New York State College of Ceramics

The College

The New York State College of Ceramics at Alfred University was established April 11, 1900 as The New York State School of Clay-working and Ceramics at Alfred University. When legislation was enacted creating the State University of New York (1948), the College became one of what are now five statutory units of the SUNY enterprise, with the Ceramics College continuing to be operated by Alfred University on behalf of the SUNY Board of Trustees. As a state-supported unit of Alfred University, students, faculty and staff gain the benefits of both a high quality, small university environment and a high quality public higher education system. Students benefit from a state-supported tuition rate.

Programs and Schools

The College of Ceramics is comprised of: the School of Art and Design, four programs within the Inamori School of Engineering (Ceramic Engineering, Glass Engineering Science, Materials Science and Engineering, and Biomedical Materials Engineering Science), and the S.R. Scholes Library. Two additional engineering programs (electrical and mechanical engineering) are part of the Inamori School of Engineering, but are not state-supported; they are non-statutory programs.

The College's academic programs lead to the B.S. degree in engineering programs with various options; the B.F.A. with numerous concentrations in art and design and the B.S. in Art History and Theory; the M.S. in the engineering areas; the M.F.A. in three art and design areas; and the Ph.D. in Ceramics, Glass Science, and Materials Science and Engineering. Specific degree requirements for undergraduate degree programs are outlined on the following pages.

Research

Research expenditures average $6 million annually. Research is conducted primarily by faculty in the engineering programs with strong involvement by both graduate and undergraduate students. Approximately 60% of research at the College is sponsored by industry, allowing both undergraduate and graduate students to obtain first-hand experience interacting with representatives from sponsoring companies. Multi-year projects funded by government agencies support cutting-edge basic research in computer modeling, electronics, materials, glass structure and properties, and composites.

Additional Resources:

Center for Environmental and Energy Research
Institute for Electronic Arts
Laboratory for Electronic Ceramics
New York State Center for Advanced Ceramic Technology
NSF Industry-University Center for Glass Research
Paul Vickers Gardner Glass Center
Schein-Joseph International Museum of Ceramic Art
S.R. Scholes Library

Buildings and Equipment

The College occupies a number of buildings on the Alfred University campus, including Charles Harder Hall, Binns-Merrill Hall, the Hall of Glass Science and Engineering, McMahon Engineering Building and Scholes Library.

Harder Hall contains many of the studios and labs for the School of Art and Design and art history lecture and seminar spaces. The building's central courtyard surrounds an impressive kiln room, containing both gas- and electric-fired kilns;

the ceramic studios and glaze labs are in close proximity. Gallery space is available for faculty and student shows, as well as for a wide range of special exhibitions.

The statutory portion of the Inamori School of Engineering is housed mainly in the three-story John F. McMahon Engineering Building, which provides approximately 56,000 square feet of space for laboratories, classrooms and offices. Students are able to gain invaluable hands-on experience with high-tech and traditional processing and characterization equipment, starting in the freshman year with engineering communications and processing courses. The programs in electrical and mechanical engineering are housed in the Engineering Lab Building[SM1], which includes engineering laboratories as well as office space.

Binns-Merrill Hall houses activities and faculty from art and engineering, including laboratories for processing and testing ceramic and glass products, X-ray and microscopy, research and development, as well as lecture and seminar rooms. Drawing, neon, hot glass and sculpture studios, and administrative offices are also located in Binns-Merrill. The Hall of Glass Science & Engineering houses laboratories and faculty offices supporting the glass engineering program.

The Scholes Library is a significant resource in the areas of engineering and art; its print and non-print resources are more fully described on page 66. The Schein-Joseph International Museum of Ceramic Art at Alfred is housed in temporary quarters on campus as plans proceed for a new building, now in the design stage.

School of Art and Design

The School of Art & Design offers three Professional Degree Programs:
The Bachelor of Fine Arts (BFA)
The Bachelor of Science in Art History and Theory (BS)
The Master of Fine Arts (MFA) in three Areas:

- Ceramic Art
- Electronic Integrated Art
- Sculpture/Dimensional Studies

The Bachelor of Fine Arts (BFA)
The BFA degree provides opportunities for undergraduate students to concentrate in ceramic art, drawing, painting, photography, graphic design, print media, video, sonic art, interactive media, or glass and sculpture. This 4-year program develops a major commitment to studio practice and fosters the conceptual and technical skills necessary to pursue a career in the arts.

BFA students take elective and academic credit from the College of Liberal Arts and Sciences and the College of Business. There are numerous options for art students who want to pursue academic minors such as studies in marketing, environmental studies, performing arts, and philosophy to name a few. Students may obtain K-12 certification in art education, or select a core of psychology courses in preparation for graduate studies in art therapy.

Foundation
Foundation is a full first year course predicated on a rigorous studio practice and a comprehensive teaching philosophy that engages a broad range of issues, extending across and beyond artistic disciplines. Individual students bring their own experiences and skills into a community of peers.

During the course of this year, Foundation emphasizes asking questions, creative thinking, and the synthesis of expanding individual creative experiences making connections between a range of media and ideas. Emphasizing experimentation, group projects and individual aspiration, the Foundation program is a "portal" to a creative education.

During the Fall semester, students work with faculty teams from different disciplines and perspectives to tackle vital topics in the education of an artist, from form and color to building and drawing to performance and kinetics. The spring semester begins to sharpen the conceptual and technical questions and skills introduced in the fall through smaller workshops. Throughout the year, all Foundation students meet collectively once a week on Wednesday mornings for films, discussions, group projects, performances, and Visiting Artists' talks.

In addition to the Foundation studio courses both semesters, students complete 6-credits of Art History, taking three, 2-credit courses in non-western art, ancient to baroque art and modern art. First year students also fulfill academic requirements in Writing I or II and Humanities.

Sophomore Year
The Sophomore curriculum is designed to enhance and further develop the studio experience of the Foundation year by creating a structure of options, which support the "high tech, high touch" mission of the school. The curriculum encourages study of studio disciplines represented across each of four Divisions - Ceramic Art; Expanded Media; Painting, Drawing and Photography; and Sculpture/Dimensional Studies.
Sophomores learn fundamental skills necessary in the development of an artistic practice. These include an awareness and ability to understand, use and integrate processes, tools, materials, and vocabularies. Through an inquiry, based in research, synthesis and the use of drawing (one semester required at the Sophomore or Junior level) each student is prepared to realize their ideas. During this year students choose four studios, one from each division or opt to take four studios in three divisions. This allows those who want to focus in a specific division, to do so, while allowing others, a more varied studio experience. Both options are meant to prepare students for the challenges of the Junior and Senior curriculum.

The sophomore Art History requirement, 'Issues and Debates in Contemporary Art' provides an exciting context to the studio experience. Students also extend the breath of their academic experience by choosing elective courses from other colleges at Alfred University.

Junior Year
Students entering the Junior year have the latitude and ability to define their interests and creative goals. Students' naturally become more focused, integrating conceptual and technical skills while developing a personal vision in their art making. At the junior level, academic and elective course work fosters interest in cross-disciplinary practice and undergraduate research possibilities.

The junior year is also the time to take advantage of study abroad opportunities. The School of Art & Design has exchange programs in England at University for the Creative Arts at Farnham, in Scotland at Edinburgh College of Art, in Germany at Fachhochschule Koblenz University of Applied Sciences, and in Australia at Sydney College of the Arts and the University of New South Wales.

Senior Year
Seniors work semi-independently in their own studio spaces, and are required to meet weekly with at least two faculty advisors to discuss their work, research and process. Additionally, Senior's participate in seminars, Visiting Artist programs, group critiques, discussions and solo and group exhibitions. Defining their own direction, seniors develop and produce a consistent body of work, which draws on their individual experiences, acquired skills and personal vision. The culmination of the senior year is the senior thesis exhibition. During the final two weeks of the academic year, the School of Art & Design is transformed into quality exhibition space where graduating seniors' display their best work. The opening celebration of 'Senior Shows' includes families and numerous guests from throughout the Southern Tier Region. Following the openings, students come back into their exhibition spaces for final reviews and faculty critiques.

