

# School of Engineering

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## Degrees Offered and Accreditation

The School of Engineering offers four-year programs leading to Bachelor of Science in Engineering (B.S.E.) degrees in

Biomedical Engineering\* (128-credits)  
 Chemical Engineering\* (128-credits)  
 Civil Engineering\* (128-credits)  
 Computer Science and Engineering\*<sup>#</sup> (126-credits)  
 Computer Engineering\* (126-credits)  
 Electrical Engineering\* (126-credits)  
 Engineering Physics (128-credits)  
 Environmental Engineering\* (128-credits)  
 Materials Science & Engineering\* (128-credits)  
 Mechanical Engineering\* (128-credits)

Bachelor of Science (B.S.) degree (120-credits) in Computer Science<sup>#</sup>  
 Bachelor of Science (B.S.) degree (139-credits) in Management & Engineering for Manufacturing\* (jointly offered with the School of Business) and accredited by the Association to Advance Collegiate Schools of Business (AACSB)

The B.S.E. and B.S. programs shown above that are asterisked (\*), are accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD., 21202-4012; telephone: (410) 347-7700. The B.S.E. Engineering Physics program will be submitted for accreditation at the earliest opportunity.

The School of Engineering and the College of Liberal Arts and Sciences offer a five-year, double-degree *EUROTECH* program leading to a B.S. in Engineering degree and a B.A. degree in German. The program includes German Language courses specially designed to include engineering content, engineering courses taught partly in German, and a six-month internship in a company in Germany.

Students who wish to concentrate their elective work in a second field within the School of Engineering may elect a double major program. This program requires the completion of all requirements in both majors. Students are required to inform the Director of Undergraduate Advising if they change or add a major.

The School of Engineering also offers Minors in Bioinformatics, Biomedical Engineering, Electronics & Systems, Environmental Engineering, Information Technology, Materials Science & Engineering and Nanotechnology. Please refer to the "Minors" section of this publication for these and other relevant minor descriptions.

**Admission Requirements.** See Admission to the University section of this publication. All students admitted to the School of Engineering are required to take a calculus placement survey prior to attending summer orientation or registering for their first semester. Based on the survey results, students may be required to take additional preparatory course work that may not be counted toward graduation.

**Admission to Junior Year.** Students should declare their major as soon as possible, but no later than the second semester of their sophomore year.

**Supplementary Scholastic Standards.** In order to be admitted to their junior year in their selected major in the School of Engineering, each student must have a cumulative grade point average of at least 2.0 in all courses in mathematics, sciences, and engineering applicable toward the degree.

**Scholarships.** The School of Engineering offers academic merit based scholarships to continuing students. The University offers merit based scholarships to eligible incoming freshmen.

**Faculty Advisors and Student Mentors.** Faculty advisors are assigned to students entering the School of Engineering according to the student's major. Faculty advisors assist students in their course selections, counsel them in meeting their educational and career goals, and advise them in both academic and non-academic issues. The school's Mentoring, Advising and Tutoring (MAT) Center is staffed by undergraduate students and provides tutoring, coaching and mentoring to all engineering students during the day. Evening tutoring is available in the Mentoring, Advising and Tutoring (MAT) Center.

## School Academic Requirements

Students in the School of Engineering must complete the following requirements:

**General Education Requirements.** The University has adopted General Education Requirements in a variety of curricular areas, which must be satisfied as part of every bachelor's degree program. Additionally, each student must demonstrate competency in the University of Connecticut's five fundamental areas. These requirements appear in the "Academic Regulations" section of this *Catalog*.

**Additionally, all engineering students are required to complete:**

- A *Plan of Study* form submitted during the first semester of the junior year
- MATH 1131Q and 1132Q (or MATH 1125Q, 1126Q, and 1132Q), ENGR 1000 and CSE 1100 or 1010 and PHIL 1104
- All majors, except B.S. in Computer Science majors, are required to complete CHEM 1127Q (or CHEM 1147Q) and PHYS 1501Q and 1502Q
- The University writing (W) course requirement is fulfilled through required major-specific W course work. Most programs have the required two W courses specified in the curriculum. If there are not two W courses in the program, each student must take a minimum of one W course outside the major to satisfy the University's General Education writing requirements.

