

BIOMEDICAL ENGINEERING, COMPREHENSIVE MAJOR

(Code 252-001)

University Requirements

GRADUATION REQUIREMENTS FOR BACCALAUREATE DEGREE

Credit Requirements	
Minimum total for graduation ¹	120
Upper division credits (courses numbered 300 and higher)	39
Liberal Education Core (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header1)	36
Academic Concentrations (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header16)	
Grade Point Requirements (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header14) ²	
Total	2.00 average
Resident	2.00 average
Major	2.00 average
Minor	2.00 average
Certificate	2.00 average
University Residency Requirements (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header15)	
Minimum total	30
Senior year	23
Major, Standard, upper division in residence	12
Major, Comprehensive, upper division in residence	21
Certificate	25 percent of credits

Procedures Required for Graduation

Obtain admission to the degree program and/or the College offering it.

Apply for graduation on CampS.

¹ Certain programs exceed this minimum.

² See special requirements in each College.

Applicability of Credits Toward Graduation

Junior College or Two-Year College Credits. A maximum of 72 semester credits earned in a junior college or two-year college will be accepted as degree credits at UW-Eau Claire.

Extension Credits. Credits earned in credit outreach courses offered by UW-Eau Claire are treated as resident credits. Credits earned in extension courses offered by other units of the University of Wisconsin System are treated as transfer credits. All other (non-UW) extension and correspondence credits are normally limited to one-fourth of the total required for graduation from any curriculum.

WTCS Credits. A maximum of 72 semester credits earned in college parallel programs at Madison Area Technical College, Milwaukee Area Technical College, Nicolet Area Technical College, or Chippewa Valley Technical

College may be accepted as degree credits at UW-Eau Claire. A set number of general education courses will be accepted from other technical schools. Occupational and technical courses may also be considered for transfer if the quality and content of the course work from the technical college is judged to be comparable to course work at UW-Eau Claire. Refer to the Transfer Credit Wizard (https://my.uwec.edu/psp/PUBLIC/EMPLOYEE/HRMS/c/EAU_SS_CUSTOM.EAU_TRNCRDWZ.GBL) or contact the UW-Eau Claire Admissions Office for information about the current transfer policy.

USAFI Credit. UW-Eau Claire will accept up to 32 semester credits for work done through the United States Armed Forces Institute, under the provision for non-UW correspondence credit (see Extension Credits above).

Activity Credit (band, chorus, drama, KINS 100-184 courses) Students may count toward graduation no more than one credit of KINS 110-184 courses. Students may count toward graduation no more than four credits earned in any single activity course and no more than 12 credits resulting from any combination of activity courses (excluding KINS 110-184 courses).

Other Restricted Credits. For other University restrictions, see the following: Cooperative Education; Credit by Examination; Satisfactory/Unsatisfactory Registration; Transfer of Credits. College or departmental restrictions may also be placed on Independent Study (399-499 courses), Directed Study (395-495), and other types of credits.

APPLICABILITY OF CREDITS TOWARD GRADUATION	Credit Restrictions
Satisfactory/Unsatisfactory	
Total degree credit	maximum 12
Major, Standard	maximum 1 course
Major, Comprehensive	maximum 2 courses
Minor	maximum 1 course
Credit by Examination	
Total degree credit	maximum ¼ of total
Major or minor	maximum ½ of total
Two-Year College Credits	
Total degree credit	maximum 72 credits
Activity credit (band, chorus, drama, KINS 100-184)	
Total KINS 100-184	maximum 1 credit
Total Band, chorus, drama	maximum 12 credits
Single course band, chorus, drama	maximum 4 credits
Extension credits	
UW-System	no maximum
Other extension/correspondence	maximum ¼ of total
USAFI	
USAFI	maximum 32 credits

Liberal Education Core

The University of Wisconsin-Eau Claire measures learning outcomes to ensure that its graduates have achieved a liberal education and prepared themselves to contribute to a complex society. Upon graduation, each undergraduate will have met the five learning goals of our liberal education core and the 12 learning outcomes they comprise.