The momentum gained during the senior year prepares graduates to enter the work force as accomplished technicians and highly motivated artists and designers.

BFA Degree Requirements

Minimum requirements for a Bachelor of Fine Arts degree are as follows:

Studio	72
Academic*	25
Art History	17
Electives	14
Senior Project	0
Total degree credit hours	**128**
Physical Education	4**
Total Credit Hours	**132**

***Academic Requirements are met by completing the English Composition Requirement (4 credit hours), the Humanities Requirement (8 credit hours), and additional "academic" courses to reach a minimum of 25 credits. The types of courses that qualify as "Academic" are defined below.**
****additional PE activity credits (100-level PHED) may not be used toward any degree requirements**

English Composition Requirement (4 credit hours)
Each student must successfully complete one semester of college writing. Students will be placed in the appropriate level course depending upon their scores on college entrance exams. Students scoring 499 or lower on the SAT Writing Exam (539 or lower on the SAT Verbal or 25 or lower on the ACT-English Exam) must take ENGL 101. Students scoring 500-699 on the SAT-Writing Exam (540-739 on the SAT Verbal or 26-29 on the ACT-English Exam) must take ENGL 102. Students scoring 700 or higher on the SAT-Writing Exam (740 or higher on the SAT Verbal, or 30 or higher on the ACT-English Exam) have satisfied this requirement.

Humanities Requirement (8 credit hours)
Courses that count toward the general education program of the College of Liberal Arts and Sciences each have a designation indicating the "Area of Knowledge" to which they apply. These Area of Knowledge designations are also used to define the BFA Humanities Requirement:

Choose one 4-credit course from Area B (Philosophy or Religious Studies)
or Area D (Historical Studies) 4

Choose one 4-credit course from Area A (Literature), Area B, Area D,
or one of these courses offered by the Division of Performing Arts: 4

DANC 311	Dance History
THEA 110	Introduction to Theatre
MUSC 200	Special Topics (depending on content)
THEA 210	Performing Arts: A Global Perspective
THEA 211	Women in Theatre

THEA 311	Theatre History I
THEA 312	Theatre History II

Academic Requirement (25 credit hours)
This requirement is met by completing the English Composition and Humanities Requirements plus enough additional academic courses to reach the minimum of 25 credits. Courses from the following areas count toward this requirement:

- Courses offered by the College of Liberal Arts and Sciences *except* 100-level PHED courses and private music lessons (MUSC 101-108 or 301-308)
- All courses offered by the College of Business
- All courses offered by the Inamori School of Engineering
- Art History courses beyond the 17-credit hour requirement
- Honors Seminars

Typical Program

First Year		
ART 101 and 102	Foundation I and II**	16
ARTH 100-level	Art History (three 2-credit classes)	6
ENGL 101 or 102	Writing I or II	4
Humanities		4
Sophomore Year		
ART 200-level	Sophomore Studios**	16
ART 282-284	Required Drawing	4
ARTH 211	Issues and Debates in Contemporary Art	3
Academic, Art History, or Elective		13
Junior Year		
ART 300-level	Junior Studios**	16
Art History, Academic, or Elective		16
PHED 100-level	Physical Education Activity Course	2
Senior Year		
ART 401	Senior Studio**	16-24
ART 499	Senior Show	0
Art History, Academic, or Elective		10
PHED 100-level	Physical Education Activity Course	2

****Studio courses are assessed a fee for special materials. This fee may vary from $10.00 to $135.00 per credit hour.**

The Bachelor of Science Degree in Art History and Theory (BS)

The BS degree in Art History and Theory is a professional degree program based on a curriculum historically developed in conjunction with studio BFA and MFA programs. It is designed to instill an understanding of artistic developments in the Western and global historical contexts, to provide students with the critical and theoretical tools necessary for functioning as art professionals, and to prepare them for the pursuit of graduate studies in the field. In accordance with this mission, the program intends to educate art historians and theorists whose knowledge of the visual arts is grounded in substantial studio experience as well as extensive academic learning and research. Therefore, the BS in Art History relies on a combination of fundamental theoretical and applied research in art. The faculty of the School and the Division of Art History believe in the necessity of anchoring historical and theoretical knowledge with material practice. Consequently, admission to the program requires the submission and review of a portfolio that will assure the candidate's ability to withstand the rigors of both academic and studio education.

Requirements for the degree:

Art/Design History and Supportive Courses: 42 credit hours		
ARTH 120-129	Foundations in Art History (Non-Western)	2
ARTH 130-139	Foundations in Art History (Ancient-Baroque)	2
ARTH 140-149	Foundations in Art History (Modern Contemporary)	2
ARTH 211	Issues and Debates in Contemporary Art	3
PHIL 283	Philosophy of the Arts I	4
ARTH 300-level	4 Junior Art History Courses: Non-Western, Ancient to Baroque, Modern to Contemporary	16
ARTH 400-level	2 Senior Level Art History Courses	8
ARTH 460	Art Historiography and Methodology	3
ARTH 499	B.S. Thesis in Art History and Theory	2
Studio: 24 credit hours		
ART 101 &102	Foundations	16
ART 2XX	Two Sophomore-level studios	8
General Studies: 16 credit hours		
ENGL 101 &102	Writing I & II	8
Humanities (as defined under the BFA requirements, above)		8
Electives: 40 credit hours		
Foreign Language (especially French or German) through the 202 level		16
Academic courses (as defined under the BFA requirements, above)		16
Additional Electives (selected under advisement)		8
Total credit hours for the BS in Art History and Theory		**122**
Plus, complete the Physical Education Requirement		4

Note: additional Physical Education activity credits (100-level PHED) may not be used toward any degree requirements

Minor in Art History

This minor provides a broad base of knowledge about art as it relates to history and culture, exposes students to a variety of theoretical and methodological issues and helps them develop critical and analytical skills that can be applied to art making.

The art history minor is available to BFA students who have successfully completed Art History Foundation required courses (ARTH 100-level requirement and ARTH 211). Sixteen additional credits in art history at the 300 and 400 level are required to complete the minor. The Art History minor is also available to students in other colleges/schools at the University with the permission of the Division Chair.

Education Minor

Students who wish to be certified to teach art in New York State must fulfill the requirements for a minor in Education (Special Subjects) in addition completing the studio, liberal arts, and art history requirements common to all BFA candidates. Students in this program fulfill the elective category with required education courses. Completion of this program requires one additional fulltime semester (nine semesters in all). See p. 97 for the education requirements.

Art Therapy

Students interested in a career in art therapy should consult the Chair of the Psychology Division in the College of Liberal Arts and Sciences. The following psychology courses, in conjunction with the BFA degree, are the prerequisites for admission to a graduate program:

Recommended core courses:

PSYC 101	Introduction to Psychology	4
PSYC 261	Cognitive Development	4

PSYC 262	Social Development	4
PSYC 341	Theories of Personality	4
PSYC 342	Abnormal Psychology	4
PSYC 485	Practicum	2-4
Recommended electives:		
PSYC 210	Communication and Counseling Skills	2
PSYC 302	Psychological Measurement	4

The Graduate Program

Three Master of Fine Arts programs are offered at the School of Art and Design: Ceramic Art, Electronic Integrated Arts and Sculpture/Dimensional Studies. All MFA students receive an assistantship. Entry into these programs is highly competitive. Those interested in learning more about the individual programs should contact the School directly at (607) 871-2442 or e-mail whitelz@alfred.edu. Application materials may be obtained from the Graduate Admissions Office, Alfred University, One Saxon Drive, Alfred, NY 14802-1205.