**Credit Restrictions.** The following courses may not be counted for credit toward graduation in the School of Engineering: MATH courses numbered 1120Q and below; MATH 1110; PHYS 1010 and 1030Q; CSE 1000; STAT 1000; and courses labeled "independent study" or "variable topics" taken in departments outside the School of Engineering. MATH 1125, only 1 credit can be used toward the required credits for the degree. No course taken on a Pass/Fail basis may be counted for credit toward graduation or may be used to meet any course requirements of the School of Engineering. Only eight credits for courses numbered CHEM 1124Q, 1125Q, 1126Q, 1127Q, 1128Q, 1147Q, and 1148Q and only eight credits for courses numbered PHYS 1201Q through 1602Q may be applied toward the degree.

**Major Requirements and Normal Sequences.** In addition to the University General Education requirements and the School requirements listed above, the requirements for the specific majors are listed in the following pages. Additionally, students successfully completing these courses will have met their general education computer technology and information literacy exit requirements for this major. Full program details, normal/updated course sequences, and accreditation requirements can be found in the respective *Guide to Course Selection* for each major.

**Accreditation Documentation States.** "The program educational objectives are intended to be statements that describe the expected accomplishments of graduates during the first several years following graduation from the program." Each program's educational objectives are listed within the actual program.

## Bachelor of Science in Engineering in Biomedical Engineering

Biomedical Engineering majors are required to complete the following:

BIOL 1107; BME 3101, 3120, ~~3300~~-3500, 3600W, 3700, 4900, 4910, 4985 (when taught as laboratory associated with ECE 3101; CHEM 1128Q (or 1148Q) and 2443; CE 2110; ECE 2001W, 3101; ENGR 1166; MATH 2110Q, 2410Q; MSE 2101; PNB 2264; PHYS 1502Q; STAT 3025Q; BME/Engineering electives (16 - 18 credits); **Elective (3 credits)**

The professional requirements and electives are specified in the *Biomedical Engineering Guide to Course Selection*.

The Biomedical Engineering undergraduate program educational objectives are that our alumni/ae: are equipped with an up-to-date technical and hands-on education in biomedical engineering emphasizing analysis, synthesis and design, allowing them to successfully work in industry, or attend graduate, medical, dental, business or law schools; possess a desire for life-long learning and a curiosity about the world; possess the quantitative and analytic skills necessary to embrace emerging technologies and the ability to look at traditional textbook learning with a fresh perspective; possess excellent written and oral communication skills necessary to interact with health care professionals, engineers and scientists; possess the ability to work effectively in teams; possess the sense of responsibility of a professional engineer; and will become global leaders in the biomedical engineering professions.

## Bachelor of Science in Engineering in Chemical Engineering

Chemical Engineering majors are required to complete the following: CHEG 2103, 2111, 3112, 3123, 3124, 3127, 3128, 3145, 3151, 4137W, ~~4139W~~, 4140, 4142, 4143, and 4147; CHEG Electives (6 credits minimum); CHEM 1128Q (or 1148Q), 2443, 2444, 2446, ~~3563~~, and ~~3566~~; ENGR 1166; MATH 2110Q and 2410Q; Professional/Engineering Requirements (9 credits); MCB/BIOL/CHEM requirement\*; Elective courses (5 credits)

\*Students may select BIOL1107/1108; MCB 2000, 2610 or 3010; CHEM 3332, 3563, 3564; or other appropriate classes by petition.

Selection of Professional Requirements courses must include engineering design work as detailed in the *Chemical Engineering Guide to Course Selection*. At least three credits of Professional Requirements must be outside of Chemical Engineering. A maximum of six credits of independent chemical engineering research credits may be applied toward degree requirements.