LIBERAL EDUCATION CORE REQUIREMENTS	a minimum of 36 credits
Knowledge Goal	
Knowledge Outcome 1 (K1): Natural Sciences (http://catalog.uwec.edu/undergraduate/attribute-k1/)	Two (2) learning experiences
One experience in laboratory science must be selected from either K1 or K2.	
Knowledge Outcome 2 (K2): Social Sciences (http://catalog.uwec.edu/undergraduate/attribute-k2/)	Two (2) learning experiences
One experience in laboratory science must be selected from either K1 or K2.	
Knowledge Outcome 3 (K3): Humanities (http://catalog.uwec.edu/undergraduate/attribute-k3/)	Two (2) learning experiences
Knowledge Outcome 4 (K4): Fine Arts (http://catalog.uwec.edu/undergraduate/attribute-k4/)	One (1) learning experience
Skills Goal	
Skills Outcome 1 (S1): Written and Oral Communication (http://catalog.uwec.edu/undergraduate/attribute-S1/)	Two (2) learning experiences
One S1 must meet the University Writing Requirement (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header10)	
Skills Outcome 2 (S2): Mathematics (http://catalog.uwec.edu/undergraduate/attribute-S2/)	One (1) learning experience
One S2 to meet the University Mathematics Requirement (http://catalog.uwec.edu/undergraduate/graduation-requirements/#header11)	
Skills Outcome 3 (S3): Creativity (http://catalog.uwec.edu/undergraduate/attribute-S3/)	One (1) learning experience
Responsibility Goal	
Responsibility Outcome 1 (R1): Equity, Diversity, and Inclusivity (http://catalog.uwec.edu/undergraduate/attribute-R1/)	Two (2) learning experiences
One R1 must satisfy Design for Diversity (http://catalog.uwec.edu/undergraduate/attribute-DDIV/#header13)	
Responsibility Outcome 2 (R2): Global Perspectives (http://catalog.uwec.edu/undergraduate/attribute-R2/)	One (1) learning experience
Responsibility Outcome 3 (R3): Civic and Environmental Issues (http://catalog.uwec.edu/undergraduate/attribute-R3/)	One (1) learning experience
Integration Goal	

Integration Outcome 1 (I1): Integration (<http://catalog.uwec.edu/undergraduate/attribute-I1/>) Two (2) learning experiences

Service-Learning Goal

Service-Learning (<http://catalog.uwec.edu/undergraduate/attribute-SL/#header13>) 30 hours

College Degree Requirements Bachelor of Science Degree (B.S.)

University Graduation Requirements. All candidates for degrees must fulfill the requirements for credits, curriculum, GPA, and University residency as specified in the section of this catalog titled University Graduation Requirements (<http://catalog.uwec.edu/undergraduate/graduation-requirements/>).

College Graduation Requirements: Grade Point Averages. All candidates for degrees in the College of Arts and Sciences must earn minimum resident and total GPAs of 2.00 in the major, the minor, and the certificate. The resident and total GPAs for the major are computed using all attempted credits applicable to the major including those offered by departments other than the major department. The resident and total GPAs for the minor and the certificate are computed similarly.

Major-Minor and Major-Certificate Requirements. A standard major (a minimum of 36 credits) must be supplemented by a minor (a minimum of 24 credits) or by a certificate (12 to 18 credits) to meet graduation requirements for completing a first and second degree program. No minor or certificate is required with a Comprehensive Major (60 or more credits) or with two majors of 36 or more credits each.

Certain degree programs which include Comprehensive Majors may require more than the minimum of 120 credits for graduation.

Acceptable academic program combinations are determined at the college level. A major and a minor or a major and certificate or two majors (if available) may not be elected in the same department or program, except in the approved combinations listed here (<http://catalog.uwec.edu/undergraduate/arts-sciences/#academicprogramstext>).

College Credits. Earn at least 90 credits in courses offered by the College of Arts and Sciences.

Bachelor of Science Degree in the College of Arts and Sciences (B.S.)

Fulfillment of all University Graduation Requirements (which includes the Liberal Education Core); all College-level degree requirements (major and minor/certificate emphases, GPAs, earning at least 90 credits in Arts and Sciences course work); mathematics competency at the MATH 111, MATH 112 or MATH 113 level. Mathematics competency can be met in one of three ways: (1) Achieve a score on the mathematics placement test that qualifies the student to enter MATH 114. (2) Earn a grade of at least C (not C-) or a mark of S in MATH 111, MATH 112, or MATH 113. (3) Achieve a satisfactory score on the MATH 112 competency test. This test may be attempted no more than two times.

Major Requirements

(Code 252-001)

The Bachelor's of Science in Biomedical Engineering is a traditional engineering major that uses engineering principles and design concepts applied to medicine with a focus on health care. Biomedical Engineering consists of a

diverse range of disciplines that are broadly focused on improving diagnosis, care and treatment of patients.