Kazuo Inamori School of Engineering

Biomedical Materials Engineering Science (BMES)
Ceramic Engineering (CE)
Electrical Engineering (EE)
Glass Engineering Science (GES)
Materials Science & Engineering (MSE)
Mechanical Engineering (ME)

The mission of the Kazuo Inamori School of Engineering is to provide academically challenging, inquiry-based programs to prepare technically proficient and broadly educated engineers and scientists at the bachelor, master, and doctoral levels. We offer these programs in a student-centered environment with a strong commitment to the personal, professional, and ethical development of our students. We engage in research to provide a foundation for our educational programs, to advance the frontiers of knowledge, and to support economic growth.

The School of Engineering offers six Bachelor of Science, six Master of Science and three Ph.D. degrees. The Bachelor of Science(BS) degree programs in Ceramic Engineering (CE), Electrical Engineering (EE), Glass Engineering Science (GES), Materials Science and Engineering (MSE), and Mechanical Engineering (ME) are accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone (410) 347-7700. Started in 2003-04, the Biomedical Materials Engineering Science (BMES) degree program is not yet accredited; however, it is expected that the program will seek ABET accreditation during the next accreditation cycle.

Upon graduating with a BS degree in CE, EE, GES, MSE, and ME, students are eligible to take the Fundamentals of Engineering (FE) examination, the next step towards registration as a Professional Engineer. Having passed the FE examination, the remaining two steps are: 1) four years of relevant post-baccalaureate experience and 2) passing the Professional Engineering (Principles and Practices) examination.

All Inamori School of Engineering faculty members have doctoral degrees, and all are engaged in teaching and research. Faculty members often bring recent research results or examples from industry into their classroom teaching. Undergraduate students have opportunities to participate in research programs in the School and/or to participate in co-operative education or internship programs that have developed from faculty contacts with industry.

School of Engineering General Requirements

GPA Requirement
All students receiving an engineering degree must achieve a GPA of at least 2.00 in engineering and technical elective courses at the time of graduation.

Written Communication Requirement
Students must complete ENGR 110, Technical Communications. Proficiency in basic English skills as demonstrated by successful completion of ENGL101, or an equivalent course, or by specified scores on standardized tests is a prerequisite for ENGR 110. Students are exempted from ENGL 101 for a score >540 on the SAT Verbal, or >500 on the SAT Writing Exam or SAT II, or >26 on the ACT-English. Credits earned by successfully completing ENGL101 do not count towards the degree credit requirements.

Humanities/Social Science Requirement
At least one humanities/social sciences course meeting the General Education Requirements must be selected from three of the following discipline areas:
1. Literature (A), Philosophy or Religion (B); 2. The Arts (C); 3. Historical Studies (D); 4. Social Sciences (E); 5. Foreign Language (II) (Note: a student must take the two-semester introductory sequence in a language, or its equivalent, in order to meet the requirement). Additional courses in the five discipline areas (with our without a letter designation) and ENGR 110 may be used to meet the 20 credit minimum for humanities and social sciences requirement, but no more than 4 credits of coursework in discipline area C (The Arts) will count towards the 20 credit minimum. Courses that meet Quantitative Reasoning III do not count towards the Humanities/Social Science Requirement. ENGL 101 does not count towards the 20 hours, or to the minimum number of credit hours required for graduation.

Seminar Requirement
Students must enroll in and successfully pass ENGR 360 Undergraduate Seminar (or ENGR 160 Freshman Seminar, as appropriate) each semester they are enrolled fulltime in one of the School of Engineering degree programs.

Engineering Major Requirements

Biomedical Materials Engineering Science (BMES)
Advanced materials are needed for biomedical applications. Implantable devices like pacemakers, defibrillators, and artificial joints must be biocompatible while carrying out complex chemical, mechanical, and electrical functions. Sensors used in medical diagnostics must recognize pathogens while ignoring a multitude of closely related molecules. The goal of the Biomedical Materials Engineering and Science curriculum at Alfred University is to train next-generation biomaterials engineers to understand the basic principles of structure and function for both living and nonliving materials and to use these concepts to create materials for biomedical applications. The curriculum is a unique fusion of materials engineering/science and molecular cell biology that puts students ahead of the curve in areas such as bioengineering, biotechnology, and nanotechnology. In addition to opening the door to countless technical careers, it also provides outstanding preparation for alternative careers such as medical school, law school, or the MBA.

BMES Program Objectives
It is expected that, during the first few years after graduation:

1) The unique expertise of our alumni will allow them to accomplish assignments that make a significant contribution to biomaterials and biomedical engineering. These accomplishments, expected to occur in a professional venue, will be the result of a unique curriculum that creates *bona fide* Materials Engineers with the education and hands-on experience in both materials and biology necessary to play a leading role in the dynamic and emerging field of biomaterials engineering.
2) Our alumni will demonstrate an accomplished understanding of the interface between living and nonliving materials that includes the body of knowledge unique to the biomedical and biotechnology applications of materials science and engineering.
3) Our alumni will be key individuals who can help other engineers accomplish a successful interface with the biomedical and biotechnology industries.
4) A substantial number of our graduates will accomplish further educational and career goals in the healthcare professions. These accomplishments include graduation from medical school, graduate school, and law school.
5) Our alumni will have accomplished tasks uniquely related to the ethical considerations created by the use of materials in medicine. As professional bioengineers, such tasks could include providing guidance to their employers (including the government) on health, safety, and industrial hygiene issues that arise from the use of materials living systems. In the university setting, such tasks could include participation on the Institutional Committees that address biosafety, human subjects, and animal welfare. In industrial, government, or academic settings, such accomplishments could include publication of articles that address the bioethics of materials in medicine.

BMES Degree Requirements and Curriculum
In addition to Alfred University's physical education requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Biomedical Materials Engineering Science are:

Mathematics (includes BIOL226)	17
Chemistry	8
Physics	8
Science and Engineering Requirements	65
Science and Engineering Electives	14
Humanities, Social Science and Communication	20
Total credit hours	**132**

The BMES curriculum is as follows:

Semester 1

MATH 151	Calculus I	4
CHEM 105	General Chemistry I	4
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 160	Freshman Seminar	0
CEMS 107	Materials Processing	3
Semester 1 Total Credit Hours		**15**

Semester 2

MATH 152	Calculus II	4
CHEM 106	General Chemistry II	4
ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Engineering	2
ENGR 160	Freshman Seminar	0
BIOL 201	Biology I	4
Semester 2 Total Credit Hours		**16**

Semester 3		
MATH 253	Calculus III	3
ENGR 110	Technical Communications	4
ENGR 360	Undergraduate Seminar	0
CEMS 214	Structure and Properties	3
CEMS 215	Microscopy and Microstructural Characterization	3
BIOL 202	Biology II	4
Semester 3 Total Credit Hours		**17**
Semester 4		
MATH 271	Differential Equations	3
PHYS 125	Physics II	4
ENGR 360	Undergraduate Seminar	0
CEMS 216	Structure and Bonding	3
CEMS 235	Thermodynamics of Materials	4
CHEM 310	Basic Organic Chemistry	3
Semester 4 Total Credit Hours		**17**
Semester 5		
PHYS 126	Physics 2	4
ENGR 360	Undergraduate Seminar	0
MECH 211	Statics	3
CEMS 368	Introduction to Bioengineering	3
Humanities/Social Science Electives		8
Semester 5 Total Credit Hours		**18**
Semester 6		
ENGR 360	Undergraduate Seminar	0
MECH 241	Mechanics of Materials	3
CEMS 334	Polymer Science	3
CEMS 347	Spectroscopy	2
CEMS 349	X-ray Characterization	2
BIOL 226	Biostatistics	
or ENGR 305	Engineering Statistics	3
Humanities/Social Science Electives		4
Semester 6 Total Credit Hours		**17**
Semester 7		
ENGR 360	Undergraduate Seminar	0
CEMS 336	Introduction to Physical Metallurgy	3
CEMS 484	Engineering Operations	4
CEMS 480	Thesis I	2
CEMS 468	Biomedical Materials	3
Biology Elective		4
Semester 7 Total Credit Hours		**16**
Semester 8		
ENGR 360	Undergraduate Seminar	0
CEMS 481	Thesis II	2
Biology Elective		4
Engineering or Science elective		3
Technical Elective		3
Humanities/Social Science Elective		4
Semester 8 Total Credit Hours		**16**

Ceramic Engineering (CE)

Ceramics are materials of basic living, of advanced technology, and of extreme environments. You encounter traditional ceramics every day of your life-dinnerware, bathroom fixtures, floor and wall tiles, and cement and brick structures. You also encounter advanced ceramics every day, but often hidden from view-components in electronic devices (computers, iPods, cellular phones), sensors in automobiles, igniters in appliances. Finally, ceramics are often used in manufacturing other materials and products-refractories that contain molten metals, filters for molten materials, insulators for furnaces, cutting tools, abrasives, and wear-resistant components.