The Chemical Engineering undergraduate program educational objectives are that our alumni/ae: demonstrate knowledge and skills that enable them to adapt to the ever-changing discipline of chemical engineering, and thus be successful, lifelong contributors to the profession and have a sense of commitment, professional ethics and responsibility that provides for life-long, mutually supportive relationships among alumni, academia, and industry.

## Bachelor of Science in Engineering in Civil Engineering

Civil Engineering majors are required to complete the following:

CE 2010, 2110, 2120, 2210, ~~2310~~, 2410, 2710, 3110, 3120, ~~3300~~ or ~~3520~~, ~~3320~~ or ~~3610~~, 3510, 3630 or 3640 and 4910W; ENVE 2310; CE 3520 or ENVE 3200; CE 3610 or ENVE 3220

A minimum grade of C- is required in each of the following courses: CE 2110, CE 2210, ENVE 2310, CE 2410, 2710, 3110, 3120, 3510 and 4910W; CHEM 1128Q or 1148Q; ~~and~~ ME 2233; ENGR 1166 (section offered by the CEE Department recommended); MATH 2110Q and 2410Q; Professional Requirements courses (~~4~~-15 credits); Science elective (minimum of 3 credits); Elective courses (as needed to reach 128 credits total) (~~5~~-credits); CE 2010 must be taken twice before CE 4910W.

The professional requirements are satisfied by ~~eighteen~~(~~18~~)-~~fifteen~~ (15) credits of 3000-level or higher courses in engineering, science or mathematics, including at most one course at the 2000-level and MGMT 5335. At least one course each from four of the following different technical areas must be selected:

*Construction Management Engineering* - CE 4210

*Environmental/Sanitary Engineering* - ~~CE 3320~~, ENVE, 3220, 4310

(~~CE-ENVE 3220~~ may be used only to fill the professional requirements by students who have taken CE 3610)

*Geotechnical Engineering* - CE 4510, 4541

*Hydraulic/Water Resources Engineering* - ~~CE-ENVE~~ 4810, 4820

*Structural Engineering* - CE 3630 or 3640

*Surveying/Geodetic* - CE 4410

*Transportation Engineering* - CE 4710, 4720, 4750

No course that was used to meet another Civil Engineering course requirement may double count as a Professional Requirement. Courses taken from the above list but not used to fulfill the four technical area requirements may be used to satisfy remaining professional requirements. Following is a list of suggested courses that may also be considered for the professional requirements: ENVE 3220 or CE 3610 (if both taken); CE 3520 or ENVE 3200 (if both taken); GSCI 3710; CE 3630 or CE 3640 (if both taken); CE 4610; CE 4730; CE 4740; ENVE 4800; EEB 3247; ECE 3002.

The science elective may be satisfied by BIOL 1107; GSCI 1050; GSCI 1051; PSYC1100; EEB 2208; GEOG 1300; GSCI 3710; ENVE 4320; NRE 3105; NRE 4135; or any other science course outside of CHEM or PHYS approved by the CE Program.

The Civil Engineering undergraduate program educational objectives are to prepare our alumni/ae with the knowledge and skills needed to: adopt and continuously practice lifelong learning through post-graduate and professional education; actively contribute to the advancement of engineering practice in the public or private sectors in the technical areas of environmental, geotechnical,

structural, transportation, and water resources engineering; and recognize the importance of, and follow a path that can lead to, licensure as professional engineers who design and construct solutions to civil engineering problems in the natural and built environments.

## Bachelor of Science in Engineering in Computer Engineering

Offered jointly by the Departments of Computer Science & Engineering and Electrical & Computer Engineering

Computer Engineering majors are required to complete the following:

CSE 1102, 2100, 2102, 2300W, 2500, 3666, 4300; ECE 1101, 2001W, 3101, 3201, 3221, 3401, 3421, 4901, 4902; MATH 2110Q, 2210Q and 2410Q; STAT 3345Q; Professional Requirements courses (9 credits); Design Laboratory courses (6 credits including ECE 3411 or CSE 4903); Elective course (4 credits)

Further details and course sequences are given in the *Computer Engineering Guide to Course Selection*.

