College of Natural Sciences and Mathematics
Undergraduate Catalog

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Mission Statement
The Faculty of The University of Toledo's College of Natural Sciences and Mathematics seek to build and disseminate foundational and applicable knowledge through excellence in teaching, research and discovery, and community engagement; foster the advancement of science, mathematics and technology locally, regionally, and globally; and serve as a transformative force within a diverse, interdisciplinary, and collaborative education environment for improving our world through science and mathematics.

Admission Policies
New first-year students must (1) submit a college test score (ACT or SAT) and (2) have either a 2.5 high school GPA or ACT composite of 20 (SAT combined reading and math score of 950) to be admitted to the College of Natural Sciences and Mathematics. Applicants not meeting these standards will be admitted to the Department of Exploratory Studies in the You College. Students applying who want to be admitted as BS Biology degree program in the Department of Biological Sciences must have a minimum high school GPA of 2.75. Students not meeting this requirement but meeting the minimum college requirements will be admitted to the BA Biology degree program.

To be considered for admission to the premed, predent and prevet programs, students will need a minimum high school cumulative GPA of 3.2 and an ACT composite score of 25 (or minimum SAT combined reading and math score of 1150). Students should also have successfully completed a minimum of three years of high school mathematics (algebra I, algebra II and geometry) and high school chemistry. Applicants not meeting these standards but meeting the Natural Sciences and Mathematics college admission standards will be admitted to the College of Natural Sciences and Mathematics degree program of their choice or as BS-UND (undeclared).

Change of College
Students in good standing (i.e. with a cumulative GPA of 2.0 or higher) who wish to change from another college of The University of Toledo to the College of Natural Sciences and Mathematics should make an appointment with a college Adviser in the College Student Services Office to discuss their transfer and have their academic records reviewed. External transfer course work previously evaluated by other UT colleges will be re-evaluated. All college requirements, including core, skill area, distributive, major and related requirements, must be fulfilled as specified in the catalog for the year in which the student enters the College of Natural Sciences and Mathematics. Credit restrictions and level requirements for Natural Sciences and

Mathematics students will apply. Beginning in Summer 2011, continuing UT students seeking admission to pre-medical, pre-dental and pre-veterinary programs must have a 3.0 cumulative college GPA and have completed CHEM 1090 or 1230 and MATH 1320 or higher with a B or better.

Change of Catalog Year
Continuing students who declared a major within the College of Natural Sciences and Mathematics prior to Fall 2012 may change to the 2013-2014 catalog year. Interested students should visit the Student Services Office (UH 3000) and meet with their academic adviser to officially declare their new catalog year.

Admission with Transfer Credit from Another Institution
No more than 94 semester hours of credit earned at other institutions may apply toward a degree in the College of Natural Sciences and Mathematics. Course work from other institutions is accepted at the level the equivalent course is taught at The University of Toledo. Students with transfer credit are generally expected to fulfill all University and college course requirements for a degree in the College of Natural Sciences and Mathematics as specified in the catalog for the year in which they enter the College of Natural Sciences and Mathematics. In some cases, not all the credits that transfer into The University of Toledo will apply toward a degree in the College of Natural Sciences and Mathematics, e.g., developmental courses. Transfers from other institutions shall take at least 30 semester hours at The University of Toledo, including 12 semester hours of work in their major field and 9 semester hours in their minor field, regardless of the number of hours transferred.

Students transferring to the University of Toledo in Spring 2007 or later, including transfer readmits, must meet minimum GPA requirements in their Natural Sciences and Mathematics majors and minors with both (1) the grades of all courses attempted at UT and (2) in a second calculation, the grades of all courses attempted at all institutions (including UT). The grades of all courses (from all institutions) which are used by those students to satisfy UT Core requirements must be used in the calculation of the UT General Education GPA.

UT students who attend other institutions as guests or transient students in Fall 2008 or later must also meet minimum GPA requirements in their Natural Sciences and Mathematics majors and minors with (1) the grades of all courses attempted at UT and (2) in a second calculation, the grades of all courses attempted at all institutions (including UT). The grades of all courses (from all institutions) which are used by those students to satisfy UT Core requirements must be used in the calculation of the UT General Education GPA.

For the purposes of meeting minimum cumulative GPA's in a student's Natural Sciences and Mathematics major(s) and/or minor(s) and the UT Core, the grades of all courses attempted at all institutions will be included in the GPA calculation(s). Note: Due to technological limitations of UT's current Degree Audit Reporting System, Degree Audit GPA calculations for students who have taken courses at other institutions may not be accurate. Consult a college staff Adviser if you have questions.

Transfer students should note that The University of Toledo will include all course work taken at all institutions of higher education in the calculation to determine if a student will graduate with honors. All college course work ever taken is computed in determining eligibility for graduation with honors, although no student will be awarded a level of honors above that indicated by The University of Toledo cumulative grade point average (GPA). Note: The University of Toledo requires a minimum of 30 semester hours of standard letter graded courses from UT in order to qualify for graduation with honors.

An applicant who has undertaken courses at a regionally accredited college or university and who submits through the Office of Undergraduate Admission for Adult, Transfer and International Students an official transcript listing courses and grades and giving evidence of good standing will be admitted to the College of Natural Sciences and Mathematics, provided the student has maintained a minimum GPA of 2.0 on a 4.0 scale.

Exceptions to this minimum admission requirement are rarely made and require the applicant to demonstrate, in a written petition to the committee on academic standing, that there are special circumstances that warrant waiver of the requirement. Approval of the petition is not automatic, and those students who are admitted by petition will be placed on special probationary status and must meet certain conditions to remain enrolled.

If the college from which the applicant transfers lacks proper accreditation, the student may be denied transfer credit on the basis of the transcript, but may be allowed to obtain credit by passing advanced standing examinations with at least a C grade. Official transcripts of records from all schools previously attended must be on file with the Office of Undergraduate Admission for Adult, Transfer and International Students before the student will be permitted to register.

A Second Degree at The University of Toledo

A Second Degree within the College of Natural Sciences and Mathematics:

A student earning a degree at The University of Toledo in the College of Natural Sciences and Mathematics may simultaneously earn a second degree in a different department within the College of Natural Sciences and Mathematics by completing the requirements of both degrees. General education courses that meet the requirements of both degrees will count for both. The two degrees must be of a different type (e.g. – BS and BA) and both must be offered by NSM. A student who has previously earned a BA degree in the College of Natural Sciences and Mathematics may return to complete a BS degree in the same major by fulfilling the major and related field requirements for the BS degree as described in the catalog for the year of readmission. A student who previously earned either a BA or BS degree in the College of Natural Sciences and Mathematics may return to complete either a BA or BS in a different department by fulfilling the NSM college, major and related field requirements for the degree and major desired, as described in the catalog for the year of readmission. University and NSM college general education courses that meet the requirements of both degrees will count for both. Courses in the Related Area of the first major may count towards the second major unless other related courses are required.

A Second Major within a Bachelor of Science or Bachelor of Arts degree in the College of Natural Sciences and Mathematics:

A student earning a Bachelor of Science or a Bachelor of Arts in the College of Natural Sciences and Mathematics may simultaneously earn a second major in a different department by completing the requirements of both majors as specified for the same degree program (BA *or* BS). Courses in the Related Area of the first major may count towards the second major unless other related courses are required. It is important to understand that completing this pathway will result in the achievement of a single degree, but with dual majors, from the College of Natural Sciences and Mathematics. All requirements for both majors must be completed in the same graduation term.

A Second Degree in the College of Natural Sciences and Mathematics at The University of Toledo:

A student earning a degree in another College at The University of Toledo may earn a second degree simultaneously in the College of Natural Sciences and Mathematics through the completion of all requirements of both degrees. A student who previously earned a degree in another College at the University of Toledo [or elsewhere] may earn a second degree in the College of Natural Sciences and Mathematics through the completion of all requirements of the College of Natural Sciences and Mathematics degree. General education courses that meet the requirements of both degrees will count for both.

Important Note:

Courses constituting a departmental or interdisciplinary major or minor may not also be used to meet requirements for a different departmental or interdisciplinary major or minor either within or outside the College of Natural Sciences and Mathematics.