In a nutshell, ceramics are some of the oldest and some of the newest materials we use. The field is small, but highly diverse, growing, and wide open for bright people with imagination. Many issues that impact energy conservation, recycling, and other environmental concerns can only be solved by the use of ceramics, including some that haven't been invented yet.

Ceramic engineering graduates have many career paths to choose from. Many become process engineers, ensuring that manufacturing operations run smoothly and developing improvements that enhance production efficiency and save energy. Others work in technical sales, explaining materials and products, and working with customers to achieve the best match between needs and products. Some are engaged in developing new materials and processes, or in testing materials and components. Of course, some choose to continue their education, achieving a Masters or Ph.D., and then going into research and/or teaching. Many ceramic engineering graduates, regardless of their initial path, achieve management positions (supervisors, plant managers, directors of research, etc.), and many end up owning their own companies.

CE Program Objectives

The objectives of the Ceramic Engineering program are as follows:

1) Graduates of the Ceramic Engineering Program will be materials engineers whose focus is on ceramic materials.
2) Graduates of the Ceramic Engineering Program will both understand the principles of engineering and can undertake the practice of producing and characterizing engineered ceramic materials.
3) Graduates of the Ceramic Engineering Program will be able to operate as engineers or managers in the field of ceramic materials and related industries, or in academia.

CE Degree Requirements and Curriculum

In addition to Alfred University's physical education requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Ceramic Engineering are:

Mathematics (including ENGR 305)	17
Chemistry	8
Physics	8
Engineering courses, required	73
Science and Engineering courses, elective	6
Humanities, Social Science and Communication	20
Total credit hours	**132**

The Ceramic Engineering curriculum is as follows:

Semester 1		
MATH 151	Calculus I	4
CHEM 105	General Chemistry I	4
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 160	Freshman Seminar	0
CEMS 107	Materials Processing	3
Semester 1 Total Credit Hours		**15**
Semester 2		
MATH 152	Calculus II	4
CHEM 106	General Chemistry II	4
PHYS 125	Physics I	4
ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Engineering	2
ENGR 160	Freshman Seminar	0
Semester 2 Total Credit Hours		**16**
Semester 3		
MATH 253	Calculus III	3
PHYS 126	Physics II	4
ENGR 110	Technical Communications	4
ENGR 360	Undergraduate Seminar	0
CEMS 214	Structure and Properties	3
CEMS 215	Microscopy and Microstructural Characterization	3
Semester 3 Total Credit Hours		**17**
Semester 4		
MATH 271	Differential Equations	3
ENGR 360	Undergraduate Seminar	0
CEMS 216	Structure and Bonding	3
CEMS 235	Thermodynamics of Materials	4
CEMS 203	Introduction to Ceramic Powder Processing	3
Humanities/Social Science Elective		4
Semester 4 Total Credit Hours		**17**
Semester 5		
ENGR 305	Engineering Statistics	3
ENGR 360	Undergraduate Seminar	0
MECH 211	Statics	3
CEMS 237	Kinetics	4
CEMS 347	Spectroscopy	2
CEMS 349	X-ray Characterization	2
CEMS 314	Ceramic Processing Principles	3
Semester 5 Total Credit Hours		**17**
Semester 6		
ENGR 360	Undergraduate Seminar	0
MECH 241	Mechanics of Materials	3
CEMS 344	Electrical, Optical and Magnetic Properties	4
CEMS 221	Electrical Engineering Laboratory	2
CEMS 321	Instrumentation and Controls for Engineers	2
CEMS 31x	Ceramic Engineering (tbd)	3
Humanities/Social Science Elective		4
Semester 6 Total Credit Hours		**18**

Semester 7		
ENGR 360	Undergraduate Seminar	0
CEMS 342	Thermal and Mechanical Properties	4
CEMS 484	Engineering Operations	4
CEMS 480	Thesis I	2
Ceramic Engineering Elective		3
Humanities/Social Science Elective		4
Semester 7 Total Credit Hours		**17**

Semester 8		
ENGR 360	Undergraduate Seminar	0
CEMS 481	Thesis II	2
Ceramic Engineering Elective		3
Technical Electives		6
Humanities/Social Science Elective		4
Semester 8 Total Credit Hours		**15**

Electrical Engineering (EE)
Electrical Engineering is the largest and most diverse field of engineering today. It deals with the practical application of electrical science and technology to the needs of society as well as to research in and development of new applications. Areas such as electronic information processing and communications, semiconducting devices, superconducting devices, computer systems, electronic instrumentation, power and machinery, control systems, and signal systems and analysis are covered. A minor in mathematics is easily obtained by Electrical Engineering students. A degree in Electrical Engineering, along with the professional engineer's license, guarantees a wide variety of career options: industry, research, marketing, consulting, management, sales, teaching, graduate school, or government.

Fields of Specialization in Electrical Engineering
Automatic Control and Robotics
Modern control systems are used for controlling the many production systems found in industrial plants and in data processing necessary in banks and other businesses. Controllers are implemented using analog components, microprocessors, PCs, and digital signal processors. The mathematics of control includes the modeling of physical systems, both natural and man-made.

Computer Engineering
Computer Engineers are concerned with the design and production of the hardware and software components comprising computer systems, computer organization and architecture, system programming, operating systems, and digital hardware design. Computer Engineers do research into network design and artificial intelligence, and embedded systems.

Power Generation, Transmission, Distribution and Use
The pervasive need for electrical energy for both industrial and private use guarantees job opportunities for electrical engineers who are concerned with all forms of power generation, transmission and distribution.
Some electrical engineers may work on innovative energy conversion by solar, fuel cell, wind generation or other alternative sources.

Communication Systems and Optoelectronics
Electrical engineers in this area may work in radio, television, telephone, or in satellite, microwave or fiber optics systems. This field requires knowledge of antennas, lasers, electromagnetic principles for waveguides and electrical and optical properties of materials.

Electronic Materials and Solid-State Circuitry
Microcircuitry is assisting the revolutions in information systems, instrumentation and controls, communications systems, and even automotive and consumer products. The microprocessor integrated circuit is altering operational methods in nearly all electrical engineering applications. Engineers who work in electronics design and development require knowledge of both electrical science and materials.

Electroceramics
These are the enabling materials for nearly all passive and active electrical components. Electroceramics are often the materials that give physical existence to the work of electrical engineers. For example, superconductors, fuel cell electrolytes, and phosphors are all electroceramics. Typical electroceramic components, produced by the billions, include multilayer capacitors, inductors, resistors, filters, resonators, sensors, actuators, computer chip substrates, and other solid state electronic parts.

EE Program Objectives
The objectives of the Electrical Engineering Program are to produce engineers who 1) advance in multidisciplinary engineering careers within the context of Electrical Engineering beginning with either entry-level positions in industry or postgraduate studies in electrical engineering and related fields, 2) actively engage in teams that solve problems with independent thinking with a drive towards excellence in their job/study performance, and 3) adopt the engineering method with their lifelong learning skills with understanding of complex social issues where engineering will play a key role.

