Mathematics and Natural Science

SCHOOL OF MATHEMATICS AND NATURAL SCIENCE

Lance Urven, Ph.D., Dean

Ben Sadoff Science Hall, Room 207
(920) 923-7175

The School of Mathematics and Natural Science offers undergraduate courses and programs in biology, chemistry, physics and physical science, and mathematics. Through effective teaching, advising, and scholarly activity, the School of Mathematics and Natural Science prepares students to engage in scientific inquiry and thought, select and pursue appropriate career options, become productive members of our scientific and technological society, and develop an appreciation of their own capabilities and accomplishments.

The School of Mathematics and Natural Science is comprised of three departments. The Biology Department offers courses in biology, radiologic technology in affiliation with a number of clinical sites, and environmental science, with degree programs in Biology, Biology Education, Radiologic Technology; and Environmental Science. The Chemistry and Physics Department offers courses in chemistry and physical science, with programs in Chemistry, Chemistry Education, Broadfield Science Education, and Natural Science. Mathematics offers courses and programs in Mathematics and Mathematics Education. In addition, Forensic Science is offered as an interdepartmental program across Mathematics and Natural Science in partnership with the School of Criminal Justice. The School sponsors two award-winning student education and service organizations: the Science and Math Association and the Environmental Sciences Club.

Courses and programs emphasize a mastery of fundamental concepts and the scientific evidence or mathematical proofs on which they are based, in combination with critical thinking skills, effective communication, and research techniques. In its role of supporting the Liberal Arts Programs, Mathematics and Natural Science helps students understand the nature of scientific thought, the value and approaches of mathematics, and the roles of science and mathematics in society. Mathematics and Natural Science supports professional training of students in other Schools, including Business, Education, and Nursing, by providing training in specific mathematical applications and basic sciences essential to those careers. Students majoring or minoring in the School of Mathematics and Natural Science are prepared for careers in teaching, research, government, and industry, and for advanced study in mathematics, natural science, and health professions.

PRE-HEALTH PROFESSIONS

Students desiring a pre-professional degree in one of the health sciences in preparation for applying to dental, medical, veterinary, physician assistant, optometry, occupational therapy, and physical therapy programs are advised to pursue a Biology major/Chemistry minor or a Chemistry major/Biology minor.

BIOLOGY DEPARTMENT (BS)

John May, Department Chair

The Biology Department offers the following degree programs: Biology (BS), Biology—Cytotechnology (BS) and Radiologic Technology (BSRT), with minors in Biology, Biology Education, and Environmental Science.

The Biology program provides its students with broad training in many aspects of the biological sciences. Through lecture, laboratory, and field work, students gain valuable experience that prepares them for careers in allied health programs, industrial and biological research fields, environmental careers, and teaching. Students desiring certification for teaching Biology in grades 5–12 take an additional major in Middle–Secondary Education. The program also conducts several courses required for students entering nursing, thus serving the School of Nursing as well as Biology majors.

Biology majors must achieve a 2.50 GPA in all of their Biology coursework before graduation. Transfer students must complete one-half of their major and one-third of their minor credits at Marian University.

General Education Program: 46-49 credits. University requirements including BIO 102 and CHE 101. Major satisfies lab science common core and natural sciences elective core requirements.

Other requirements

16 credits:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHE 101</td>
<td>Principles of Chemistry I</td>
<td>4 cr.</td>
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<tr>
<td>CHE 102</td>
<td>Principles of Chemistry II</td>
<td>4 cr.</td>
</tr>
<tr>
<td>CHE 201</td>
<td>Organic Chemistry I — Lecture</td>
<td>3 cr.</td>
</tr>
<tr>
<td>CHE 202</td>
<td>Organic Chemistry II — Lecture</td>
<td>3 cr.</td>
</tr>
<tr>
<td>CHE 251</td>
<td>Organic Chemistry I — Laboratory</td>
<td>1 cr.</td>
</tr>
<tr>
<td>CHE 252</td>
<td>Organic Chemistry II — Laboratory</td>
<td>1 cr.</td>
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32–33 credits:
Electives: MAT 122 Introduction to Probability and Statistics, MAT 201 Calculus I, PHS 203 University Physics I, and PHS 205 University Physics II are strongly recommended.

BIOLOGY MAJOR

38 credits as follows:

27 credits:
- BIO 101 Biological Principles I & Lab, 4 cr.
- BIO 102 Biological Principles II & Lab, 4 cr.
- BIO 231 Botany & Lab, 4 cr.
- BIO 300 Biology Literature and Seminar, 2 cr.
- BIO 301 Genetics & Lab, 4 cr.
- BIO 302 Cell Biology, 3 cr.
- BIO 311 Bacteriology & Lab, 4 cr.
- BIO 424 Senior Research in Biology, 2 cr.