Requirements for Students with an Associate's Degree

Students holding an Associate of arts or Associate of science degree from an accredited college are encouraged to enroll in the College of Natural Sciences and Mathematics and, in many instances, may expect to earn an appropriate baccalaureate upon completion of two years of full-time study. Students with an Associate's degree in a technical program will likely require more time to complete a bachelor's degree. The following regulations apply:

- Students must complete the equivalent of the specified University and college core and distributive requirements for a bachelor's degree.
- In all baccalaureate programs, a minimum of 64 hours must be taken at the 2000 to 4000 levels; of these, a minimum of 32 hours must be taken at the 3000 to 4000 levels in baccalaureate degree - granting colleges. Course work from other institutions is accepted at the level the equivalent course is taught at The University of Toledo..
- Students may enroll in any departmental, interdepartmental or interdisciplinary program for which they meet the admission criteria. All of the usual major and related area requirements must be fulfilled as specified in the catalog for the year in which the student entered the College of Natural Sciences and Mathematics.

Readmission of Former Arts and Sciences or Natural Sciences and Mathematics Students

Students who have withdrawn from the College of Arts and Sciences or the College of Natural Sciences and Mathematics and The University of Toledo and have not attended any other institution in the Interim may be readmitted, provided they were eligible to continue enrollment in the college at the time they discontinued attendance. Such students should readmit at the College Student Services Office. Students who have been suspended from the College of Natural Sciences and Mathematics must submit a written letter of petition. Students who readmit after more than 12 consecutive months' absence must comply with existing college requirements at the time of readmission.

Academic Policies

Refer to UT Policy website for academic policies that apply to all students.

Academic Advising
Academic advising is a process intended to help students derive as many benefits as possible from their educations. This occurs when Advisers help students develop and reach academic and career goals. While the ultimate responsibility for making personal and educational decisions rests with the student, Advisers assist by helping to identify and assess alternatives and the consequences of decisions. Advising can be much more than selecting courses. The more frequently students arrange to meet with their Advisers, the better their needs can be served. New students, transfer students, students changing colleges, and continuing general studies students are advised in the College of Natural Sciences and Mathematics Student Services Office, University Hall Room 3000, by college staff Advisers. Limited advising hours are also available in Wolfe Hall, room 2243. See the Tri-College Student Services web page for more information. They provide essential information; help students select courses to meet University General Education and college skill area and distributive requirements; suggest courses for the exploration of majors and minors; and help students evaluate academic progress and adjustment to university life. Students with declared majors and/or minors are advised by departmental major or program Advisers, faculty who provide general information as well as more specialized information about majors and minor programs, departmental course offerings, and career and graduate opportunities. They help students select courses for general, major, related, and other requirements. Students in the Honors College and those seeking more than one major or degree, a minor, or admission to professional school should meet periodically with one or more additional Advisers. A complete list of academic Advisers is available on the college website or in the College office.

Student Responsibilities
Students are responsible for correctly selecting courses for their programs of study each semester and for fulfilling all degree requirements. Although Advisers will assist wherever possible, the final responsibility rests with the student. Students are expected to make sure that they are fulfilling all degree requirements, as published in the issue of the catalog of the College Natural Sciences and Mathematics under which they entered. Students who have been out of the College of Natural Sciences and Mathematics for 12 consecutive months are responsible for the requirements in the University catalog under which they reenter.

Transcripts and Degree Audit Reports
A transcript is a complete chronological list of a student's academic course work (including all courses attempted and grades earned). It does not show how specific courses apply or do not apply to University and college requirements as stipulated in this catalog. For example, developmental, non-repeatable and certain other courses are not counted toward minimum credits for degrees, but appear on transcripts. The Degree Audit Report (DAR) details all requirements applicable to a student's academic program (degree, major, minor) and applies the student's courses on the transcript (including transfer credit) to those requirements. The DAR should be used to identify requirements remaining when all registered courses are completed. The College of Natural Sciences and Mathematics Student Services Office (UH Room 3000) will provide an unofficial transcript and DAR to a College of Natural Sciences and Mathematics student presenting a picture ID. Students also may view their transcript and DAR through the myUT portal with Student Self-Service.

Declaring or Changing a Major or Minor
To declare a major or minor or change one previously declared, students must fill out a form that is available in the College Student Services Office.

Sequence of Courses
There is no single prescribed sequence of courses, except that all first-year students should take NSM 1000 Orientation, and any developmental courses required on the basis of placement testing and/or high school deficiencies. Students should consult the later sections of the catalog devoted to programs of study and course offerings, and they should review their programs with their academic Advisers to ensure they complete courses in the proper sequences. In addition, students should use their Degree Audit Reports to track their progress.

Entering students majoring in mathematics or in one of the areas of the natural sciences usually should begin the special courses designated as prerequisite for advanced courses in their first year. For example, calculus is a prerequisite for other mathematics courses and for later courses in physics, chemistry and geology. General Chemistry I and II, Biology Fundamentals of Life Science I and II, and Fundamentals of Geology are prerequisites for succeeding courses required for majors in these areas.

Study Abroad
Students who plan to study abroad must be sure that their proposed course of study is properly accredited. Its academic acceptability should be verified by the college before departure. Students also should ascertain in advance from their Advisers whether the course work will count toward their general requirements, majors, or related areas or only be regarded as elective. Credit for foreign language study is subject to the approval and recommendation of the department of foreign languages. Information about study abroad programs is generally available from Advisers in many college programs and departments and from the Office of Study Abroad.

Transient (Guest) Enrollment at Another Institution
College of Natural Sciences and Mathematics students must have advance permission both to enroll elsewhere as a guest and to take specific courses. The Transient Student form for this purpose is available in the College Student Services Office and on the college website. Students enrolling without permission will be considered transfer readmits upon their return to UT. Natural Sciences and Mathematics students enrolled as transients or guests at another institution must submit an official transcript to the UT Office of Admission at the conclusion of the enrolled term. Grades of all courses attempted in the major, minor, and UT Core will be used in cumulative GPA calculations.

GPA Recalculation for Repeated Courses
The College of Natural Sciences and Mathematics permits a maximum of 12 semester hours or the equivalent of 18 quarter hours of course work to be deleted from the GPA calculation. Students who have had their GPAs recomputed under the Academic Forgiveness Policy are not eligible for grade deletions. Criteria governing GPA recalculation are given in the General Section of this catalog. Students should check with the College Student Services Office for more specific information on this policy. Students may not use repeat courses taken at other institutions to qualify for a GPA recalculation.

Withdrawal Policy (W, IW, DR Grades)
The number of credit hours of W, IW and DR is limited to 22 hours for all undergraduate students in degree programs in the College of Natural Sciences and Mathematics. Once a student has accumulated 22 hours of W, IW or DR, further withdrawals will be counted as F's in computation of the student's GPA for purposes of probation or suspension. In addition, students who receive financial aid risk the loss of financial aid if they accumulate excessive hours of W, IW and DR. Students who transfer into the College of Natural Sciences and Mathematics from another college at The University of Toledo will bring with them the number of W's, IW's and DR's accumulated in their previous work. **Note**: Assignment of the IW and DR grades has been discontinued. A student wanting to be withdrawn from a course must file a petition in the Records Office by the deadline in the term of enrollment.

Academic Probation
A student whose cumulative GPA is less than 2.0 is automatically placed on probation until a 2.0 cumulative GPA is achieved (See Withdrawal Policy above). It is recommended that a student on probation not enroll for more than 12 to 14 credits.

Academic Suspension
Academic suspension means that a student is prohibited from registering at The University of Toledo for a period of at least one semester. Students are subject to academic suspension if their GPA falls below the minimum GPA listed below or if they fail to make sufficient progress toward attainment of the degree. (See Withdrawal Policy). Students may remove Incompletes while under suspension. A student is subject to academic suspension if the cumulative GPA is less than: 1.0 for 10 to 19 hours attempted; 1.5 for 20 to 29 hours attempted; 1.7 for 30 to 39 hours attempted; 1.8 for 40 to 49 hours attempted; 1.9 for 50 to 59 hours attempted; less than 2.0 for 60 or more hours attempted. After accumulating 60 credit hours without suspension, a student may be suspended if the cumulative GPA falls below 2.0 for two consecutive semesters.

Trial Readmission Policy
After the required suspension period, a student may petition for readmission to the College of Natural Sciences and Mathematics committee on academic standing. The petition must be received at least one month before the beginning of the semester in which the student wishes to readmit. If the petition is accepted, the college committee will determine the terms of the conditional registration agreement, under which the student will be permitted to re-enroll. Suspended students who are granted readmission must maintain the designated GPA for each semester thereafter and meet the conditions of their readmission agreement. Students failing to meet these conditions are subject to a one-year suspension.