A minimum of 92 credits is required for the major and a minimum of 128 credits for the degree. In addition to core courses, students must complete 3 credits of engineering electives and 3 credits of technical electives.

Code	Title	Credits
Required Courses		
BIOMEDICAL ENGINEERING		
BME 201	Introduction to Biomedical Engineering	2
BME 301	3D Printing in Medicine	3
BME 320	Clinical Problems in Biomedical Engineering	3
BME 330	Biomedical Engineering Instruments and Measurements w/lab	4
BME 340	Biomaterials	3
BME 370	Medical Imaging	3
BME 430	Cell and Tissue Engineering w/lab	4
BME 450	Medical and Implantable Devices w/ lab	5
BME 460	Biological Systems Analysis	3
BME 486	BME Capstone I	2
BME 487	BME Capstone II	2
BIOLOGY		
BIOL 214	Human Anatomy and Physiology I	4
BIOL 314	Human Anatomy and Physiology II	4
BIOL 221	Foundations of Biology I	4
CHEMISTRY		
CHEM 115	Chemical Principles	6
Or		
CHEM 105 & CHEM 106 & CHEM 109	General Chemistry I Lecture and General Chemistry I Laboratory and General Chemistry II with Lab ¹	
MATERIALS SCIENCE AND ENGINEERING		
MSE 120	Introduction to Engineering	2
MSE 256	Introduction to Computer Aided Design	1
MSE 286	Engineering Sophomore Seminar	1
MSE 307	Engineering Statistics	4
MSE 386	Engineering Junior Seminar	1
MATHEMATICS		
MATH 114	Calculus I	4
MATH 215	Calculus II	4
MATH 312	Differential Equations and Linear Algebra	4
PHYSICS		
PHYS 231	University Physics I	5
PHYS 232	University Physics II	5
PHYS 240	Computational Physics	3
Elective Courses		
Engineering Electives ²		3
MSE 221	Living in a Materials World	
MSE 315	Materials Characterization	

MSE 334	Soft Materials	
MSE 372	Transport Phenomena	
MSE 475	Nanomaterials	
PHYS 255	Statics	
PHYS 350	Electric and Electronic Circuits	
PHYS 360	Electronics	
Technical Electives ²		3
BIOL 250	Microbiology	
BME 291	Special Topics in Biomedical Engineering	
BME 395	Directed Studies	
BME 399	Independent Study - Juniors	
BME 493	Collaborative Internship	
BME 494	Off-campus Biomedical Engineering Internship	
BME 499	Independent Study - Seniors	
CHEM 213	Quantitative Analysis	
CHEM 325	Organic Chemistry I with Laboratory	
CHEM 326	Organic Chemistry II with Laboratory	
CHEM 352	Fundamentals of Biochemistry	
CS 145	Programming for New Programmers	
or CS 148	Programming for Experienced Programmers	
CS 163	Introduction to Programming in C++	
CS 170	Computing for the Sciences and Mathematics	
CS 245	Advanced Programming and Data Structures	
CS 252	Computer Systems	
CS 330	Programming Languages	
MSE 363	Microelectronic Materials Processing Lab	
MATH 216	Calculus III	
MATH 313	Digital Signal Processing	
MATH 314	Discrete Mathematics	
MATH 315	Advanced Calculus I	
MATH 316	Introduction to Real Analysis	
MATH 317	Introduction to Real Analysis II	
MATH 318	Introduction to Complex Variables	
MATH 324	Linear Algebra	
MATH 351	Numerical Analysis I	
MATH 354	Introduction to Mathematical Modeling	
MATH 440	Digital Image Processing	
MATH 441	Linear Regression Analysis, with Time Series	
MATH 443	Experimental Design and Analysis	
PHYS 255	Statics	
PHYS 340	Optics	
PHYS 350	Electric and Electronic Circuits	
PHYS 356	Dynamics	
PHYS 360	Electronics	
PHYS 361	LabVIEW Basics	
PHYS 362	LabVIEW Applications	

¹ Only 6 credits from the CHEM 105, CHEM 106 and CHEM 109 sequence can count toward the major.

² Cannot count a course in both engineering electives and technical electives categories.

Program Learning Outcomes

Students completing this program will be expected to meet the following learning outcomes:

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- Communicate effectively with a range of audiences.
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

Sample Degree Plan

Biomedical Engineering, Comprehensive Major, B.S.