4–8 credits from the following:
- BIO 201 Anatomy & Physiology I, 4 cr.
- BIO 202 Anatomy & Physiology II, 4 cr.
- BIO 310 Invertebrate Zoology & Lab, 4 cr.
- BIO 312 Developmental Biology & Lab, 4 cr.
- BIO 322 Vertebrate Zoology & Lab, 4 cr.

3–7 credits: Biology electives
- Biology/Middle–Secondary Education students are required to take BIO 310 Invertebrate Zoology & Lab and BIO 322 Vertebrate Zoology & Lab.

BIOLOGY MINOR

39 credits as follows:

23 credits:
- BIO 101 Biological Principles I & Lab, 4 cr.
- BIO 102 Biological Principles II & Lab, 4 cr.
- BIO 231 Botany, 4 cr.
- BIO 301 Genetics, 4 cr.
- BIO 302 Cell Biology, 3 cr.
- BIO Electives, 4 cr.

16 credits (Biology Minor prerequisites):
- CHE 101 Principles of Chemistry I, 4 cr.
- CHE 102 Principles of Chemistry II, 4 cr.
- CHE 201 Organic Chemistry I — Lecture, 3 cr.
- CHE 202 Organic Chemistry II — Lecture, 3 cr.
- CHE 251 Organic Chemistry I — Laboratory, 1 cr.
- CHE 252 Organic Chemistry II — Laboratory, 1 cr.

BIOLOGY–CYTOTECHNOLOGY PROGRAM (BS)

The Biology–Cytotechnology Program is a 3+1 program leading to a B.S. or B.A. degree in Biology with a subspecialization in Cytotechnology, the study of cells exfoliated or removed from the body manually for determination of the cancerous vs. normal state. Three years of successful academic study at Marian allows for application for admission to one year of professional training at the accredited School of Cytotechnology, State Laboratory of Hygiene, Madison, Wis.

The degree offered is a B.S. degree in Biology with a subspecialization in Cytotechnology. Students must meet all of the requirements for the Biology major (see Biology Program). The courses below must be taken as part of the subspecialization.

BIOLOGY–CYTOTECHNOLOGY MAJOR

Biology Major Requirements

Cytotechnology subspecialization requirements:

11–12 credits as follows:

8 credits:
- BIO 201 Anatomy and Physiology I, 4 cr.
- BIO 202 Anatomy and Physiology II, 4 cr.

3–4 credits from the following:
- BIO 402 Virology & Lab, 4 cr.
- BIO 422 Immunology, 3 cr.

4 credits:
- MAT 122 Introduction to Probability and Statistics, 4 cr.

BIOLOGY EDUCATION MINOR

46 credits as follows:

30 credits:
- BIO 100 Life Systems, 3 cr.

16 credits: Life Systems Laboratory, 1 cr.
- BIO 231 Botany, 4 cr.
- BIO 301 Genetics, 4 cr.
- BIO 302 Cell Biology, 3 cr.
- BIO 310 Invertebrate Zoology, 4 cr.
- BIO 322 Vertebrate Zoology, 4 cr.
- BIO 104 Environmental Science, 4 cr.
- BIO 315 Ecology, 3 cr.

16 credits (Biology Education Minor prerequisites):
- CHE 101 Principles of Chemistry I, 4 cr.
- CHE 102 Principles of Chemistry II, 4 cr.
- CHE 201 Organic Chemistry I — Lecture, 3 cr.
- CHE 202 Organic Chemistry II — Lecture, 3 cr.
- CHE 251 Organic Chemistry I — Laboratory, 1 cr.
- CHE 252 Organic Chemistry II — Laboratory, 1 cr.
ENVIRONMENTAL SCIENCE MINOR

The Environmental Science minor is an optional minor for Elementary–Middle Education majors or a support minor for Science majors.

24 credits as follows:

8–10 credits:
- BIO 104 Environmental Science & Lab, 4 cr.
- BIO 315 Ecology, 3 cr.
- BIO 304 Field Study, 1–3 cr.

4–8 credits from the following:
- BIO 100 Life Systems, 3 cr.
- BIO 150 Life Systems Laboratory, 1 cr.
- OR
  - BIO 101 Biological Principles I & Lab, 4 cr.
  - BIO 102 Biological Principles II & Lab, 4 cr.