Dismissal Policy
Students who fail to meet the conditions for readmission after their second suspension are subject to dismissal and are not eligible for readmission to the College of Natural Sciences and Mathematics for at least three years. *Refer to the University Academic Policy web page (www.utoledo.edu/policies) for information on the Academic Forgiveness Policy.*

Academic Grievance
A student has the responsibility and right to call to the attention of an instructor any grade that the student believes to be in error or unfair. A student may appeal the decision of the instructor, in order, to the department Chair, the Dean, then to the college appeals committee if the problem is not resolved. If the problem is not resolved at the college level, the student may appeal to the student grievance council (*See also The University of Toledo Student Handbook*). A student must begin the appeals process no later than the end of the semester following the one in which the grievance arose.

Statement on Academic Dishonesty
A student found to be academically dishonest by a faculty member may appeal, in order, to the department Chair, the Dean, the college appeals committee and the University student grievance council. The procedures for making an appeal to the student grievance council may be found in The University of Toledo Student Handbook.

College Level Examination Program (CLEP)
The College of Natural Sciences and Mathematics will accept a maximum of 21 semester hours of CLEP through successful completion of the four general examinations. Additional credit may be earned through satisfactory scores on individual subject examinations. Required minimum scores and credits awarded are as follows:

General Examinations
Humanities: For a score of 50, a student will receive six hours credit in the humanities.
College mathematics: For a score of 65, a student will receive three hours credit for MATH 1180.
Natural sciences: For a score of 50, a student will receive six hours credit in the natural sciences.
Social sciences and history: For a score of 50, a student will receive six hours credit in the social sciences.

Subject Examinations
American government: For a score of 50, a student will receive three hours credit for PSC 1200.
Biology: For a score of 50, a student will receive three hours credit for BIOL 1120.
Calculus: For a score of 65, a student will receive four hours credit for MATH 1850.
Chemistry: For a score of 50, a student will receive eight hours credit for CHEM 1230 and CHEM 1240.
College algebra: For a score of 65, a student will receive three hours credit for MATH 1320.
College algebra – Trigonometry: For a score of 65, a student will receive four hours credit for MATH 1340.
French language: For a score of 50, a student will receive four hours credit for FREN 1500. For a score of 62, a student will receive seven hours credit for FREN 1500 and FREN 2140.
German language: For a score of 50, a student will receive four hours credit for GERM 1500. For a score of 62, a student will receive seven hours credit for GERM 1500 and GERM 2140.
Spanish language: For a score of 50, a student will receive four hours credit for SPAN 1500. For a score of 66, a student will receive seven hours of credit for SPAN 1500 and SPAN 2140.
Trigonometry: For a score of 65, a student will receive three hours credit for MATH 1330.

Advanced Placement Program
Refer to the College of Natural Sciences and Mathematics programs of study section for specific information on minimum scores and credits awarded for Advanced Placement examinations administered by the College Board Advanced Placement Program.

Pass/No Credit Option
Refer to the General Section of this catalog for an explanation of the pass/no credit grading option. Refer to programs of study in the College of Natural Sciences and Mathematics section of this catalog for the limitations on pass/no credit grading in effect for different majors. Undeclared students, as a general rule, should not elect pass/no credit grading in major-level courses.

Graduation Evaluation Requirement
Two or three semesters (at 80 earned credit hours) before a student intends to graduate, the student and the student's major Adviser must complete a Graduation Quick Check Form. This process is initiated by the student. Students with more than one major or one or more minors must be evaluated for the completion of each major and minor. Detailed instructions on the Graduation Quick Check Form and graduation procedures are available at the college office.

Field Experience/Internship
Policies and procedures for incorporating field experiences or internships in academic programs vary from major to major. Some majors require a field experience or internship; for other majors, they are optional. Students should seek information from their major departments and obtain advance approval for all field experiences or internships.

Degree Requirements
The College of Natural Sciences and Mathematics offers both Bachelor of Arts and Bachelor of Science degrees. Requirements differ based on degree as indicated below.

A. Grade Point Averages
A cumulative grade point average (GPA) reflects all grades earned, including grades of F and grades in repeated courses. Candidates must earn a minimum overall cumulative GPA of C (that is, a 2.0 GPA on a 4.0 scale) for all UT course work. In addition, candidates must earn a minimum cumulative GPA of C in the major, ,minors (optional) and UT General Education, with the grades of all courses attempted at all institutions included in the GPA calculation. Some programs require a higher GPA in the major. For example, BS Chemistry, BS Biochemistry, and BS Geology require a 2.5 GPA. *Refer to the General Section of this catalog for information on grade deletions and academic forgiveness.*

B. Residency Requirement
Students transferring from other institutions must earn at least 30 hours of credit at The University of Toledo; at least 12 of these must be in the major area, and for students pursuing a minor, at least 9 hours must be earned at The University of Toledo. Full-time students must take their last semester, and part-time students their last 12 hours, in residence, unless alternative arrangements have been made in advance with the Dean of the College of Natural Sciences and Mathematics.

C. Credit Hours and Levels
1. Students must complete a minimum of 124 hours of course work that must include the University General Education and college skill area and distributive requirements, and either major and course work related to the major, or an interdisciplinary program.

2. In all baccalaureate programs, a minimum of 64 hours must be taken at the 2000 to 4000 levels; of these a minimum of 32 hours must be taken at the 3000 to 4000 levels.

3. Students are cautioned to make use of their degree audit and review remaining requirements with their Adviser before every registration in order to make progress toward completion of their requirements in an orderly, timely manner. Insofar as a student can complete the basic courses and the courses required for a chosen major (as outlined in sections E - J below) in fewer than the 124 hours required for a degree, the student must choose elective courses to complete the total of 124 hours, subject to the restrictions outlined below.

D. Credit Restrictions
Total earned hours shown on a student's transcript may not all be applicable to the minimum 124 credits required for a degree, as follows:

1. Students with entrance deficiencies in mathematics and other students who are required or choose to take developmental course work will need to complete additional hours.

2. No courses in typing, shorthand or keyboarding will apply toward the degree.

3. No more than two hours in skill courses in physical education or recreation courses at the 1000 level will apply toward the degree.

4. No more than two hours in Student Leadership Development I and II will apply toward the degree.

5. Duplicate credit – except for courses identified as repeatable courses, students will not receive credit for repeated courses (taking the same course twice), whether taken at The University of Toledo or elsewhere.

6. The college reserves the right to deny credit for other specific courses (including most SKLS courses) and for blanket technical credit not applicable to a student's specific program.

E. University General Education Requirements
Students earning baccalaureates in all colleges and programs are required to complete between 33-34 credit hours of courses that comprise the General Education Curriculum. Those courses are distributed in the areas of English composition, humanities/fine arts, social sciences, natural sciences and mathematics, and multicultural studies courses. Students should view their Degree Audit Report or contact their academic department or college office for specific details.

F. Natural Sciences and Mathematics Skill Area Requirements
Students are placed into mathematics courses by ACT scores or placement tests in those subjects. Students are placed into foreign language courses through placement testing.

1**. Orientation (NSM1000)** - 1 hour
All new first-year students are required to take NSM1000. The course is optional for transfer students.

2**. English Composition** (University of Toledo General Education and College of Natural Sciences and Mathematics requirement) – 6 hours. To earn a degree in the College of Natural Sciences and Mathematics, students must pass both Composition I and II with a C or better. (Students in the Honors College must pass HON 1010 and 1020 with a C or better to meet the Composition I and II requirements.) The College of Natural Sciences and Mathematics recommends that these requirements be met before completing 45 credit hours.

a. Native speakers track (for students for whom English is a first language).
ENGL 1110 – 3 hours College Composition I
ENGL 1130, 1140, 1150, 2950, or 2960 – 3 hours College Composition II

b. Nonnative speakers track (for students for whom English is a second language). Students will take an English placement test to determine appropriate starting level.
ENGL 1020 – 3 hours Writing and Grammar for English as a Second Language
ENGL 1110 – 3 hours College Composition I
ENGL 1130, 1140, 1150, 2950, or 2960 – 3 hours College Composition II

3. **Mathematics** (UT General Education and College of Natural Sciences and Mathematics requirement) – 3-8 hours.

a. Bachelor of Arts (BA)
MATH1320 College Algebra or **MATH1340** College Algebra and Trigonometry or **MATH2600** Intro to Statistics or **MATH2640** Statistics for Applied Science or higher Math.

b. Bachelor of Science (BS)
Two semesters of Calculus (**MATH1750** and **MATH1760** or **MATH1830** and **MATH1840** or **MATH1850** and **MATH1860**).