EE Degree Requirements and Curriculum
In addition to Alfred University's physical education requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Electrical Engineering are:

Engineering Courses, required	58
Engineering Courses, electives	15
Humanities/Social Sciences	20
Mathematics (includes ENGR 305)	20
Physics	8
Chemistry	4
Total credit hours	**125**

The Electrical Engineering curriculum is as follows:

Semester 1

CHEM 105	General Chemistry I	4
ELEC 106	Discoveries Laboratory	2
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 160	Seminar	0
MATH 151	Calculus I	4
ENGR 110	Technical Communications	4
Semester Total Credit Hours		**18**

Semester 2

ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Design	2
ENGR 160	Seminar	0
MATH 152	Calculus II	4

PHYS 125	Physics I	4
Humanities/Social Sciences Elective		4
Semester Total Credit hours		**16**

Semester 3

ELEC 210	Digital Logic	4
ENGR 206	Engineering Economy	3
ENGR 360	Undergraduate Seminar	0
MATH 253	Calculus III	3
PHYS 126	Physics II	4
Semester Total Credit hours		**14**

Semester 4

ELEC 220	Circuit Theory I	4
ELEC 303	Software Engineering	4
ELEC 310	Microprocessor Systems	4
ENGR 360	Undergraduate Seminar	0
MATH 271	Differential Equations	3
Semester Total Credit Hours		**15**

Semester 5

ELEC 320	Circuit Theory II	4
ELEC 354	Device Electronics	3
ENGR 305	Engineering Statistics	3
ENGR 360	Undergraduate Seminar	0
MECH 320	Thermodynamics I	3
Humanities/Social Sciences Elective		4
Semester Total Credit Hours		**17**

Semester 6

ELEC 322	Signals and Systems	3
ELEC 356	Electronic Circuits	4
ENGR 360	Undergraduate Seminar	0
ENGR 388	Applied Complex Variables	3
Humanities/Social Sciences Elective		4
Semester Total Credit Hours		**14**

Semester 7

ELEC 468	Electric Machinery	3
ELEC 490	Engineering Design Methods	2
ENGR 360	Undergraduate Seminar	0
Technical Elective		3
Technical Elective		3
Technical Elective		3
Semester Total Credit Hours		**14**

Semester 8

ELEC 496	Senior Design Project	4
ENGR 360	Undergraduate Seminar	0
MECH 212	Dynamics	3
Humanities/Social Sciences Elective (advanced)		4
Technical Elective		3
Technical Elective		3
Semester Total Credit Hours		**17**

EE Technical Electives
Electrical Engineering students take a minimum of 15 credit hours of technical electives.

These courses are chosen in consultation with the student's advisor to form an in-depth, coherent plan of study. A minimum of four hours must involve aspects of design.

Glass Engineering Science (GES)

Glasses have been used for thousands of years--in drinking glasses, storage bottles, prized decorative objects, and jewelry. Glasses have these same uses today, but glasses are truly high-technology materials used in optical applications, as sophisticated windows that control light and heat, and in fiber optics that make high-speed, high-capacity voice and data communications possible. Glasses are essential components of many medical devices, such as X-ray tubes, endoscopes, and lasers. Advanced testing is being done on using small glass spheres, injected into the bloodstream, to carry radiation or chemotherapy agents directly to the liver to attack cancer in the liver.

Most glass products are made from abundant raw materials, such as sand and soda, and glasses are recyclable. In fact, in some countries, glass containers are made using over 90% recycled glass. There are numerous opportunities for new applications for glass, the development of new glasses, and further efficiencies in glass manufacturing. You can't imagine life today without glass, and that will be even more the case in the future.

Glass engineering science graduates are highly sought after by the glass industry and by companies that use glasses in processes or products. The Glass Engineering Science program is unique. There simply isn't another program like it in the United States. Graduates can oversee glass production, work on developing new processes and products, test glass products, or work in technical sales. Many choose to continue their education, obtaining a Masters or Ph.D., preparing them for research or teaching at a college or university. With time, and the time may be very short, many will become managers or owners of their own companies.

GES Program Objectives

The program objectives of the Glass Engineering Science program are as follows:

1) Graduates of the Glass Engineering Program will be fully qualified as materials engineers with a specialized knowledge of the vitreous state, its science, engineering and manufacture.

2) Graduates of the Glass Engineering Science Program will be well-rounded individuals who both understand the principles and can undertake the practice of engineering materials, particularly glass.

3) Graduates of the Glass Engineering Program will be able to operate as effective engineers or managers in both glass and other related industries or academia.

GES Degree Requirements and Curriculum

In addition to Alfred University's physical education requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Glass Engineering Science are:

Mathematics (including ENGR 305)	17
Chemistry	8
Physics	8
Engineering courses, required	69
Science and Engineering courses, elective	9
Humanities, Social Science and Communication	20
Total credit hours	**131**

The Glass Engineering Science curriculum is as follows:

Semester 1		
MATH 151	Calculus I	4
CHEM 105	General Chemistry I	4
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 160	Freshman Seminar	0
CEMS 107	Materials Processing	3
Semester Total Credit Hours		**15**
Semester 2		
MATH 152	Calculus II	4
CHEM 106	General Chemistry II	4
PHYS 125	Physics I	4
ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Engineering	2
ENGR 160	Freshman Seminar	0
Semester Total Credit Hours		**16**
Semester 3		
MATH 253	Calculus III	3
PHYS 126	Physics II	4
ENGR 110	Technical Communications	4
ENGR 360	Undergraduate Seminar	0
CEMS 214	Structure and Properties	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**18**
Semester 4		
MATH 271	Differential Equations	3
ENGR 360	Undergraduate Seminar	0
CEMS 216	Structure and Bonding	3
CEMS 235	Thermodynamics of Materials	4
CEMS 215	Microscopy and Microstructural Characterization	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**17**
Semester 5		
ENGR 305	Engineering Statistics	3
ENGR 360	Undergraduate Seminar	0
MECH 211	Statics	3
CEMS 237	Kinetics	4
CEMS 347	Spectroscopy	2
CEMS 349	X-ray Characterization	2
CEMS 322	Introduction to Glass Science	3
Semester Total Credit Hours		**17**
Semester 6		
ENGR 360	Undergraduate Seminar	0
MECH 241	Mechanics of Materials	3
CEMS 344	Electrical, Optical and Magnetic Properties	4
CEMS 221	Electrical Engineering Laboratory	2
CEMS 321	Instrumentation and Controls for Engineers	2
CEMS 325	Glass Lab	2
Technical Elective		3
Semester Total Credit Hours		**16**

Semester 7		
ENGR 360	Undergraduate Seminar	0
CEMS 342	Thermal and Mechanical Properties	4
CEMS 484	Engineering Operations	4
CEMS 480	Thesis I	2
CEMS 324	Mass Transport in Glass and Melts	3
Technical Elective		3
Semester Total Credit Hours		**16**

Semester 8		
ENGR 360	Undergraduate Seminar	0
CEMS 481	Thesis II	2
CEMS 328	Industrial Glass and Glass-Ceramics	3
Technical Elective		3
Humanities/Social Science Electives		8
Semester Total Credit Hours		**16**

Materials Science and Engineering (MSE)
Advanced materials are critical to nearly every modern technology (electronics, transportation systems, and medical devices). They also play an important role in the solutions to energy and environmental problems we face today. Materials Science and Engineering (MSE) is the broad interdisciplinary field that uses the principles of chemistry, physics, engineering, and biology to develop the improved materials. With an increased focus on nanotechnology, the field is advancing rapidly and will be at the heart of new technologies that we haven't even envisioned.