6–12 credits from the following:
- BIO 221 Fall Flora, 1 cr.
- BIO 222 Spring Flora, 1 cr.
- BIO 231 Botany and Lab, 4 cr.
- BIO 301 Genetics and Lab, 4 cr.
- BIO 310 Invertebrate Zoology and Lab, 4 cr.
- BIO 311 Bacteriology and Lab, 4 cr.
- BIO 312 Developmental Biology and Lab, 4 cr.
- BIO 322 Vertebrate Zoology and Lab, 4 cr.
- BIO 342 Ornithology and Lab, 4 cr.
- BIO 365 Ecology Laboratory, 1 cr.
- PHS 108 Earth Science & Lab, 4 cr.
- PHS 110 Introduction to Meteorology & Lab, 4 cr.

RADIOLOGIC TECHNOLOGY PROGRAM (BSRT)

(2 years academic + 2 years professional study)

Upon completion of the required Marian University courses, the clinical program, and certification as a registered Radiologic Technologist, the traditional program in Radiologic Technology leads to a B.S.R.T. degree. Those who are already certified may take accelerated classes in the MAAP program to fulfill the requirements for the B.S.R.T. degree.

RADIOLOGIC TECHNOLOGY MAJOR

General Education Program: 46-49 credits.
University requirements including BIO 100 and BIO 150, CHE 103, and TEC 102. Major satisfies natural sciences lab science and elective core requirements, and the applied liberal arts elective core requirement.

Other requirements

89 credits as follows:

29 credits:
- BIO 100/150 Life Systems and Lab, 4 cr.
- CHE 103 General, Organic and Biochemistry, 5 cr.
- BIO 201 Anatomy and Physiology I, 4 cr.
- BIO 202 Anatomy and Physiology II, 4 cr.
- BIO 220 Introduction to Medical Terminology, 2 cr.
- PHS 211 Elementary Physics, 5 cr.
- TEC 102 Computer Software Applications, 3 cr.
- General Elective, ATC 101 and ATC 111 recommended, 2 cr.

AND

60 credits:
Two years Radiologic Technology program from an accredited School of Radiologic Technology and subsequent certification as a registered Radiology Technologist. It is the student’s responsibility to seek acceptance at an accredited School of Radiologic Technology.

Students will register for five courses to maintain continuous enrollment at Marian University and to indicate their progress in their off-campus training, beginning with their entrance into an accredited School of Radiologic Technology as follows:

- RAD 380 Radiologic Technology Clinical I, 14 cr.
- RAD 390 Radiologic Technology Clinical II, 14 cr.
- RAD 400 Radiologic Technology Clinical III, 14 cr.
- RAD 410 Radiologic Technology Clinical IV, 14 cr.
- RAD 420 Radiologic Technology Clinical V, 4 cr.

A BSRT Completion program is offered through MAAP as well. See the Marian Adult Accelerated Program section of this Bulletin for more information.

CHEMISTRY AND PHYSICS DEPARTMENT (BS)
Thomas Richardson, Department Chair

The Chemistry and Physics Department offers majors in Chemistry and Broad Field Science Education, and minors in Chemistry, Chemistry Education, and Natural Science.
The Chemistry and Physics Department provides its students with courses and experiences in a wide variety of areas in the discipline of Chemistry. It prepares students for entrance into the chemical industry, graduate school, medical technology, medicine and teaching science in elementary and secondary schools. Students desiring certification for teaching science in grades 5–12 take a major in Middle–Secondary Education. The program also serves...
Mathematics and Natural Science

students in the School of Nursing, and offers courses in physics and physical science to support a variety of disciplines. Chemistry majors must achieve a 2.50 GPA in all of their chemistry courses before graduation. Transfer students must complete 18 or more of their chemistry credits at Marian University for the Chemistry major and must complete eight or more of their chemistry credits at Marian University for the Chemistry minor.

General Education Program: 46-49 credits.
University requirements including MAT 201 Calculus I and CHE 101 Principles of Chemistry I.

Major satisfies the lab sciences and the mathematics common core.

Other requirements

20 credits as follows:

10 credits:
MAT 201 Calculus I, 5 cr.
MAT 202 Calculus II, 5 cr.

10 credits:
PHS 203 University Physics I & Lab, 5 cr.
PHS 205 University Physics II & Lab, 5 cr.