4. **Writing Across the Curriculum (WAC) Requirement**
Students must pass two writing intensive courses approved by their adviser. Many courses will require completion of Composition I and II (or HON 1010 and HON 1020) as pre-requisites. The College of Natural Sciences and Mathematics recommends that the first of these writing intensive courses be completed within the first 65 and the second within the first 90 hours. At least one of these courses must be taken within the student's major. In consultation with their advisers, students with dual or interdisciplinary majors will meet this requirement by selecting a course within one of their chosen majors.

Transfer students from institutions that have required writing intensive courses should have their former institution certify that they have completed a series of writing intensive courses comparable to those required in the College of Natural Sciences and Mathematics. Transfer students who have not taken writing intensive courses must meet the College of Natural Sciences and Mathematics Writing Across the Curriculum requirements.

5. **Natural Sciences/Mathematics** (UT General Education requirement is two courses for 6 hours; College of Natural Sciences and Mathematics requirement differs based on degree as indicated below).

a. Bachelor of Arts (BA)

Two science/mathematics courses from two different departments outside of the student's major are required. Students may select courses from biology, chemistry, environmental sciences, mathematics, and physics and astronomy. Courses must be major-level. See DAR for more information.

b. Bachelor of Science (BS)

Three science/mathematics courses from three different departments outside of the student's major are required. Students may select courses from biology, chemistry, environmental sciences, mathematics, and physics and astronomy. Courses must be major-level. See DAR for more information.

6. **Cultural Experience (Bachelor of Arts (BA) requirement only, not required for Bachelor of Science (BS))**– 0 to 8 hours (foreign languages 1110 and 1120 (or 1500) or one semester of Study Abroad)
Every student enrolled in a BA degree program in the College of Natural Sciences and Mathematics is required to demonstrate proficiency in a single foreign language (Arabic, Chinese, French, German, Japanese, Latin, Spanish, or American Sign Language) through the elementary (foreign languages 1120) level by successfully completing a foreign language course at this level or by achieving an appropriate score on a proficiency/placement test administered by the department of foreign languages that reflects the equivalent. Students beginning a foreign language should enroll in their chosen language at the elementary 1110 level and will take two semesters of foreign language. Those continuing a foreign language or attempting to demonstrate competency by examination should take a proficiency/placement test. Alternatively, students may satisfy the cultural experience requirement by studying abroad for at least once semester in an approved study abroad/exchange program for academic credit.

G. Natural Sciences and Mathematics Distributive Requirements (Bachelor of Arts (BA) requirement only, not required for Bachelor of Science (BS))
Students should consult with their Advisers in selecting courses that will meet distributive requirements. With their Adviser's approval, students may select higher-level courses for which they have the prerequisites. With careful planning, students will be able to satisfy UT General Education Curriculum and College of Natural Sciences and Mathematics requirements by taking the minimum required hours. A student may take no more than two courses under each departmental code in satisfying the distributive requirements.

1. **Humanities and Fine Arts** (UT General Education requirement is two courses for six hours; students enrolled in a BA degree program in the College of Natural Sciences and Mathematics are required to take an additional 9 hours). Students will take five courses (15 hours) in the humanities in addition to those taken to meet the English composition and foreign language requirements. Students may select humanities courses that also will satisfy a UT General Education humanities or multicultural requirement.

Required Courses– 9 hours (see suggested courses listed below):
English Literature – 3 hours
History – 3 hours
Fine Arts – 3 hours (course must be an appreciation or theory course, not a studio or skills course)
Electives – two courses for 6 hours Students may select courses from art, art history, communication, english, film, foreign languages (courses higher than 1120/1500 or culture courses 1080 and 1090, or a second foreign language), history, humanities, music, philosophy, religious studies and theatre.

Among the courses with minimal or no prerequisites are as follows: ARTH 1500; CLC 1010; COMM 1010, 2000; ENGL 2710, 2720, 2730, 2740 and 2760; FILM 1310; FREN 1080 and 1090; GERM 1080 and 1090; HIST 1000 through 1200; HUM 1010, 1200, 2220, 2010 and 2020; JAPN 1080 and 1090; MUS 2200, 2210, 2220, 2240, 2250 and 2420; PHIL 1010, 1020, 2200 and 2400; REL 1220 and 2000; SPAN 1080, 1090 and 1100; and THR 1010 and 1100. However, higher-level humanities courses will satisfy these requirements and may be taken if student has met the prerequisites.

2. **Social Sciences** (UT General Education requirement is two courses for six hours; Students in a BA degree program in the College of Natural Sciences and Mathematics are required to take one additional course for a total of nine hours).

Students may select social science courses that also will meet a UT General Education social science requirement and one multicultural requirement. Students may select courses from anthropology, economics, geography, political science, psychology, and sociology. Among the courses with minimal or no prerequisites areas follows: ANTH 1020, 2020, 2800, and 2900; ECON 1010, 1150 and 1200; GEPL 1010 and 1100; PSC 1200, 1300, 1400 and 1710; PSY 1010; and SOC 1010 and SOC 1750. No more than two courses can be from a single discipline.

H. Major Area
Every student must complete either a departmental major or an interdepartmental or interdisciplinary major. Courses given in other colleges of the University may be credited to the major only with the approval of the Dean of the College of Natural Sciences and Mathematics upon recommendation of the department Chair. Waiver of a required course or the substitution of a course from another department does not necessarily reduce the minimum credits required in the major.

1**. Departmental Major**
See the complete list of departmental majors under "Degrees Offered" in the College of Natural Sciences and Mathematics section of this catalog.
In most cases, the minimum number of semester hours a student must complete for a departmental major is 34 hours See specific degree requirements in the departmental sections of the catalog. A student may have two majors from two different departments provided the requirements of both programs are satisfied. Work in the second major may be accepted as fulfilling the related course requirement upon the approval of the Advisers in both departments. A student cannot use courses from the first major to satisfy the second and vice-versa. See section on "Earning a Second Degree" for statement on requirements when two or more desired major programs are offered as different degrees.

2**. Interdisciplinary Majors**
A student may complete one of the interdisciplinary majors if accepted into that particular program. A student completing a departmental major and a second major in an interdisciplinary or interdepartmental major cannot use courses from the first major to satisfy the second or vice-versa. See the complete list of interdisciplinary majors under "Degrees Offered" in the College of Natural Sciences and Mathematics section of this catalog.

I. Related Courses
Every student who chooses a departmental major and students in some interdisciplinary majors also must complete courses related to the major. These courses must be in addition to courses taken to fulfill the basic requirements listed above. For BA degree programs the minimum number of major and related area courses is 58 hours. For BS degree programs the minimum number of major and related area courses is 64 hours. Each department defines the areas from which courses may be chosen by its majors, and these listings are given in the later sections of this catalog under Programs of Study. For most programs, related courses must be chosen from courses acceptable for credit in a College of Natural Sciences and Mathematics major. Generally, these are upper-level courses.

Courses given in other colleges of the University may be credited to the major or to related courses only if indicated in later sections of the this catalog under Programs of Study or with the approval of the Dean of the College of Natural Sciences and Mathematics upon recommendation of the department Chair.

J. Minors
Many College of Natural Sciences and Mathematics departments offer minors. Departmental requirements for particular minors are given in later sections of the catalog under Programs of Study. Students wishing to pursue minors should consult with their primary program Advisers and then with an Adviser in the Natural Sciences and Mathematics college office. Not all minors can be added to all degree programs. Courses selected for the minor must be chosen from courses acceptable for credit toward a major in that department. In meeting requirements for some majors, work in the minor may be accepted as fulfilling the required hours of related courses, but only with the approval of the student's major Adviser. Students completing a minor cannot use courses from their minor to satisfy requirements in the major or to satisfy another minor. No more than six hours of courses taken for minor credit may be applied to the total College of Natural Sciences and Mathematics distributive requirements. A minimum GPA of 2.0 is required in the minor. Students must complete a minimum of 21 hours for a minor; at least nine of those hours must be completed at The University of Toledo.

Premedical, Predental and Preveterinary Concentration
Sharon L. Schnarre, Adviser
Students interested in professional medical, dental or veterinary careers may choose to apply for the premedical, predental and preveterinary concentrations. **Students choosing this option must also complete the requirements for a major in a specific discipline or in an interdisciplinary baccalaureate program.**
Because admission to a professional school is very competitive, students need to maintain high GPAs, both cumulative and in the sciences. The premedical/predental/preveterinary Adviser will continually monitor a student's academic performance and make recommendations as to whether this program should be continued. If at any time a student's GPA drops below a 3.0, the student will be dropped from the program, unless extenuating circumstances exist, in which case the student will be placed on a probationary status until the grades improve.