The Computer Engineering program combines coursework in computer science and electrical engineering providing a program that focuses on the design of computer hardware and digital systems.

The Computer Engineering undergraduate program educational objectives are that our alumni/ae: make technical contributions to design, development, and manufacturing in their practice of computer engineering (corresponding to the description of the computer engineering program described above); demonstrate professionalism and a sense of societal and ethical responsibility in all their endeavors and engage in professional development or post-graduate education to pursue flexible career paths amid future technological changes.

## Bachelor of Science in Computer Science

Computer Science majors are required to complete the following:

CSE 1102, 2100, 2102, 2304 or 3666, 2500, 3000 or 3002, 3500, 3502, 4300, and 4939W; MATH 2210Q, and *either* MATH 2110Q or 2410Q; Either STAT 3025Q or STAT 3375Q; One two-semester laboratory course sequence from *either* chemistry (CHEM 1127Q-1128Q, 1137Q-1138Q or 1147Q-1148Q) or physics (PHYS 1401Q-1402Q, 1501Q-1502Q or 1601Q-1602Q); One additional science course (from BIOL 1107, 1108, or 1110; CHEM 1127Q, or 1128Q; PHYS 1401Q, 1402Q, 1502Q, 1601Q, or 1602Q) but not in the same department as the two semester sequence; Either CSE 4100 or CSE 4102; Three courses from CSE 3300, 3800, 3802, 4095 with prior approval, 4500, 4701, 4703, 4705, 4707; One design laboratory course from CSE 4900, 4902, 4903, 4904, and 4905; Additional CSE courses as required to reach 42 credits in CSE courses not including CSE 2500; A minimum of three 3-credit courses at the 2000-level or above in a single related area forming a cohesive body of knowledge outside of Computer Science; Elective courses to reach a minimum of 120 credits.

Further details and course sequences are given in the *Computer Science Guide to Course Selection*.

The Computer Science program combines a rigorous education in computer science with added coursework in an area outside of computing, in the sciences, business or humanities. With a background that combines computer science and a non-computing discipline, our graduates have the breadth of understanding to apply computer science to other disciplines, which is particularly valuable as computing has become a key aspect of nearly all endeavors.

The Computer Science undergraduate program educational objectives are that our alumni/ae: practice as computing professionals (appropriate to the description of the computer science program described above), conducting research and/or leading, designing, developing, or maintaining projects in various technical areas; apply the ethical and social aspects of modern computing technology to the design, development, and usage of computing artifacts; and enhance their skills and embrace new computing technologies through self-directed professional development and post-graduate training or education.

## Bachelor of Science in Engineering in Computer Science and Engineering

Computer Science and Engineering majors are required to complete the following:

CSE 1102, 2100, 2102, 2300W, 2500, 3500, 3502, 3504, 3666, 4100, 4300, 4302,

and 4939W; Either CSE 3000 or 3002; One CSE design laboratory course from CSE 4900, 4901, 4902, 4903, 4904, 4905, or ECE 4079, or ECE 4242; MATH 2110Q, 2210Q, and 2410Q; One of MATH 3160, STAT 3025Q, 3345Q, or 3375Q; ECE 2001W, and 3101; Professional Requirements courses (9 credits); Elective courses to reach a minimum of 126 credits.

Further details and course sequences are given in the *Computer Science & Engineering Guide to Course Selection*.

The Computer Science and Engineering program combines a rigorous education in computer science with added emphasis on the physical and architectural underpinnings of modern computer system design. With a background that spans computer science and computer engineering, the graduates are able to address computing systems across the hardware-software spectrum.

The Computer Science and Engineering undergraduate program educational objectives are that our alumni/ae: practice as computing professionals (appropriate to the description of the computer science and engineering program described above), conducting research and/or leading, designing, developing, or maintaining projects in various technical areas; apply the ethical and social aspects of modern computing technology to the design, development, and usage of computing artifacts; and enhance their skills and embrace new computing technologies through self-directed professional development and post-graduate training or education.

