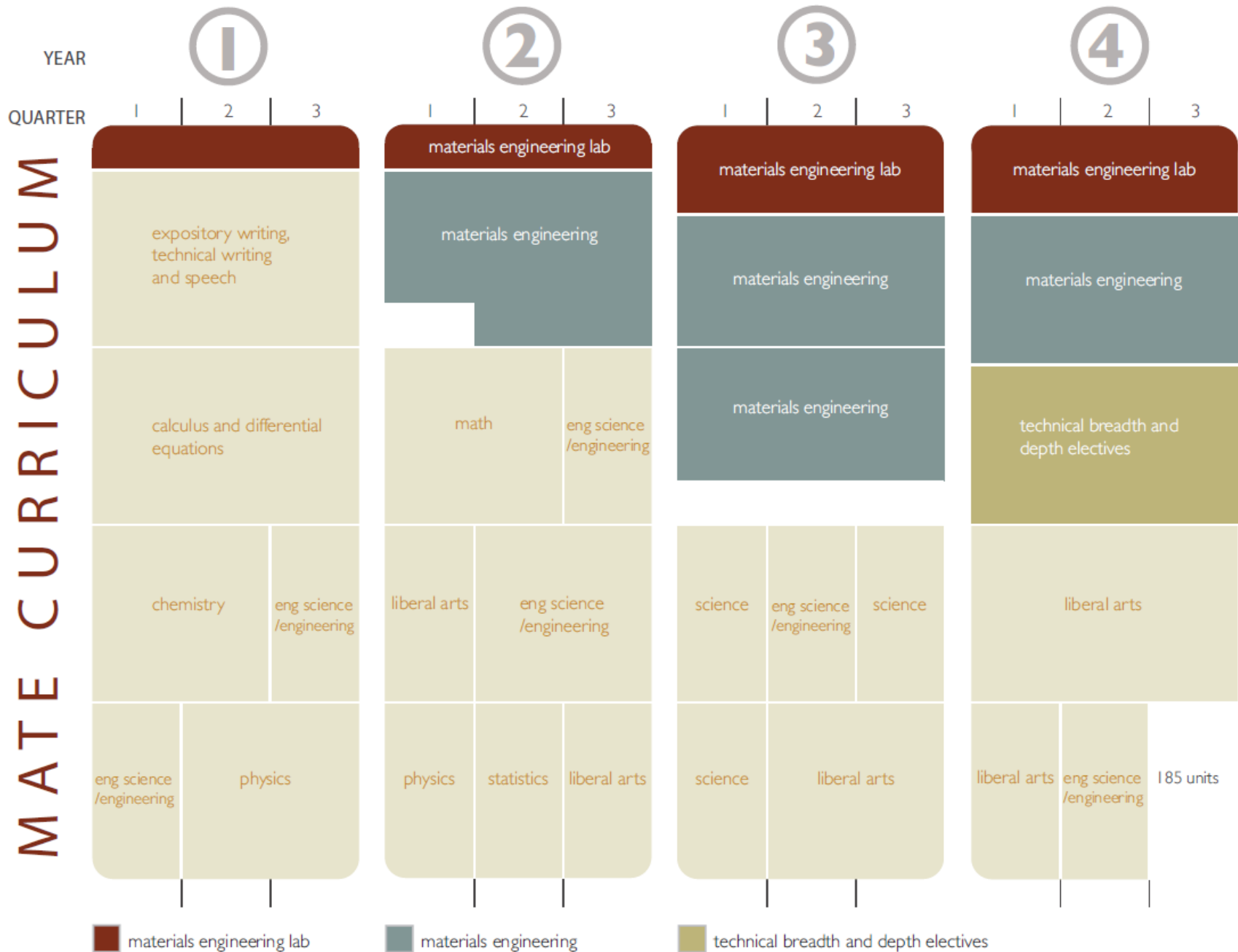
### Threads: Building mastery of...

- Foundational Skills
- Teamwork
- Communication
- Self-Directed Learning
- Design
- Systems Thinking
- Design of Materials Systems & Processes
- Analysis of Materials Systems & Processes
- Contextual understanding
- Creativity

**At the end,** you will have developed the confidence, skills and abilities to contribute your materials engineering knowledge to any design team.

**CAUTION:** You won't feel like an expert. This is normal. It takes decades of experience to be an expert. You will be an independent learner with a strong foundation in materials engineering.

# MATE CURRICULUM



## YEAR 1

### INTRODUCING THE 21<sup>ST</sup> CENTURY MATERIALS ENGINEER

#### Focus

support network, seeing connections, engineer's role in society, design, materials engineering career insights

#### What to Expect

*3 hours per week in MatE classes*

Expect to be a little overwhelmed, if only for the fact that you'll be dealing with a lot of change. Your courses will feel fast and furious. Outside of participating in classes, plan to invest 35-40 hours per week in your learning.

The basic humanities, math, science and technology that you'll be learning are absolutely critical. It will sometimes be very hard to see how these are connected at all to engineering, so we've designed a MatE lab sequence (110/120/130) to tie these together as much as possible. We've also designed this experience to create a strong, healthy tie between you and your greatest defense against academic hardship: your peers. Studies show that supporting relationships like these are critical to your success.

In the lab sequence you'll work in teams to design and build something that helps society live more sustainably in partnership with a local client.

## YEAR 2

### ACQUIRING THE FUNDAMENTALS

#### Focus

materials science, systems thinking, engineering vocabulary and knowledge, design, laboratory practice

#### What to Expect

*6-7 hours per week in MatE classes*

This is a year where you'll be strengthening your ability to critically think through a problem. You'll also be building your ability to contribute on a design team by developing your knowledge and vocabulary around engineering fundamentals. In the lab, you'll apply your mathematics knowledge (statistics) to measurement. You'll also begin using equipment for materials analysis and data collection.

## YEAR 3

### COMBINING THE FUNDAMENTALS THROUGH PRACTICE

#### Focus

learning materials science and applying it, design and process improvement

#### What to Expect

*12 hours per week in MatE classes*

Here is where you REALLY dig in. This year is run in a project-based format, where you learn the science and engineering in the context of working on projects. You'll be working in teams, but the work requires a great deal of self-initiated learning. This is the year in which you are challenged to fully embrace your responsibility to begin putting the science and engineering together. If there are gaps in your understanding, it is up to you to identify these gaps and pursue their closure. The faculty act as coaches to help you through this process. At the end of this year, if you've developed yourself to your fullest, you will feel a great sense of accomplishment.

## YEAR 4

### HONING THE PROFESSIONAL ENGINEERING SKILLS

#### Focus

independent design, professionalism

#### What to Expect

*10 hours per week on senior project + technical electives*

Your big task this year is to complete your senior project while both deepening and broadening yourself through electives. You have the opportunity to choose from a number of courses. The senior project builds on all the mastery you have developed in yourself in the first three years, including the ability to self-direct your learning. You'll have a faculty advisor to guide you through this process.