The premedical/predental/preveterinary Adviser will assist the student in determining the entrance requirements of the professional school being considered, since these requirements vary among schools. In general, these professional schools specify for entrance a core set of science courses that include one year (two semesters) each of biology, general chemistry, organic chemistry, physics and mathematics. Most schools recommend that candidates plan a broad course of study leading to either a B.A. or a B.S. degree in any discipline.

Honors
Honors in the College of Natural Sciences and Mathematics, which is available to its academically talented and highly motivated students, is offered in conjunction with the University of Toledo Honors College. A departmental Honors curriculum is also offered by individual departments within the College of Natural Sciences and Mathematics.

Student Selection and Admission Criteria
Admission to the Honors College is competitive and limited to academically talented students. Students entering directly from high school are admitted based on a review of application materials, which include a high school transcript, references, an essay, an extracurricular resume, and ACT or SAT scores. Students with an ACT composite score of 28 or higher (SAT composite of 1260 or higher) and a high school GPA of 3.75 or higher are encouraged to apply. Highly motivated students with an ACT composite of at least 25 (SAT composite of at least 1140) and a minimum high school GPA of 3.5 also are considered for admission to the program. Currently enrolled University of Toledo students and transfer students may apply for admission to the Honors College if they have completed at least 15 but not more than 60 graded semester hours of college work, and earned a minimum GPA of 3.3 (on a 4.0 scale).

Students are admitted to the Honors College on a space-available basis.

Program Requirements
In order to graduate with the Honors College diploma, a student must:

- Complete all requirements for an approved degree program within the College of Natural Sciences and Mathematics.
- Complete a minimum of 33 semester hours of honors courses. Honors courses are of two kinds – those offered by the Honors College and those offered by various departments and colleges. Of the 33 hours required, the following must be completed by all Honors College students:
    a. Six semester hours of Honors Readings Conference (HON1010 and HON1020).
    b. A minimum of three semester hours selected from HON2020 (Multicultural Literatures: The North American Experience) or HON2030 (Multicultural Literatures: The Non-European World).
    c. A minimum of six semester hours of two upper-division interdisciplinary seminars offered through the Honors program (HON4950 and/or 4960).
    d. All of the requirements for departmental honors in their major. This includes the completion of an honors thesis or project supervised by a faculty member in the major department.
- Earn a minimum overall GPA of 3.3

Note: For a student pursuing more than one major, or an interdepartmental major, the Honors College's departmental honors requirement may be fulfilled through meeting requirements for one of the majors.

Retention Standards
To remain in good standing in the Honors College, a student must:

- Earn a minimum overall GPA of 3.0 by the end of the first year (typically at least 30 semester hours); 3.1 by the end of the second year (typically at least 60 semester hours); and 3.2 by the end of the third year (typically at least 90 semester hours).
- Make satisfactory progress toward fulfillment of the requirements for a degree with honors in the college.

Departmental Honors
Requirements for departmental honors designations are set by the various departments of the College of Natural Sciences and Mathematics and are described under the departmental entries in this catalog. All departments, however, require successful completion of an honors thesis or project supervised by a faculty member in that department. It is possible for a student to fulfill all departmental requirements and earn the departmental honors citation upon graduation without participating in the Honors College. The reverse is not possible, however, as departmental honors is required to earn the Honors College diploma.

Undergraduate Programs of Study

Degrees Offered

Departmental Majors
Astronomy (B.A.)
Biochemistry (B.A. and B.S.)
Biology (B.A. and B.S., an optional concentrations in ecology and organismal biology [BIOM] is available)
Chemistry (B.A. and B.S.)
Environmental sciences (B.S.)
Environmental studies (B.A.)
Geology (B.A. or B.S.)
Mathematics (B.A. or B.S. with concentrations in applied mathematics, mathematics with computer science, pure mathematics and statistics)
Medical Technology (B.S.)
Physics (B.S. with concentrations in astrophysics, biomedical physics, and applied physics; B.A.)
See Department of Environmental Sciences for requirements for the B.S. in Indepartmental Studies with a concentration in Geophysics.

Minors
Astrophysics
Biology
Chemistry
Computer science and engineering*
Environmental sciences
Geology
Mathematics
Physics
Renewable Energy

*Students interested in pursuing a minor in computer science and engineering should consult with an Adviser in the department of electrical engineering and computer science in the College of Engineering.

Programs of Study

Astronomy

(Administered by the Department of Physics and Astronomy)
Lawrence Anderson-Huang, Chair
Scott Lee, Undergraduate Adviser

Degrees Offered
The department of physics and astronomy offers a program of study leading to the Bachelor of Arts in astronomy. There is also an astrophysics concentration for the Bachelor of Science in physics (see Physics section later in this catalog).

Requirements for the Bachelor of Arts in Astronomy
The B.A. in astronomy program consists of 37 hours of required astronomy and physics courses in the department of physics and astronomy, 12 hours of calculus, and at least 12 additional hours in the natural sciences and mathematics, chosen with the Adviser's approval. This program is intended to provide the combination of fundamental physics, together with general and advanced astronomy, required for a career in astronomy or a related area. It also has the flexibility required by students who wish to pursue interdisciplinary studies or prepare for careers in teaching or other professions requiring a fundamental understanding of the physical sciences.

Basic astronomy sequence: The sequence ASTR 2010 to 2020 (6 hours) is required.

Advanced astronomy courses: The advanced courses ASTR 4810, 4820 and 4880 (9 hours) are required. PHYS 1910 is strongly recommended.

Physics courses: Either the sequence PHYS 2130 to 2140 (10 hours), or the sequence PHYS 2070 and 2080 to 2100 (12 hours) is required. In addition, PHYS 3180, 3310, 3320 and 3610 (or 4620) (12 hours) are required.

Required mathematics courses: One of MATH 1830, 1850 or 1920, one of MATH 1840, 1860 or 1930, and one from MATH 2850 or 2950 (12 hours) are required.

Other courses in related areas: At least 12 additional hours in natural sciences, chosen with Adviser's approval. Possibilities include BIOL 2150, 2160, 2170 and 2180; CHEM 1230, 1240, 1280 and 1290; and EEES 2010 and 2100.

Free electives: Elective hours total 29 to 43 and may include, for example, ASTR 4800 and ASTR 2310, 2320, 2330 and 2340.

Department of Biological Sciences

Douglas Leaman, Chair and Undergraduate Adviser
Brian Ashburner, Adviser for the University of Salford Exchange Program
Bruce Bamber, Undergraduate Adviser
Lirim Shemshedini, Graduate Adviser
John Plenefisch, departmental honors Adviser and Medical Technology Adviser
Deborah Vestal, Undergraduate Adviser
Robert Steven, Undergraduate Adviser
William Taylor, Undergraduate Adviser
Sally Harmych, Undergraduate Adviser

Degrees Offered
The Department of Biological Sciences offers a degree program for a bachelor of science and bachelor of arts in biology, and a bachelor of science in Medical Technology. The department of Environmental Sciences also offers a degree program for a bachelor of science in biology, with a concentration in ecology and organismal biology (see department's section for requirements).

Advanced Placement
Students with a score of 3 will receive credit for BIOL 1120; students with a score of 4 will receive credit for BIOL 2150; students with a score of 5 will receive credit for BIOL 2150 and 2170.
Students earning Advanced Placement (AP) scores of 4 or 5 may receive credit for BIOL 2160 and/or BIOL 2180 upon evaluation of their AP laboratory materials by the department of biological sciences.

Requirements for the Bachelor of Science in Biology
The B.S. program requires at least 34 hours of biology and includes a core of BIOL 2150, 2160, 2170, 2180, 3010, 3030, 3070 (or 3410) and 3090. In addition, students must complete at least nine hours of biology elective courses numbered above BIOL 3000, which must include at least two courses with laboratory or field experiences. Undergraduate research (BIOL 4910) not applied to Departmental Honors may be used to fulfill one of the two laboratory requirements. A maximum of three credit hours of BIOL 4910 not applied to Departmental Honors may be used to fulfill biology elective credits. Finally, students must complete BIOL 4700 in their final year.

Cognate course work in mathematics, physics and chemistry also is required as follows: MATH 1750 and 1760 or MATH 1830 and 1840 or MATH 1850 and 1860; MATH 2600 or PSY 2100; PHYS 2070 and 2080 or PHYS 2130 and 2140; CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2460, 3510 and 3520.

Requirements for the Bachelor of Arts in Biology
The B.A. program requires at least 33 hours of biology and includes a core of BIOL 2150, 2160, 2170, 2180, 3010, 3030 and 3070 (or 3410). In addition, students must complete at least eleven hours of biology elective courses numbered above BIOL 3000 A maximum of three credit hours of BIOL 4910 not applied to Departmental Honors may be used to fulfill biology elective credits. Finally, students must complete BIOL 4700 in their final year.