### Bachelor of Science in Engineering in Electrical Engineering

Electrical Engineering majors are required to complete the following:

CSE 1102 or ECE 1110 or ENGR 1166 and CSE 2300W; ECE 2001W, 3001, 3101, 3111, 3201, 3211, 4111, 4201, and 4211; ECE 4901 and 4902; MATH 2110Q, 2210Q and 2410Q; STAT 3345Q or MATH 3160; Professional Requirements courses (12 credits); Design Laboratory courses (6 credits); Elective courses (9 credits)

Further details and course sequences are given in the *Electrical Engineering Guide to Course Selection*.

The Electrical Engineering program educational objectives are that our alumni/ae: make technical contributions to design, development, and manufacturing in their practice of electrical engineering; demonstrate professionalism and a sense of societal and ethical responsibility in all their endeavors; and engage in professional development or post-graduate education to pursue flexible career paths amid future technological changes.

### Bachelor of Science in Engineering in Engineering Physics

Offered jointly by the Physics Department of the College of Liberal Arts and Sciences and the School of Engineering

Engineering Physics majors can concentrate in either Electrical, Materials Science, or Mechanical Engineering. Students choose the college/school that they wish to graduate from and must satisfy the course requirements of either the College of Liberal Arts and Sciences or the School of Engineering to complete their degree.

Engineering Physics majors are required to complete the following:

CHEM 1128Q or 1148Q; PHYS 2300, 2501W, 3101, 3201, 3202, and 3401; MATH 2110Q, 2410Q, and 3410

*Electrical Engineering* - ECE 2001W, 3101, 3111, 3201, 4111, 4211, 4901, and 4902; CSE 2300W; MATH 2210Q; PHYS 3300; STAT 3345Q; Elective courses (4 credits).

*Mechanical Engineering* - ME 2233, 2234, 3220, 3227, 3242, 3250, 3253, 4972 and 4973W; CE 2110, 3110; STAT 3345Q; ME Elective Courses (6 credits); PHYS Elective courses (6 credits).

*Materials Science and Engineering* - MSE 2001, 2002, 2053, 3001, 3002, 3003, 3004, 3055 and 3056, 4003W, 4901 and 4902W; CHEG 3156; PHYS 4150 and 4210; MSE Elective Courses (6 credits); Physics Elective Courses (3 credits).

The professional requirements and electives are specified in the *Engineering Physics Guide to Course Selection*.

The Engineering Physics undergraduate program educational objectives are that our alumni/ae: contribute to current and future scientific and technological

developments in the areas of physics and electrical, mechanical and materials science engineering; excel in engineering and physics careers and responsible citizenship in industry, government, academia and other professional practices; and engage in professional development or graduate education to pursue flexible career paths.

### Bachelor of Science in Engineering in Environmental Engineering

Environmental Engineering majors are required to complete the following:

CE 2110, 3120/ENVE 3120 (or CHEG 3123); CHEG 2111; ENVE 3270; CHEM 1128Q (or 1148Q); ENGR 1166; ENVE 2310, 2320, 2330, 3200, 3220, 3230, 4210, 4310, 4810 or 4820, 4910W, 4920W, and 4996; MATH 2110Q and 2410Q; ENVE 4320 and one of the following: NRE 3105 or 3205, 3155; and NRE 4135 (or GSCI 3710/ENVE 3530); Elective course (6 credits); Professional Requirements courses (9 credits).