Electives: (BIO 101, BIO 102, MAT 301 recommended)

CHEMISTRY MAJOR

34–36 credits:
CHE 101 Principles of Chemistry I and Lab, 4 cr.
CHE 102 Principles of Chemistry II and Lab, 4 cr.
CHE 201 Organic Chemistry I, 3 cr.
CHE 202 Organic Chemistry II, 3 cr.
CHE 251 Organic Chemistry I Lab, 1 cr.
CHE 252 Organic Chemistry II Lab, 1 cr.
CHE 300 Analytical Chemistry and Lab, 4 cr.
CHE 301 Instrumental Analysis and Lab, 4 cr.
CHE 401 Physical Chemistry I, 3 cr.
CHE 402 Physical Chemistry II, 3 cr.
CHE 412 Chemistry Literature and Seminar, 1 cr.
CHE 420 Senior Research, 1–3 cr.
CHE 451 Physical Chemistry I Lab, 1 cr.
CHE 452 Physical Chemistry II Lab, 1 cr.

2 credits:
CHE Chemistry electives, 2 cr. (choose from course numbers above 200)

CHEMISTRY MINOR

24 credits as follows:

12 credits:
CHE 101 Principles of Chemistry I and Lab, 4 cr.

CHE 102 Principles of Chemistry II and Lab, 4 cr.
CHE 300 Analytical Chemistry and Lab, 4 cr.

12 credits:
CHE Chemistry electives, 12 cr. (choose from course numbers above 200)

CHEMISTRY EDUCATION MINOR

24–25 credits as follows:

20 credits:
CHE 101 Principles of Chemistry I and Lab, 4 cr.
CHE 102 Principles of Chemistry II and Lab, 4 cr.
CHE 201 Organic Chemistry I, 3 cr.
CHE 202 Organic Chemistry II, 3 cr.
CHE 251 Organic Chemistry I Lab, 1 cr.
CHE 252 Organic Chemistry II Lab, 1 cr.
CHE 300 Analytical Chemistry and Lab, 4 cr.

4–5 credits from the following:
CHE 301 Instrumental Analysis and Lab, 4 cr.
CHE 302 Biochemistry and Lab, 4 cr.

22 credits as follows:

12 credits:
BIO 101 Biological Principles I & Lab, 4 cr.
BIO 102 Biological Principles II & Lab, 4 cr.
BIO 104 Environmental Science & Lab, 4 cr.

10 credits:
PHS 203 University Physics I & Lab, 5 cr.
PHS 205 University Physics II & Lab, 5 cr.

Additional requirements

All other courses normally applicable to the Middle–Secondary Education major in sciences.

BROAD FIELD SCIENCE EDUCATION MAJOR

28 credits as follows:

14 credits in each of the following:
Biology including BIO 104 Environmental Science and Lab
Chemistry

16 credits as follows:

8 credits in each of the following:
Earth and Space Science
Physics

10 additional credits from:
Biology, Chemistry and/or Philosophy of Science
6 credits of math

NATURAL SCIENCE MINOR

This minor is available to all students, but will be of greatest interest to students majoring in Elementary–Middle Education. The minor is made up of a series of courses designed to satisfy the requirements of the Wisconsin Department of Public Instruction for a science minor. For certification in grades 1–6 and grades 1–9, 28 credits as follows:

28 credits as follows:

8 credits:
PHS 108  Earth Science & Lab, 4 cr.
PHS 110  Introduction to Meteorology & Lab, 4 cr.

9 credits:
PHS 211  Elementary Physics, 5 cr.
CHE 101  Principles of Chemistry I, 4 cr.

4 credits from the following:
BIO 102  Biological Principles II & Lab, 4 cr.
BIO 100  Life Systems, 3 cr.
BIO 150  Life Systems Laboratory, 1 cr.
fulfills Liberal Arts requirements

4 credits:
CHE 102  Principles of Chemistry II
fulfills Liberal Arts requirements

4 credits:
BIO 104  Environmental Science & Lab

Mathematics and Natural Science Prerequisites required:
MAT 112  Pre-Calculus Mathematics, 5 cr.
BIO 101  Biological Principles I and Lab, 4 cr. (if taking BIO 102)

Students seeking certification for grades 1–9 must also student-teach in their minor in the middle school.

FORENSIC SCIENCE PROGRAM (BS)

In collaboration of the School of Criminal Justice, the Forensic Science Program combines knowledge of criminal justice in its broadest sense with thorough training in the approaches, knowledge, and analytical techniques of the laboratory scientist. Forensic science technicians may be called on to analyze a wide variety of evidence and events, such as blood spatter and blood chemistry; physical forces produced by auto impacts and other human body traumas; microscopic matching of hairs, tools, and weapons with their sources and trace evidence at a crime scene; genetic and enzymatic comparisons of fluids and tissues; and time of death determinations based on biological and chemical processes; to name a few. Consequently, forensic science technicians require thorough preparation in a broad array of science disciplines and mathematics, including statistics, physics, biology, and chemistry. This intense and broad program of study includes all courses required for application to most health professions programs, including medicine, dentistry, optometry, and veterinary schools. In addition, this program includes the array of chemistry, physics, math, and biology expected of candidates seeking employment in industrial quality control, many basic science laboratories, and industrial product development research laboratories.