Cognate course work in mathematics, physics and chemistry also is required as follows: MATH 1320, 1330 and MATH 2600 (or PSY 2100) or MATH 1340 and MATH 2600 (or PSY 2100) or MATH 1750 and 1760; PHYS 2070 and 2080 or PHYS 2130 and 2140; CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2460 and 2470.

No classes used to satisfy the requirements of the Biology major or minor may be taken P/NC with the exceptions of BIOL 4910, BIOL 4950, and BIOL 4990.

Requirements for the Minor in Biology
The minor in biology requires 22 credits including the following required courses: BIOL 2150, 2160, 2170, 2180, 3010, 3030 and 6 credits of elective courses at the 3xxx-4xxx level.

Honors in Biology
The department of biological sciences Honors Program is available for qualified majors. Admission is by invitation and is based on performance in required biology courses completed during the freshman and sophomore years. Potential students should indicate their interest in this program to the departmental honors Adviser before the beginning of the sophomore year.

To receive an undergraduate degree with honors in biology, all requirements for the B.S. or B.A. degree plus an additional 6 credits of Undergraduate Research/Honors Thesis (BIOL 4910) must be completed with a minimum GPA of 3.2 overall and in BIOL courses. The program of study must include honors sections of at least two biology courses (minimum of 6 credits) in addition to BIOL 4910. The Undergraduate Research/Honors Thesis credits are completed under the direction of a faculty research director selected by the student. Students must submit a written Honors Thesis to the department before completion of their senior year and make a formal public oral presentation of their research (typically at the spring Biology Undergraduate Research Symposium). The requirement of Honors Thesis research may be fulfilled in one of three ways:

1. Laboratory research in a Biosciences faculty member's laboratory;
2. Laboratory research in a summer or academic year program, in which the student carries out full-time independent research for at least 10 weeks under the direction of a senior scientist on a topic approved by the departmental honors Adviser and/or the department Chair;
3. Laboratory research in the laboratory of a senior scientist who is not a member of the department of biological sciences on a topic approved by the departmental honors Adviser and/or the department Chair.

For options 2 and 3, it is very important that the student get his/her proposed thesis research project approved in advance by the departmental honors Adviser and/or the department Chair, who will monitor progress and direct the 4910 courses.

Junior Year Studies in England for Biology Majors
The Department of Biological Sciences participates in a well-established exchange program with the University of Salford, England. Selected UT biology (and pre-medical, pre-dental and pre-veterinary) students have the opportunity to spend their junior year at Salford. Participants in the program will pay their instructional and general fees to The University of Toledo. Eligibility to participate in the program is based on criteria established by the Department of Biological Sciences. Information on the program may be obtained from the departmental exchange program Adviser, Dr. Brian Ashburner. Details are available on academic issues, living accommodations, recreational opportunities and life in England on the departmental Web site at *www.utoledo.edu/as/bio/undergrad/abroad.html*

Bachelor of Science in Medical Technology Program This degree program prepares you for certification as a Medical Laboratory Scientist (Medical Technology Scientist). You will complete three years of baccalaureate college work, and then complete 12 months of hospital based clinical training in medical technology. A certification examination is taken at the successful completion of a hospital training program. The requirements for certification are established by the Board of Certification of the American Society of Clinical Pathologists.

Acceptance into the clinical year of the program is competitive and application is made during the fall of the Junior year. In order to be admitted to the clinical year, completion of 90 semester hours of college work with an accumulated GPA of no less than 2.5 overall and a grade of C or better in the preclinical science courses is required.

The clinical program in the fourth year includes externship sites at the University of Toledo Medical center laboratory and ProMedica hospital laboratories. Upon successful completion, you will be awarded the degree of Bachelor of Science in Medical Technology and you are then eligible to take the national certification examination.

Click here for a complete program description (.pdf). The description includes a sample 4 year curriculum. The medical technology adviser will assist students in planning the sequence in which the pre-clinical courses are taken during the student's years at the university. Therefore, interested applicants should consult with the medical technology adviser, Dr. John Plenefisch, before selecting this professional career option.

Department of Chemistry & Biochemistry

Jon R. Kirchhoff, Chair and Distinguished University Professor
Cora Lind-Kovacs, Associate Chair
Don Ronning, Director of Graduate Studies
Andrew D. Jorgensen, Undergraduate Advising Coordinator
John Bellizzi, Undergraduate Honors Adviser
Xiche Hu, Undergraduate Adviser
Edith Kippenhan, Undergraduate Adviser
Timothy Mueser, Undergraduate Adviser
Jianglong Zhu, Undergraduate Adviser
James Zubricky, Undergraduate Adviser

Degrees Offered

The department of chemistry and biochemistry offers degree programs for a bachelor of arts or a bachelor of science in chemistry or biochemistry.

Advanced Placement

Students with a score of 3 on the Advanced Placement Exam will receive credit for CHEM 1100; students with a score of 4 will receive credit for CHEM 1230 and 1280; students with a score of 5 will receive credit for CHEM 1230, 1280, 1240 and 1290.

Requirements for the Undergraduate Major

For the bachelor of arts degree in chemistry, 37 hours of CHEM courses are required. The following courses must be included: CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2480, 2490, 3310, 3360, 3710, 3720, 3510 or 3610, and 3860. Additional courses to reach 37 hours in the major may be selected from the 3000 or 4000 level CHEM courses, excluding CHEM 3712, 3910, 3920, 4910, and 4920. The following related courses are required: MATH 1830 or 1850, MATH 1840 or 1860; PHYS 2070 and 2080; and one additional course selected from the following: MATH 2850, 2890, 3610, BIOL 2170 (or a 4000 level BIOL course), EEES 2010, 2200, 2400, 3050, 4220, 4450.

For the bachelor of arts degree in biochemistry, 35 hours of CHEM courses are required. The following courses must be included: CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2460, 2470, 3310, 3360, 3510, 3520, 3560, 3710 or 4570, and one additional course from CHEM 3860, 3720, 4500, 4510, 4520, 4530, or 4580. The following related courses are required: MATH 1750 or 1830 or 1850, MATH 1760 or 1840 or 1860; PHYS 2070 and 2080; BIOL 2170 and 3030.

For the bachelor of science degree in chemistry, 44 hours of CHEM courses are required. The following courses must be included: CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2480, 2490, 3310, 3360, 3510, 3610, 3730, 3740, 3860, 3870, 4300 and 4880. Optional advanced chemistry courses include CHEM 3520, 3560, 3810, 4500, 4510, 4520, 4530, 4570, 4580, 4620 and 4980. CHEM 4910 also can be taken as an advanced chemistry course with a minimum of three credit hours. The following related courses are required: MATH 1830 or 1850, MATH 1840 or 1860 and 2850; and PHYS 2130 and 2140. A minimum cumulative GPA of 2.5 in chemistry is required for graduation with this degree.

For the bachelor of science degree in biochemistry, 49 hours of CHEM courses are required. The following courses must be included: CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2480, 2490, 3310, 3360, 3510, 3520, 3560, 3610, 3860, 4300 and 4570. The advanced laboratory requirement must also include either CHEM 3910 (2 hours), or 4880 or 4910 (2 hours). One advanced biochemistry course must be selected from: CHEM 4500, 4510, 4520, 4530, 4580 and 4980. The following related courses are required: MATH 1750 or 1830 or 1850, MATH 1760 or 1840 or 1860; PHYS 2070 or 2130, PHYS 2080 or 2140; and BIOL 2170 and 3030. A minimum cumulative GPA of 2.5 in chemistry is required for graduation with this degree.

The Bachelor of Science degree programs meet the minimum standard of the American Chemical Society as specified by its Committee on Professional Training, so that the degree recipients are certified by the American Chemical Society and are eligible for full membership in the society.

The department of chemistry strongly advises students who wish to enroll in 3000- or 4000-level courses to earn minimum grades of C in prerequisite courses. Students pursuing a chemistry major may not elect the P/NC option in major or related courses, or prerequisites for these courses, except as noted in specific course descriptions.

Experience in Research
The department offers experience in research under faculty guidance at all levels, in CHEM 2910, 3910 and 4910. Students are encouraged to talk with faculty members about research participation and to consult with more than one faculty member about appropriate projects. A student who wishes to participate in research should obtain the consent of a faculty member who agrees to guide this work and the approval of a departmental undergraduate Adviser before the first day of the first semester that he/she enrolls for CHEM 2910, 3910 or 4910. Students may enroll in the different courses, CHEM 2910, 3910 and 4910, with different faculty members.