Professional Requirements include at least *one* course each to strengthen *three* of the following eleven focus areas: Atmospheric Systems and Air Pollution Control, Environment and the Society, Environmental and Occupational Health, Environmental Chemistry, Environmental Sustainability, Environmental Systems Modeling, Hazardous Waste Management, Hydrology and Earth Resources, Solid Waste Management, Wastewater Management, Water Supply and Natural Resources. The following courses may be used to meet the Professional Requirements:

AH 3175 and 3275; ARE 3434 and 4462; CE 3510; CHEG 3151, 4147; CHEM 3332, 3563 and 3564; EEB 3247; ENVE 3530, 4810, 4820; GEOG 2300, 3320W, 3340, 3400, and 3410; GSCI 3510; LAND 2210; MARN 3016 and 4030W; MCB 2000, 2610, 3635 and 3640W; ME 3239; MGMT 5335; NRE 3105, 3205, 3115, 3145, 3535, 4000W, 4135, and 4165; OPIM 3610; OSH 3277W and 4570; SOCI 3407W; SOIL 3410 and 4420

The Environmental Engineering undergraduate program educational objectives are to impart our alumni/ae with the knowledge and skills needed to actively contribute to the advancement of engineering practice in the public and/or private sectors in the technical area of environmental engineering; recognize the importance of, and follow the path that leads towards, becoming licensed professional engineers, assessing the impact of human activities on the environment, designing and constructing solutions to minimize and mitigate such impacts, and tending to the natural environment as our life support system; and adopt and continuously practice lifelong learning through post-graduate and professional education.

### Bachelor of Science in Management and Engineering for Manufacturing

Offered jointly by the School of Business and the School of Engineering Management & Engineering for Manufacturing majors are required to complete the following:

ACCT 2001 and 2101; ANTH 1000 or GEOG 1700; BADM 3001; BLAW 3175; CE 2110, 2120, and 3110; ECON 1200; ECE 3002; FNCE 3101; HIST 1400; MATH 2110Q and 2410Q; ME 2233, 3221, 3222, 3227, and 3260; MEM 1151, 2210, 2211, 3221, 3231, 4225, and 4915W; MGMT 3101, and 4900; MKTG 3101; MSE 2001 or 2101; OPIM 3652; STAT 1100Q; Technical Electives courses (6 credits)

The Technical Electives must be 3000 to 4000-level or higher courses from departments listed in the School of Business and the School of Engineering as specified in the *Management & Engineering for Manufacturing Guide to Course Selection*. Students are encouraged to seek faculty-supervised manufacturing summer internships prior to their junior and senior years. Such internships may be shown on the student records by registering for MEM 3281 – Manufacturing Internship, with instructor and advisor approval.

The Management and Engineering for Manufacturing undergraduate program educational objectives are that our alumni/ae: practice their profession with solid engineering and business knowledge and skills and have a total enterprise vision of world class manufacturing organizations; compete successfully using principles of lean manufacturing, time management and quality assurance in the design and manufacture of products and services; approach engineering and business decisions consistent with ethical, global, environmental, societal contexts; and responsible leadership and continue to extend their professional and personal skills and engage in life-long learning.

### Bachelor of Science in Engineering in Materials Science and Engineering

Materials Science and Engineering majors are required to complete the following:

CHEM 1128Q or 1148Q; ENGR 1166; MATH 2110Q and 2410Q; CE 2110 and 3110; MSE 2001, 2002, 2053, 3001, 3002, 3003, 3004, 3055, 3056, 4001, 4003W, 4004, 4005, 4901, and 4902W

Professional requirement courses (12 credits); Technical Elective courses (9 credits)

• Elective sequences that satisfy the (12 credit) MSE concentrations in Electronic Materials, Metallurgy, Biomaterials, and Nanomaterials, as well as recommended Professional and Technical Electives are listed below.

• *Electronic Materials Concentration*: PHYS 3401, 3150, 4210; MSE 4241, 5317; *Metallurgy Concentration*: MSE 3020 or ME 3228, MSE 4021 or MSE 4038, MSE 3032 and MSE 4034; *Biomaterials Concentration*: MCB 2000, CHEM 2443, BME 3700 and BME 4701; *Nanomaterials Concentration*: MSE 4240, MSE 4241, ENGR 4243 and PHYS 3401.

• Recommended Professional Elective courses - 12 credits from: BME 3700 and 4701; CHEG 3156; ME 3217 and 3228; and MSE 3020, 3029, 3030, 3032, 4021, 4034, 4038, 4240 and 4241. Students with CGPA of 3.2 or greater may elect graduate core courses.