A materials engineer may specialize in a specific material class (ceramics, metals, polymers) or a specific area of materials science (electrical properties, mechanical properties, processing, testing, etc.), but should possess a broad background in materials science and engineering. Increased emphasis on cost, weight, and size reduction, while still improving product performance, creates challenges for monolithic materials, and opportunities for composites and other new materials. Miniaturization of components frequently is limited by the interactions of dissimilar materials at a microscopic scale. A materials engineer must be able to optimize the overall performance of complex systems involving several materials. In many industries, several materials may be competing for the same market (e.g., polymer composites versus metallic aircraft structures, and ceramic versus metallic engine components). In these applications, a materials engineer must be able to make an unbiased decision in selecting the best material (or combination of materials), which requires a fundamental understanding of the properties and performance of each of the competing materials.

The broad technical base of the Materials Science and Engineering degree prepares graduates for employment in a wide range of industries, including electronics, automotive, and aerospace, as well as for graduate school in engineering and science. Graduates of this program are particularly well suited to work for smaller companies that need materials engineers with a broad background, rather than people specialized in particular fields. Many companies involved in manufacturing require engineers with this broad materials background who can specify materials selection, oversee production, or maintain quality control.

MSE Program Objectives
The MSE program objectives are as follows:

1) MSE program graduates will be prepared for careers in materials related industries and will continue to move into positions with both increased technical skill requirements and increased managerial responsibilities.
2) MSE program graduates will be prepared to continue their educational endeavors in both technical and non-technical fields including graduate studies in MSE, and in other science and engineering majors; MBA programs; medical school; law school or short course/workshops applicable to growth within a chosen technical field.
3) MSE program graduates will be prepared to become leaders in the development of their professions including professional society activities, conference presentations, scholarly publications, and student recruiting and mentoring.

MSE Degree Requirements and Curriculum
In addition to Alfred University's physical education requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Materials Science and Engineering are:

Mathematics (including ENGR 305)	17
Chemistry	8
Physics	8
Engineering courses, required	73
Science and Engineering courses, elective	6
Humanities, Social Science and Communication	20
Total credit hours	**132**

The Materials Science and Engineering curriculum is as follows:

Semester 1		
MATH 151	Calculus I	4
CHEM 105	General Chemistry I	4
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 160	Freshman Seminar	0
CEMS 107	Materials Processing	3
Semester Total Credit Hours		**15**
Semester 2		
MATH 152	Calculus II	4
CHEM 106	General Chemistry II	4
PHYS 125	Physics I	4
ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Engineering	2
ENGR 160	Freshman Seminar	0
Semester Total Credit Hours		**16**
Semester 3		
MATH 253	Calculus III	3
PHYS 126	Physics II	4
ENGR 110	Technical Communications	4
ENGR 360	Undergraduate Seminar	0
CEMS 214	Structure and Properties	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**18**
Semester 4		
MATH 271	Differential Equations	3
ENGR 360	Undergraduate Seminar	0

CEMS 216	Structure and Bonding	3
CEMS 235	Thermodynamics of Materials	4
CEMS 215	Microscopy and Microstructural Characterization	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**17**

Semester 5		
ENGR 305	Engineering Statistics	3
ENGR 360	Undergraduate Seminar	0
MECH 211	Statics	3
CEMS 237	Kinetics	4
CEMS 322	Introduction to Glass Science	3
CEMS 347	Spectroscopy	2
CEMS 349	X-ray Characterization	2
Semester Total Credit Hours		**17**

Semester 6		
ENGR 360	Undergraduate Seminar	0
MECH 241	Mechanics of Materials	3
CEMS 344	Electrical, Optical and Magnetic Properties	4
CEMS 221	Electrical Engineering Laboratory	2
CEMS 321	Instrumentation and Controls for Engineers	2
CEMS 334	Polymer Science	3
Technical Elective		3
Semester Total Credit Hours		**17**

Semester 7		
ENGR 360	Undergraduate Seminar	0
CEMS 342	Thermal and Mechanical Properties	4
CEMS 484	Engineering Operations	4
CEMS 480	Thesis I	2
CEMS 316	Chemical Processing of Ceramics	3
or CEMS 314	Ceramic Processing Principles	
CEMS 336	Introduction to Physical Metallurgy	3
Semester Total Credit Hours		**16**

Semester 8		
ENGR 360	Undergraduate Seminar	0
CEMS 481	Thesis II	2
CEMS 446	Composite Design and Fabrication	3
Technical Elective		3
Humanities/Social Science Electives		8
Semester Total Credit Hours		**16**

Mechanical Engineering (ME)
Mechanical engineers are often called the 'general practitioners' of engineering because of the broad scope of their education and the diversity of their professional opportunities. The characteristics commonly shared by mechanical engineers are individuality, creativity and flexibility. Due to its breadth, Mechanical Engineering is generally linked to the economy as a whole; job prospects are relatively immune to isolated economic events.

Mechanical Engineering is an ideal education for professional entrance into industry, for development of one's own company, or for a variety of opportunities in educational institutions and government agencies.

A bachelor's degree in Mechanical Engineering frequently precedes the study of law, business or medicine, as well as graduate engineering studies. Because the undergraduate training is broad, as well as comprehensive, the mechanical engineer is in demand in practically every type of manufacturing, research and government organization. He/she may be employed in the automotive, aerospace, electrical, chemical, solar, petroleum, plastics, or metal-processing industries. The work may involve one or several of the following: research and development, design and testing of equipment and systems, supervision of production, sales engineering, plant engineering, and administration.

Some mechanical engineers work in areas not usually considered to require engineering expertise. For example, biomechanical engineers work with physicians to investigate the mechanics of the body and to design instruments and devices for medical purposes. Other mechanical engineers work closely with trainers and athletes, to design sports equipment. Certainly, the professional mechanical engineer has influenced most products and systems we deal with on a regular basis.

Some examples of mechanical engineering applications include:

- Applied Mechanics. Engineers apply mechanics principles to the study, design, and development of systems and components that transmit specified motion, forces, and power and that withstand the stresses, strain, fatigue, shock, and vibration within the system itself.
- Controls. With the advent of the microprocessor, on-line data processing and control are incorporated into a variety of manufacturing and processing systems.
- Design. Design engineers combine a working knowledge of materials and components with the complexities and economics of assembling these components into products and systems.
- Engines and Power Plants. Engineers work with reciprocating and rotating engines utilizing gas combustion or steam pressure to generate power that is transmitted through shaft motion.
- Energy. Engineers make use of solar, wind, geothermal, nuclear and fossil-fuel sources to generate power.
- Fluids. Utilizing the various properties of fluids such as density, viscosity, and compressibility, engineers develop applications with these fluids for new hydraulic control or power transmission devices.
- Lubrication. Engineers try to inhibit the wear on moving parts by choosing or developing a lubricating method that minimizes friction and energy dissipation.
- Heating, Ventilating, and Air-Conditioning (HVAC). HVAC engineers must understand heat transfer, thermodynamics, and control theory to develop energy-efficient systems that control temperature and air quality.
- Materials. Mechanical engineers select, develop, and apply materials for bearings, brakes, clutches, gears, chains, screws, bolts, lubrication, insulation, heat transfer, and so on.
- Pressure Vessels and Piping. Containment structures for solids, liquids and gases are developed to withstand temperatures and pressures, which may vary dynamically.
- Transportation and Aerospace. Engineers in this specialty are engaged in the production or study of the motion of automobiles, trains, ships, planes, missiles, satellites, and rockets. Among their many responsibilities, they may develop improved gasoline or diesel engines, improve automobile power train transmission characteristics, modify the configuration of aircraft structures, or improve solid propellant rocket engines.

The mechanical engineering faculty stresses undergraduate research as an important part of the educational process.