Minor in Chemistry
The minor in chemistry is designed to complement the objectives of students in a variety of majors. A minimum of 22 hours of chemistry courses and a minimum GPA of 2.0 in those courses are required for the minor in chemistry. No courses in the minor may be taken P/NC except CHEM 4920. The following courses must be included: CHEM 1230, 1240, 1280, 1290, 2410, 2420, 2460 and 2470 (or 2480 and 2490). For the minor in chemistry, additional courses may include any 3000 or 4000 level CHEM course except CHEM 3910, 3920 or 4910. MBC 3550 and 3560 may be substituted for CHEM 3510 and 3520.

Honors in Chemistry
Qualified students may be invited to work for the citation "honors in chemistry."
A. Admission: The Honors Program is open to all chemistry majors studying toward the B.S. degree and to other students with the consent of the departmental honors Adviser and the Chair of the department. The program may be undertaken concurrently with University Honors. Admission to the departmental Honors Program is based on academic standing, recommendations by instructors and an interview with the departmental honors Adviser. A minimum overall GPA of 3.3 and a minimum GPA of 3.5 in chemistry course work are typically required for admission and for retention in the program. Any student may petition the departmental honors Adviser for admission to the program. A student should normally begin the program no later than the end of the sophomore year.

B. Requirements: In addition to the credits required to complete the major, each honors student must satisfactorily complete CHEM 4910, independent research, with a written thesis and an oral research report upon completion of the research project. A minimum of six hours of the required chemistry courses at the 3000 and 4000 levels, in addition to CHEM 4910, must be taken for honors. These courses must be in at least two different areas of chemistry, to be selected from among analytical chemistry, biochemistry, inorganic chemistry, organic chemistry and physical chemistry. The instructor in each of these courses will plan activities above the normal requirements of the course for the honors student, in line with the aims of the Honors Program, to encourage independent scholarship. Outside reading and writing may be important components of each Honors course assignment. Students enrolled in the departmental Honors Program also are encouraged to participate in the department's colloquium program. For good standing, a minimum overall GPA of 3.3 and a minimum GPA of 3.5 in chemistry course work must be maintained throughout the program.

Junior Year Studies in England for Chemistry Majors
The University of Toledo has an exchange program agreement with the University of Salford, England. Selected UT students spend their junior years at Salford, and students in the Salford three-year chemistry honors program spend their second year at UT. Eligibility is based on scholastic standing. Participants in the program pay their instructional and general fees to their home institutions. Information on the program may be obtained from the departmental international exchange Adviser or from Dr. Brian Ashburner, Associate Dean and Director of the UT-Salford Exchange Program.

Department of Environmental Sciences

Timothy G. Fisher, Chair, Professor,
Johan F. Gottgens, Associate Chair, Professor, undergraduate adviser (BIOM)
Alison L. Spongberg, undergraduate adviser (environmental studies)
Todd D. Crail, undergraduate Adviser (environmental sciences)
James Martin-Hayden, adviser (environmental sciences)
Jonathan M. Bossenbroek, Honors research adviser
Mark J. Camp, undergraduate adviser (environmental sciences)
Von Sigler, undergraduate adviser (environmental sciences, 3+2)
Richard Becker, undergraduate adviser (geology)

Degrees Offered
The department of environmental sciences offers degree programs for a bachelor of arts in environmental studies, a bachelor of science in environmental science, a bachelor of arts and a bachelor of science in geology, and a bachelor of science in biology with a concentration in ecology and organismal biology (BIOM). The department of biological sciences also offers a degree program for a bachelor of science in biology with a concentration in cell-molecular biology (CMOL) (see department of biological sciences' section for requirements).

Advanced Placement
For a score of 3, 4 or 5 on the Environmental Science Advanced Placement exam, the department will award credit for EEES 2010 (3 credits).

Requirements for the Bachelor of Arts Degree in Environmental Studies (ENST) and the Bachelor of Science Degree in Environmental Sciences (ENST)
All students in the B.A. and B.S. programs must complete the following courses: EEES 1020, 2010, 2100, 2150, 2160, 2500, 3050, 3100 (or 2400 or 4240), 3900 and 4970, as well as MATH 2640, PSC 4340, ECON 3240, GEPL 3900 and PHIL 3180. Prerequisites will be waived for environmental studies (ENST) and environmental sciences (ENSC) majors enrolling in these last four courses.

All environmental studies and environmental sciences students also will select an area of concentration in an academic department within the College of Natural Sciences and Mathematics; College of Languages, Literature and Social Sciences or College of Communications and Arts. Students must complete at least 21 hours of course work in their area of concentration. Qualified environmental sciences majors may elect a track in environmental health and continue for a 5th year to earn an M.S. in Public Health or in Occupational Health from the University's College of Medicine and Life Sciences. Students also are required to complete a 100-hr environment-related internship in an agency, corporation, university laboratory or other approved location. With the exception of EEES 4940, students may not take any courses required in the major as P/NC.

In addition to the above requirements, students in the B.S. program must also complete the following: EEES 2510, 3060 and 1 advanced lab; CHEM 1230, 1240, 1280 and 1290; and MATH 1750 and 1760 or MATH 1850 and 1860. Students in the B.A. program also must take CHEM 1090 or 1100 and MATH 1180. Students choosing a concentration in economics must complete either MATH 1320 and 1330, or MATH 1340, or MATH 1750 and 1760 instead of taking MATH 1180.

Public Health Track
This track requires the student to maintain an overall GPA of 3.0 or higher during the first 2 years of university study. The student normally will apply at the end of the sophomore year (year 2). In addition to the courses listed above, students electing this concentration take CHEM 2410, 2420 (Organic Chemistry I & II) during the junior year (year 3) and take the following graduate courses at the University's Health Science Campus during their senior year (year 4): PUBH 6000 (Public Health Statistics), PUBH 6640 (Issues in Public Health), PUBH 6010 (Public Health Epidemiology) and PUBH 6600 (Health Behavior). If students maintain a 3.0 average in these 4 courses and their overall GPA, these students will be able to use these 12 credits toward the Master of Public Health Degree and should be able to complete BOTH the BS in Environmental Science and the MPH degrees in 5 years. Students interested in the Master of Science in Occupational Health degree rather than the MPH should also take PHYS 1750 (Introduction to Physics) during the fourth year as an undergraduate elective.

Minor in Environmental Sciences
Students electing to minor in environmental sciences must complete at least 22 21 hours of course work consisting of EEES 2010, 2100, 2150, 2400, and at least six additional hours of EEES course work listed at 3000 or 4000 level. At least one, one-hour EEES laboratory course must be included. A minimum GPA of 2.0 in the EEES course work is required, and the program must be approved in advance by a departmental ENSC Adviser.

Junior Year Studies at the University of Hertfordshire in England for Environmental Studies/Sciences Majors

The College of Natural Sciences and Mathematics of The University of Toledo participates in an exchange program with the University of Hertfordshire, England. Selected UT students have the opportunity to spend their junior year at Hertfordshire. Participants in the program will pay their instructional and general fees to The University of Toledo. Eligibility to participate in the program is based on scholastic criteria. Information on the program may be obtained from the departmental exchange program Adviser. Details are available on academic issues, living accommodations, recreational opportunities and life in England.

Junior Year Studies at the University of Salford in England for Environmental Sciences and Biology Majors
Selected UT students in the Department of Environmental Sciences have the opportunity to spend their junior year at Salford. Participants in the program will pay their instructional and general fees to The University of Toledo. Eligibility to participate in the program is based on

criteria established by the Department of Environmental Sciences. Information on the program may be obtained from the departmental exchange program Adviser or from Dr. Brian Ashburner, Associate Dean and Director of the UT-Salford Exchange Program. Details are available on academic issues, living accommodations, recreational opportunities and life in England on the departmental Web site at *www.utoledo.edu/as/bio/undergrad/abroad.html*

Requirements for the Bachelor of Science Degree in Geology (Degree requirements are pending upon the approval of the faculty senate)
The Bachelor of Science degree in geology requires a minimum of 40 hours in the major, including the following: EEES 1020, 2100, 2230, 2500, 2510,3210, 3220, 3310, 4640 (3 hours), 4920. An additional 5 courses from the following two groups with at least 2 from each group. Group A: EEES 2400, 3100, 4100, 4200, 4240; Group B: 4150, 4220, 4410, 4450, 4490, 4610. In addition, the following related courses are required: MATH 1850 and 1860 or MATH 1750 and 1760; CHEM 1230, 1240, 1280, and 1290; and PHYS 2070 and 2080 or PHYS 2130 and 2140. Students must achieve a minimum GPA of 2.5 in the major to graduate. Students may not take any required course in the major or related areas as P/NC.