FORENSIC SCIENCE MAJOR

General Education Program: 46-49 credits.
University requirements including BIO 102, CHE 101, and MAT 201. Major satisfies natural sciences and mathematics common and elective core requirements, the laboratory common core requirement, and the applied liberal arts elective core requirement.

Other requirements: The Forensic Science major requires completion of a concurrent minor in chemistry, including CHE 302: Biochemistry.

50-53 credits as follows:

47-49 credits:
BIO 101  Biological Principles I, 4 cr.
BIO 102  Biological Principles II, 4 cr.
BIO 301  Genetics & Lab, 4 cr.
CRJ 102  Constitutional Law, 3 cr.
CRJ 302  Criminal Procedural Law, 3 cr.
CRJ 340  Principles of Judicial Practice, 3 cr.
CRJ 350  Principles of Professional Practice, 3 cr.
FOS 105  Survey of Forensic Sciences, 1 cr.
FOS 304  Forensic Science I: Rules of Evidence, 3 cr.
FOS 405  Forensic Science III – Advanced Methods, 4 cr.
FOS 405  Forensic Science III – Advanced Methods, 4 cr.
FOS 497  Internship, 1-3 cr.
PHS 203  University Physics I, 5 cr.
PHS 205  University Physics II, 5 cr.

3-4 credits:
CRJ 214  Stat Techniques Research Data Analysis 3 cr.
MAT 122  Introduction to Probability and Statistics, 4 cr.
MAT 304  Introduction to Mathematical Statistics I, 3 cr.
The Mathematics Department offers a BS degree with a major in Mathematics.

The Mathematics Department presents the student with an aesthetic view of mathematics as well as the role of mathematics in science, technology, business and other fields. The variety of courses in introductory mathematics, calculus, geometry, algebra, probability and statistics offers the student a wide range of choices to meet their interests. The program provides the student with the necessary mathematical knowledge and skills to pursue further study in mathematics and careers in education, business, science, and government. The Mathematics Department recommendation for students taking their first course in mathematics is made on the basis of the student’s ACT score, high school record, University objectives and/or an Accuplacer assessment. Students desiring state certification to teach mathematics in grades 5–12 take an additional major in Middle–Secondary Education. All Mathematics majors must achieve a 2.50 GPA in all of their mathematics courses applicable to the degree (e.g., MAT 201 and above) before graduation. Transfer students must complete one-half of their major credits and one-third of their minor credits at Marian University.

**General Education Program:** 46-49 credits.
University requirements. Major and minor satisfy the Mathematics core.

**MATHEMATICS MAJOR**

**41 credits as follows:**

**26 credits:**
MAT 201 Calculus I, 5 cr.
MAT 202 Calculus II, 5 cr.
MAT 212 Introduction to Abstract Mathematics, 3 cr.
MAT 301 Calculus III, 4 cr.
MAT 304 Introduction to Mathematical Statistics I, 3 cr.
MAT 334 Linear Algebra, 3 cr.
MAT 344 Abstract Algebra, 3 cr.

**12 credits:**
MAT Electives (must be numbered above 300)

**3 credits from the following:**
Elective (must be numbered 201 or above)
TEC 212 Computer Programming I, 3 cr.

**MATHEMATICS MINOR**

**25 credits as follows:**

**19 credits:**
MAT 201 Calculus I, 5 cr.
MAT 202 Calculus II, 5 cr.
MAT 212 Introduction to Abstract Mathematics, 3 cr.
MAT 304 Introduction to Mathematical Statistics I, 3 cr.
MAT 334 Linear Algebra, 3 cr.

**3 credits:**
MAT Elective (must be numbered above 300)

**3 credits:**
CPS Elective (must be numbered 201 or above)
TEC 212 Computer Programming I, 3 cr.
MTE 200 Mathematics Education and Technology, 3 cr.

**MATHEMATICS EDUCATION MINOR**

**25 credits:**
MAT 150 Mathematics for Elementary School Teachers I, 3 cr.
MAT 151 Mathematics for Elementary School Teachers II, 3 cr.
MTE 288 Mathematics for Middle School Teachers I, 3 cr.
MTE 289 Mathematics for Middle School Teachers II, 3 cr.
MTE 375 Historical Topic in Mathematics, 2 cr.
MAT 201 Calculus I, 5 cr.
MAT 212 Introduction to Abstract Mathematics, 3 cr.
MTE 200 Mathematics Education and Technology, 3 cr.