The following is a sample degree plan, based on the 2023-2024 catalog. It is based on the 120-credit graduation requirement and assumes no transferred credits, no requirements waived by placement tests, no courses taken in the summer or winter, no repeated courses, and no remedial courses that may be required. This sample degree plan is intended for first-year students entering UW-Eau Claire in the fall semester. Your own degree plan may differ depending on the course of study selected (second major, minor, etc.). UW-Eau Claire cannot guarantee all courses will be offered as shown, but will provide a range of courses that may enable prepared students to fulfill their requirements in a timely period. This sample degree plan is just a guide. Please consult your advisor, your degree audit, and the catalog to create your own degree plan. *Note:* In order to earn the required minimum of 120 credits for the degree in four years, you should plan to take 15 credits each semester or 30 credits each year.

To earn a degree, students must fulfill all University Graduation Requirements, including the Liberal Education (LE) Core. LE Core course work in the following sample degree plan uses abbreviations such as LE-K1, LE-S2, LE-R3, and LE-I1 to represent the learning outcomes students will meet via completion of their liberal education course work. Please click (<https://catalog.uwec.edu/undergraduate/graduation-requirements/>) here for a description of the Liberal Education Core outcomes and requirements. Note that the LE Core may be completed through both course and non-course experiences.

FIRST YEAR

FIRST SEMESTER

CHEM 105	General Chemistry I Lecture	3
CHEM 106	General Chemistry I Laboratory (LE-K1)	2

WRIT 114	Intensive Blugold Seminar in Critical Reading and Writing (LE-S1)	5
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OR

WRIT 116	Blugold Seminar in Critical Reading and Writing (LE-S1)	
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MATH 114	Calculus I (LE-S2)	4
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MSE 120	Introduction to Engineering (LE-S3)	2
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TOTAL		16
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SECOND SEMESTER

CHEM 109	General Chemistry II with Lab	4
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BIOL 214	Human Anatomy and Physiology I	4
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MATH 215	Calculus II	4
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PHYS 231	University Physics I (LE-K1)	5
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TOTAL		17
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SECOND YEAR

FIRST SEMESTER

PHYS 232	University Physics II (LE-K1)	5
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MSE 286	Engineering Sophomore Seminar	1
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BIOL 221	Foundations of Biology I	4
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BIOL 314	Human Anatomy and Physiology II	4
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BME 201	Introduction to Biomedical Engineering	2
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TOTAL		16
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SECOND SEMESTER

PHYS 240	Computational Physics	3
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MSE 307	Engineering Statistics	4
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MATH 312	Differential Equations and Linear Algebra	4
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MSE 256	Introduction to Computer Aided Design	1
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BME 320	Clinical Problems in Biomedical Engineering	3
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TOTAL		15
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THIRD YEAR

FIRST SEMESTER

MSE 386	Engineering Junior Seminar ^a	1
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BME 301	3D Printing in Medicine	3
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BME 330	Biomedical Engineering Instruments and Measurements w/lab	4
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PHIL 120	Ethical Reasoning (LE-K3, LE-R3) ^b	3
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LE Option: Skills 1 (LE-S1) Written and Oral Communication		3
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LE Option: Knowledge 4 (LE-K4) Fine Arts		3
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TOTAL		17
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SECOND SEMESTER

BME 340	Biomaterials	3
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BME 370	Medical Imaging	3
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SOC 101	Introduction to Sociology (LE-K2, LE-R1)	3
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LE Option: Integration (LE-I1)		3
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LE Option: Responsibility 2 (LE-R2) Global Perspectives		3
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TOTAL		15
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FOURTH YEAR

FIRST SEMESTER

BME 430	Cell and Tissue Engineering w/lab	4
BME 486	BME Capstone I	2
Technical Elective ^c		3
LE Option: Knowledge 3 (LE-K3) Humanities		3
LE Option: Responsibility 1 (LE-R1, DDIV) Equity, Diversity, and Inclusivity with Design for Diversity		3
Elective		1
TOTAL		16
SECOND SEMESTER		
BME 487	BME Capstone II (LE-I1)	2
BME 460	Biological Systems Analysis	3
BME 450	Medical and Implantable Devices w/ lab	5
Engineering Elective ^d		3
LE Option: Knowledge 2 (LE-K2) Social Sciences		3
TOTAL		16