Many undergraduate students participate in their faculty's research programs, which offer excellent opportunities for students to apply the knowledge they have gained in classrooms and to be aware of the current industrial needs and state of technologies. Undergraduate students also have opportunity to gain valuable experiences participating in engineering, research, and/or manufacturing projects through cooperative education and internship programs at a companies or national laboratory.

The mission of the Mechanical Engineering Division is to provide a superior student-centered engineering education within a small university environment. Our dedicated faculty place highest value on the undergraduate teaching-learning process, while also being active in professional engineering activities and societies and engaging in scholarly activities. Graduates of our program will understand the social and ethical implications of their engineering decisions, and be prepared to excel in the engineering profession.

ME Program Objectives

The objectives of the Mechanical Engineering program are as follows: 1)to produce engineers who have a broad based mechanical engineering background with a solid foundation in the fundamental principles of science and engineering, 2) to produce graduates who are skilled at applying math, science and engineering principles to solve technical problems, 3) to produce graduates who are able to communicate effectively about their work and can function collaboratively in multi-disciplinary teams, 4) to produce graduates who have the skills for critical thinking and lifelong learning and who place a high value on professional integrity and ethical responsibility.

ME Degree Requirements and Curriculum

In addition to Alfred University's PE requirement and Global Perspective requirement (see pg. 57), and the School of Engineering general requirements, the minimum requirements for the Bachelor of Science in Mechanical Engineering are:

Engineering Courses, required	64
Engineering Courses, electives	9
Humanities/Social Sciences	20
Mathematics (includes ENGR 305)	21
Physics	8
Chemistry	8
Total credit hours	**130**

The Mechanical Engineering curriculum is as follows:

Semester 1		
CHEM 105	General Chemistry I	4
ENGR 101	Introduction to Engineering	2
ENGR 102	Computer Aided Design	2
ENGR 360	Undergraduate Seminar	0
MATH 151	Calculus I	4
ENGR 110	Technical Communications	4
Semester Total Credit Hours		**16**
Semester 2		
CHEM 106	General Chemistry II	4
ENGR 103	Introduction to Software Engineering	2
ENGR 104	Computer Aided Engineering	2
ENGR 360	Undergraduate Seminar	0
MATH 152	Calculus II	4

PHYS 125	Physics I	4
Semester Total Credit Hours		**16**

Semester 3

ENGR 360	Undergraduate Seminar	0
MATH 253	Calculus III	3
MECH 211	Statics	3
CEMS 214	Structure and Properties	3
PHYS 126	Physics II	4
Humanities/Social Science Elective		4
Semester Total Credit Hours		**17**

Semester 4

ELEC 220	Circuit Theory I	4
ENGR 360	Undergraduate Seminar	0
MATH 271	Differential Equations	3
MECH 212	Dynamics	3
MECH 241	Mechanics of Materials	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**17**

Semester 5

ENGR 305	Engineering Statistics	3
ENGR 360	Undergraduate Seminar	0
MECH 320	Thermodynamics I	3
MECH 324	Fluid Mechanics	3
MECH 343	Mechanics of Materials Lab	2
MECH 362	Kinematics and Dynamics of Machines	3
Humanities/Social Science Elective		4
Semester Total Credit Hours		**18**

Semester 6

ENGR 360	Undergraduate Seminar	0
MECH 321	Thermodynamics II	3
MECH 326	Heat Transfer	3
MECH 327	Thermal Sciences Lab	2
MECH 364	Machine Design	3
MECH 366	Manufacturing	3
MECH	Elective	3
Semester Total Credit Hours		**17**

Semester 7

ENGR 206	Engineering Economy	3
ENGR 360	Undergraduate Seminar	0
MATH 401	Advanced Engineering Math	4
MECH 417	Introduction to Finite Element Analysis	3
MECH 495	Senior Design I	3
MECH	Elective	3
Semester Total Credit hours		**16**

Semester 8

ENGR 360	Undergraduate Seminar	0
MECH 496	Senior Design II	3
MECH	Elective	3
Humanities/Social Science Elective		4
Technical Elective		3
Semester Total Credit Hours		**13**

The Mechanical Engineering Manufacturing Concentration
This option is available for those considering advanced study and/or careers in manufacturing industries. Courses are selected from such areas as business, economics, and mechanical engineering. The Bachelor of Science in ME with a concentration in manufacturing may be completed in four years.

Undecided Engineering Major – First-Year Option
The School of Engineering provides a first-year option that enables students to smoothly progress into the sophomore year in any of the engineering programs. This alternative to the specific programs allows students to experience the various types of engineering before choosing a major as a sophomore. Note that students selecting the undecided options may be required to take 2 to 5 credits above those required for the major they eventually select, depending on the major they chose. The following tables compare the first-year undecided option to the first-year curricula of the specific engineering degrees.

Semester One

Undecided Option	BMES/CE/ GES/MSE	EE	ME
MATH 151	MATH 151	MATH 151	MATH 151
CHEM 105	CHEM 105	CHEM 105	CHEM 105
ENGR 101	ENGR 101	ENGR 101	ENGR 101
ENGR 102	ENGR 102	ENGR 102	ENGR 102
ENGR 160	ENGR 160	ENGR 160	ENGR 160
ELEC 106		ELEC 106	
CEMS 107	CEMS 107		
			PHED
	ENGL 101*	ENG101* or ENGR 110	ENGL 101* or ENGR 110
17 credit hours	15 or 19 credit hrs	18 credit hours	18 credit hours

Semester Two

Undecided	BMES	CE/GES/ MSE	EE	ME
MATH 152	MATH 152	MATH 152	MATH 152	MATH 152
PHYS 125	BIOL 202	PHYS 125	PHYS 125	PHYS 125
CHEM 106	CHEM 106	CHEM 106		CHEM 106
ENGR 103	ENGR 103	ENGR 103	ENGR 103	ENGR 103
ENGR 104	ENGR 104	ENGR 104	ENGR 104	ENGR 104
ENGR 160	ENGR 160	ENGR 160	ENGR 160	ENGR 160
ENGL 101*			Humanities	
16 or 20 credit hours	16 credit hours	16 credit hours	16 credit hours	16 credit hours

**** Students are exempted from ENGL 101 for a score >540 on the SAT Verbal, or >500 on the SAT Writing Exam or SAT II, or >26 on the ACT-English. Credits earned by successfully completing ENGL101 do not count towards the degree credit requirements.**

Minors in the School of Engineering

Students enrolled in any of the School's undergraduate degree programs may take one of the following minors: Biomedical Materials, Electrical Engineering, Glass Science and Technology, Materials Science, or Photonics and Optical Materials.

Biomedical Materials Minor

Required courses (10 – 15 credit hours)		
BIOL 362	Molecular Cell Biology	4
CHEM 310	Basic Organic Chemistry	
or CHEM 315/315	Organic Chemistry I and II	3-8
CEMS 468	Biomedical Materials	3
Plus at least two courses from the following (6-7 credits)		
CEMS 115	*Materials and Society	4
CEMS 214	*Structure and Properties	3
CEMS 215	Microscopy & Microstructural Characterization	3
CEMS 251	*Mechanics of Materials	
CEMS 334	Polymer Science	3
CEMS 336	Introduction to Physical Metallurgy	3
CEMS 342	Thermal/Mechanical Properties	3
CEMS 368	Introduction to Bioengineering	3
CEMS 434	Polymer Characterization	3
CEMS 436	Physical Metallurgy	3
CEMS 446	Composite Design and Fabrication	3
Plus at least two courses from the following (8 credits)		
BIOL 302	General Microbiology	4
BIOL 372	Advanced Cell Biology	4
BIOL 376	Animal Physiology	4
BIOL 402	Immunology	4
BIOL 420	Biochemistry: Proteins and Metabolism	4
BIOL 422	Biochemistry: Nucleic Acids	4
Total credit hours		**24-30**

*** Students cannot use two starred courses to satisfy requirements for the minor.**
All chemistry, biology and math prerequisites for these courses must also be satisfied (typically CHEM 105/106, BIOL 201/202 and MATH 151/152) and may not count as CEMS Technical Electives (300 & 400 level courses in CEMS); therefore this Minor will require completion of more than 24-30 credit hours.