• Recommended Technical Elective courses - 9 credits, at least 3 credits must be in mathematics or basic science, from: CHEM 2443, 2444, 3563, and 3564; ECE 3002, 4244; ENGR 4243; MCB 2000; ME 3253, and 3255; MATH 2210Q, 3160, and 3210; PHYS 3401 and 3402; STAT 3025Q, 3075, and 3345Q

Selection of courses is detailed in the *Materials Science and Engineering Guide to Course Selection* at <http://www.cmbc.engr.uconn.edu/mseundgcurric.html>.

The Materials Science and Engineering program educational objectives are that our alumni/ae: are flexible, responsible, and creative citizens, professionals, and leaders of change in a global technological society; serve the ever-changing materials engineering needs of industry by applying and continually expanding special, in-depth competencies in material design, properties and processing; apply professional skills of critical and cooperative thinking, communication, and leadership; and continue a life-long, mutually supportive relationship with the Department and University.

### Bachelor of Science in Engineering in Mechanical Engineering

Mechanical Engineering majors are required to complete the following:

CE 2110, 2120, and 3110; ECE 3002; ENGR 1166; MATH 2110Q and 2410Q; ME 2233, 2234, 3220, 3227, 3242, 3250, 3253, 3255, 3263, 3264, 4972, and 4973W; MSE 2001 or 2101; ME Requirement (9 credits); Professional Requirements (6 credits); Electives (5 credits).

All mechanical engineering students are required to have at least six credits of work in the mathematical sciences and sciences beyond those courses specifically

required in the program. The course credits can be met at any course level. Those at the 2000-level and above can be used to meet the professional requirements of the program. Restrictions on courses are noted in the following:

All MATH 2000-level and above courses except MATH 2194W, 2720W, 2784, and 2794W; all STAT courses except STAT 1000Q; all BIOL, EEB, MCB, and PNB courses; all CHEM courses except CHEM 1101; all GSCI courses, all MARN courses may be used.

Concentration requirements: 9 credits (3 courses, 2000-level and above); no course grades of less than C; plan of study for concentration; must take courses from subset of identified courses.

• *Aerospace Concentration*: Three courses from: ME 3239, 3251, 3275, 3280, 5311\*, and 3295 Special Topics taught as any of these: Acoustics, Aerospace Control Systems, Computer Aided Engineering, or Turbomachinery, or ME 6160\*

• *Energy and Power Concentration*: Three courses from: ME 3239, 3270, 3275, 3280, 3285, Special Topics 3295 when taught as any of these: Energy Systems Engineering, Fuel Cells, Sustainable Energy, or Turbomachinery, ME 5311\*, or 6160

(\* ) These courses are offered as combined Undergraduate/Graduate classes. Students may opt to take the graduate course or take it as ME 3295 Special Topics

• *Dynamic Systems and Control Concentration*: Three courses from: ME 3214, Special Topics 3295 when taught as any of these: Advanced Vibrations, Intelligent Material Systems and Structures, Linear Automatic Control Systems, or Mechatronics, ME 5160, 5180, 5210, 5420, 6330, or 5895 Special Topics when taught as Mechatronics

• *Design and Manufacturing Concentration*: Three courses from: ME 3217, 3221, 3222, 3224, 3225, 3228, Special Topics 3295 when taught as any of these: Analytical and Applied Kinematics, Computer Aided Engineering, Geometric Modeling, Intelligent Material Systems and Structures, Principles of Machining and Machine Tools, or Principles of Optimum Design, ME 5511, 5155, 5150, 5210, 5220

Details on the ME and Professional Requirements are specified in the *Guide for Mechanical Engineering Majors*.

The Mechanical Engineering program educational objectives are that our alumni/ae: practice mechanical engineering by designing systems, solving problems, and effectively communicating results using mathematical, scientific, and engineering principles and tools; approach engineering decisions with an informed consideration of ethical, global, and societal contexts and consequences; and continue to expand their professional and personal skills and engage in life-long learning.