Minimum total for the baccalaureate degree = 128 credits

- a Enrolling in this course initiates the Engineering Tuition.
- b Or other course that satisfies 2 Liberal Education outcomes.
- c Technical Elective – 6 credits are required from the following courses: BIOL 250, BME 291, BME 395, BME 399, BME 493, BME 494, BME 499, CHEM 213, CHEM 326, CHEM 352, CS 145 or CS 148, CS 163, CS 170, CS 245, CS 252, CS 330, MATH 216, MATH 313, MATH 314, MATH 315, MATH 316, MATH 317, MATH 318, MATH 324, MATH 351, MATH 354, MATH 440, MATH 441, MATH 443, MSE 363, MSE 493, MSE 494, PHYS 240, PHYS 255, PHYS 340, PHYS 350, PHYS 356, PHYS 360, PHYS 361, PHYS 362. A maximum of three credits from BME 395, BME 399, BME 499, BME 493, and BME 494 toward the technical electives.
- d Engineering Elective – Courses used to satisfy the engineering elective may not also be used as a technical elective. 3 credits are required from the following courses: MSE 221, MSE 315, MSE 334, MSE 372, MSE 475, PHYS 255, PHYS 350, PHYS 360.

Note: All students must complete the 30-hour Service-Learning Requirement via a non-credit or credit option (see University Graduation Requirements (<http://catalog.uwec.edu/undergraduate/graduation-requirements/>)).

RECOMMENDATIONS FOR HIGH IMPACT PRACTICES (HIPs)

The University of Wisconsin-Eau Claire encourages all students to participate in High Impact Practices. The following information identifies any specific recommendations that faculty in this major have concerning which HIPs might be most beneficial to students, and any recommendations about when those HIPs best fit into the degree plan. Students should also consult their faculty advisor for information on HIPs. There are many additional high impact opportunities available. Talk to your academic advisor for more information about incorporating HIPs like Study Abroad (<https://studyabroad.apps.uwec.edu/>), Intercultural Immersion (<https://www.uwec.edu/immersion/>), Internship (<https://www.uwec.edu/career-services/info-students/internships/>), and/or Student/Faculty Collaborative Research (<https://www.uwec.edu/orsp/students/student-faculty-collaborative-research-guide/>) into your time at UW-Eau Claire.

Students are especially encouraged to explore immersion experiences including faculty/student collaborative research, off-campus summer research, off-campus internship, Study Abroad, Domestic Intercultural Immersion, or other HIP experience.

Liberal Education (LE) Core Guidance**Liberal Education Core (LE Core)**

The LE Core comprises 17 learning experiences across 11 learning outcomes. Students must complete a minimum of 36 credits in courses approved for the LE Core.

- K1 – Natural Sciences; two experiences (one lab science experience is required in K1 or K2).
- K2 – Social Sciences; two experiences (one lab science experience is required in K1 or K2).
- K3 – Humanities; two experiences.
- K4 – Fine Arts; one experience.
- S1 – Written and Oral Communication; two experiences (one experience must satisfy the University writing requirement).
- S2 – Mathematics; one experience (must satisfy the University math competency requirement).
- S3 – Creativity; one experience (can be fulfilled in a student's major).
- R1 – Equity, Diversity, and Inclusivity; two experiences (one experience must meet the UW System Design for Diversity (DD) requirement).
- R2 – Global Perspectives; one experience.
- R3 – Civic and Environmental Issues; one experience.
- I1 – Integration; two experiences (one experience can be fulfilled in a student's major).
- SL—Service Learning; 30 hours

Additional LE Core Information

- Most LE Core learning experiences are course based, and many courses meet more than one learning outcome (e.g., K3 and R2 or K1 and R3).
- Some learning experiences can also be met outside of a traditional course (e.g., undergraduate research (S3), study abroad (I1)).
- S1 – An English placement score that fulfills the University writing requirement fulfills one S1 experience.
- S1 – A foreign Language placement score that qualifies the student to enter the 102 level satisfies one S1 experience.
- S1, R2 – A foreign language placement score that qualifies the student to enter the 202 level satisfies one experience in S1 and the R2 experience.
- S2 – A math placement score that qualifies the student to enter Math 111, 112, 113 or 114 fulfills the S2 experience.
- S3 – Completion of two credits from any approved music ensemble fulfills the S3 experience.
- I1 – Any semester long study abroad program can fulfill one I1 experience.