This Minor in Biomedical Materials could be helpful for students planning to apply for graduate school in the field of Biomedical Engineering, either at Alfred or elsewhere. Students that plan on applying for graduate school at Alfred in the Biomedical Materials Engineering Science (BMES) program may be able to take courses for the minor as graduate credit and reduce the time it takes to complete the Masters of Science degree in BMES. This may also require combining the student's undergraduate thesis research with their graduate thesis topic.

Electrical Engineering Minor

Electrical Engineering offers a minor in Electrical Engineering. This is accomplished by taking either ELEC 220 (4 credit hours) or CEMS 221 (2 credit hours), *plus* 16 credit hours from the following list:

ELEC 210	Digital Logic	4
ELEC 303	Software Engineering	4
ELEC 310	Microprocessor Systems & Applications	4
ELEC 320	Circuit Theory II	4
ELEC 322	Signals and Systems	3
ELEC 354	Device Electronics	3

ELEC 356	Electronic Circuits	4
ELEC 400	Topics in Electrical Engineering	2-4
ELEC 422	Control Systems	3
ELEC 424	Digital Control Systems	3
ELEC 440	Communications Systems Engineering	3
ELEC 444	Applied Electromagnetism	3
ELEC 452	Superconducting Electronics	3
ELEC 468	Electric Machinery	3
ELEC 478	Electric Power Systems	3
ELEC 486	VLSI Design	3
ELEC 487	Laser Theory and Applications	3
ELEC 563	Plasma Engineering	3
Total credit hours		**18-20**

Glass Science and Technology Minor
Required Courses (8 credits)

CEMS 322	Introduction to Glass Science	3
CEMS 325	Glass Laboratory	2
CEMS 328	Industrial Glass and Glass-Ceramics	3
Plus at least 6 credits from among the following:		
CEMS 324	Mass Transport in Glasses and Melts	3
CEMS 420	Optical Glasses	3
CEMS 424	Introduction to Photonics	3
CEMS 425	Optical Spectra of Solids	2
CEMS 426	Advanced Glass Science	3
CEMS 450*	Independent Study in Glass	1-3
CEMS 480/481*	Senior Thesis in Glass	4
COOP 385*	Co-op Program (in Glass)	3
Total credit hours		**14**

***with permission of instructor and minor advisor**

Materials Science Minor
Required Courses (9 credits)

CEMS 214	Materials Science II	3
CEMS 251	Mechanics of Materials	3
CEMS 235	Thermodynamics of Materials	3
Plus at least 2 of the following 4 courses (6 credits) **		
CEMS 203	Introduction to Powder Processing	3
CEMS 322	Introduction to Glass Science	3
CEMS 334	Polymer Science	3
CEMS 336	Physical Metallurgy I	3
CEMS 446	Composite Design and Fabrication	
Total credit hours		**15**

*** The two courses chosen must be beyond the requirements for the student's major (The following cannot be counted towards the materials science minor requirements: CEMS 203 and CEMS 322 for CE majors; CEMS 322 for GES majors; and CEMS 334 and CEMS 336 for BMES majors.)**

Photonics and Optical Materials Minor
Required Courses (8 credits)

CEMS 322	Introduction to Glass Science	3
CEMS 428	Fundamentals of Optical Behavior	2
CEMS 424	Introduction to Photonics	3
Plus at least 7 credits from among the following:		
CEMS 325	Glass Laboratory	2
CEMS 352	Electroceramics	3
COOP 385*	Co-op (in Optical Materials/Photonics)	3

CEMS 420	Optical Glasses	3
CEMS 425	Optical Spectra of Solids	2
CEMS 450*	Independent Study in Optical Materials/Photonics	1-3
CEMS 480/481*	Senior Thesis in Optical Materials/Photonics	4
ELEC 354	Device Electronics	3
ELEC 420	Communications Systems Engineering	3
ELEC 444	Optical Fiber Communications Systems	3
ELEC 472	Image Processing	3
ELEC 487	Laser Theory and Applications	3
PHYS 325	Elementary Optics	3
PHYS 401	Quantum Physics	4
PHYS 424	Advanced Electricity and Magnetism	4
Total credit hours		**15**

***with permission of instructor and minor advisor.**

Minors in Other Areas of Study

Minors in nearly every other area of study at the University are open to students in the School. Minors in business, mathematics, chemistry, and physics are very compatible with the degree programs, since upper-level courses in these areas can be used as technical electives. A minor in Business is facilitated by allowing two courses required for the Business minor, MKTG 221 and MGMT 328, to count as technical electives in BMES, CE, GES, and MSE. The Business minor can be used as the foundation for an MBA (see the section on MBA and Law Programs.)

Special Programs/Options/Opportunities

Cooperative Education (Co-op) and Internships

Undergraduate students have the opportunity to gain experience in a real engineering, research or manufacturing project at a company or national laboratory. Students in the co-op program commonly work during one of their junior year semesters during which they receive 3 academic credits; the sponsor pays a salary and some expenses. Co-op work sites for students in our program are extensive and are distributed from Maine to California in companies big and small. Quality work experience is considered to be extremely valuable by employers hiring graduates for permanent positions. Over 70% of our students participate in a co-op or an internship (summer employment) in an engineering environment before graduating.

Study Abroad

Opportunities exist abroad for our students to study in their major without impeding progress toward the degree, at the following institutions.

- University of Erlangen-Nürnberg; University of Clausthal, Germany
- University of Parma; University of Modena, Italy
- École Nationale Supérieure de Céramique Industrielle, Limoges, France
- University of Sheffield, England
- Kansai Gaidai University, Japan
- University Jaume I, Castellon, Spain

Students going to a non-English speaking country must complete language study through at least the first college year. An intensive language course abroad precedes study at the host institution. Knowledge of a foreign language and culture is considered quite valuable by employers operating in a global economy.

Double Degrees

Students have the option of obtaining two Bachelor degrees simultaneously in two different units of the University. The minimum requirements for the awarding two degrees are successful completion of at least 148 semester hours, completion of the general education requirements of both units, and completion of the specific requirements for each major. Students who wish to pursue double degrees should start as early as possible, and they need to have an academic advisor in each college or school.

Preparation for the Health Professions

An engineering education provides a strong background for continued study in the health professions. Interested students must choose electives wisely and maintain a high grade point average. Students must take biology (BIOL 201 and 201) and organic chemistry (CHEM 315 and 316). An upper-level course in biology is recommended.

Medical schools are interested in students who are aware of current medical trends in our society and who have strong written, oral, and interpersonal skills. Students need to be able to articulate the origin of their interest in medicine and to demonstrate that interest through volunteer/internship experiences in health care facilities/settings.

Interested students wanting more information about academic preparation and the application and admissions processes should consult with the Chair of the University Health Professions Advisory Committee.

Participation in Research

The School has more than $6 million of sponsored research annually. This research has a positive impact on the undergraduate programs in many ways, including by providing state-of-the-art equipment, by generating new knowledge that gets discussed in classes, and by maintaining contacts with industry. Also, many senior thesis projects are done in cooperation with companies or government laboratories. Opportunities for part-time work on funded research projects in the School are numerous. Many undergraduate students are hired for summer research positions in the School, and there are also opportunities for part-time work during the academic year.

"4+1" Engineering/MBA Program

Students in any of the School of Engineering's undergraduate degree programs who complete the minor in Business Administration also will have completed the foundation courses for the MBA program at Alfred University. These students can obtain an MBA at Alfred in one year of graduate study.

Engineering/Law

Engineering graduates are well prepared for the study of law, including patent law. Students who have an interest in engineering/law should discuss this option with their advisor as early as possible in their program.