Requirements for the Bachelor of Arts Degree in Geology
The Bachelor of Arts degree in geology requires a minimum of 41 hours in the major. All students must complete the following: EEES 1020, 2100, 2230, 2500, 3210, 3220, 3310, 4640 (3 hours), 4920 as well as 3 courses from Group A (EEES 2400, 3100, 4100, 4200, 4240) and 3 courses from Group B (4150, 4220, 4410, 4450, 4490, 4610). In addition, students must complete MATH 1340 or MATH 1320 and 1330 or an approved higher level math course; CHEM 1230 and 1280; and nine hours of approved electives in astronomy, biology (including EEES ecology courses), chemistry, engineering, geography and planning and/or physics. This degree is designed to give students greater flexibility in designing a program of study tailored to their specialized interests in geology and the related sciences. Students must achieve a minimum GPA of 2.0 in the major to graduate. Students may not take any required course in the major or related areas as P/NC.

Minor in Geology
Students electing to minor in geology must complete EEES 1020, 2100, 2230, 2500, 3100, 3210, 3220, 3310, and one additional formal 3000-4000 level geology course. The departmental undergraduate Adviser must approve a program of study in advance, and a minimum GPA of 2.0 must be achieved for the course work completed in the minor.

Requirements for the Bachelor of Science Degree in Biology with a concentration in Ecology and Organismal Biology The Bachelor of Science degree in biology with a concentration in ecology and organismal biology (BIOM) requires a minimum of 27 hours in the major, including EEES 2150, 2160, 3050, 3060, 3900 and 4150. Twelve additional hours are required from EEES electives and must include at least three advanced laboratory courses (EEES 4250, 4260, 4510, 4730, 4740, 4750, 4760, 4910 or 4940, 4980). In addition, the following related courses are required: CHEM 1230, 1240, 1280, 1290, 2410, 2420 and 2460; PHYS 2070 and 2080 or 2130 and 2140; MATH 2640; and MATH 1750 and 1760 or 1830 and 1840 or 1850 and 1860; BIOL 2170, 3010, and 3030.

Requirements for the Bachelor of Science Degree in Interdepartmental Studies with a concentration in Geophysics
The requirements for this degree, as approved by the three participating departments, are as follows: MATH 1850, 1860, 2850, 3860 (or 2860) and 1890 (18 credits); PHYS 2130, 2140, 3180, 4210 and 4230 (19 credits); and EEES 2100, 1020, 2500, 3210, 3220, 3310, 4610 and 4620 (or 4630) (21 credits). Students must also take an additional three to four hours of Adviser-approved electives at the 3000 or 4000 level from the mathematics, physics and astronomy, or environmental sciences departments to reach at least 60 hours. In addition, students must complete CHEM 1230 and 1280.

Departmental Honors
Qualified sophomores, juniors and seniors working on degree programs within the department of environmental sciences may be invited to work for one of the following citations, consistent with their degree program: “honors in biology,” “honors in environmental sciences,” “honors in environmental studies” or “honors in geology.”

A. Admission: The departmental Honors Program is open to all department majors and may be taken concurrently with College Honors. Admission to the departmental Honors Program is based on academic achievement. Normally, students invited to participate will have achieved a 3.3 or better overall GPA by the end of the sophomore year.

B. Requirements: A student must satisfactorily complete from three to six credits of EEES 4910 Directed Research and graduate with a minimum overall GPA of 3.3 in order to receive the honors citation. Candidates must prepare a written thesis based on their research and present an oral report at an open forum. Candidates also will provide two unbound copies of the approved thesis to the department for binding, one each for the research Adviser and department. This program provides an opportunity for the exceptional student to work closely with a faculty Adviser on an independent research topic. This research experience often leads to publication and is an excellent preparation for graduate studies.

Department of Mathematics and Statistics

Donald White, Chair, Professor
Alessandro Arsie, Associate Professor, Associate Chair
Denis White, Professor, Graduate Admissions Director
Nathaniel Iverson, Lecturer, Undergraduate Adviser

Degrees Offered
The department of mathematics and statistics offers a program for either a Bachelor of Arts or a Bachelor of Science degree.

Advanced Placement
Students with a score of 3 or better on either AB or BC calculus will receive credit for MATH 1850. Students with a score of 3, 4 or 5 on the BC calculus test will receive credit for both MATH 1850 and 1860. Students with a score below 3 may be able to obtain credit by taking a departmental test. Students with a score of 3 or better on the Statistics Test will receive credit for MATH 2600.

Degree Requirements:
To obtain a Bachelor of Science degree in mathematics, students must complete MATH 1840 (or 1860), 1890 (or 2890), 2850 and 2190 (or 3190) and follow one of the following concentrations for a total of at least 38 hours.

1. Pure Mathematics

a. The following are required: MATH 2860 Elementary Differential Equation, 4330 Abstract Algebra I, 4820 Intro to Real Analysis I, and 4880 Complex Variables.
b. One course must be completed from MATH 4300 Linear Algebra I, 4450 Intro to Topology I, or 4540 Classical Differential Geometry I.
c. One course must be complete from MATH 4830 Real Analysis II or MATH 4340 Abstract Algebra II.
d. Two courses may be chosen from courses at the 3000 or 4000 level approved by the Adviser.

2. Applied Mathematics

a. The following are required: MATH 3320 Intro to Abstract Algebra or 4330 Abstract Algebra I, 2860 Elementary Differential Equation, 4300 Linear Algebra I or 4350 Applied Linear Algebra, and 4820 Intro to Real Analysis I or 4880 Complex Variables.
b. One of the following two-semester sequences must be completed: MATH 4710 Methods Of Numerical Analysis I and 4720 Methods Of Numerical Analysis II or 4740 Advanced Applied Mathematics I and 4750 Advanced Applied Mathematics II.
c. One course must be complete from MATH 3610 Statistical Methods I or MATH 4680 Intro to Theory of Probability or MATH 4800 Ordinary Differential Equations, Math 4810 Partial differential Equations or MATH 4860 Calculus Of Variations And Optimal Control I.
d. One course may be chosen from courses at the 3000 or 4000 level approved by the Adviser.

3. Statistics

a. The following courses are required: MATH 3610 Statistical Methods I, 3620 Statistical Methods II, 4350 Applied Linear Algebra, 4600 Applications Of Statistics I, 4610 Applications Of Statistics II, 4680 Intro to Theory of Probability, and 4690 Introduction To Mathematical Statistics.
b. One more course may be chosen from courses at the 3000 or 4000 level approved by the Adviser.

4. Mathematics with Computer Science

a. The following are required: MATH 2860 Elementary Differential Equation, 4380 Discrete Structures And Analysis Of Algorithms, 4710 Methods Of Numerical Analysis I, MATH 3320 Intro to Abstract Algebra or 4330 Abstract Algebra I, 4820 Intro to Real Analysis I or 4880 Complex Variables, and 4350 Applied Linear Algebra or 4390 Theory Of Computation or 4720 Methods Of Numerical Analysis II.
b. Two courses may be chosen from courses at the 3000 or 4000 level approved by the Adviser.
c. A minimum total of 18 hours in related area courses should be taken from EECS 1100 to 4990. At least two of these courses should be from EECS 2550 or at the 3000 or 4000 level approved by the Adviser.

5. Actuarial Sciences

a. The following courses are required: MATH 3610 Statistical Methods I, 3620 Statistical Methods, 2860 Elementary Differential Equation, 4620 Theory of Interest, 4680 Intro to Theory of Probability, 4690 Introduction To Mathematical Statistics, 4760 Actuarial Mathematics I, and 4770 Actuarial Mathematics II.
b. The related area courses should include the following list: ECON 1150, 1200; BUAD 1020, 2040, 2050, 3040; FINA 3600; INFS 3150.

Related Courses in Bachelor of Science

The 26 semester hours of related area course work should be chosen according to the interests of the student in view of his or her anticipated career in mathematics. These courses could be in Accounting, Astronomy, Biology, Chemistry, Economics, Environmental Science, Engineering, Finance, Operations Analysis, Philosophy, Physics, Pharmacy and Pharmaceutical Sciences, Medicine and Life Sciences.

Choices include courses numbered 2000 to 4990 for the following departments: ACCT, ASTR, BUAD, BIOE, CHEE, CHEM, CIVE, EBUS, EEES, FINA, GEOL, IBUS, IE, INBT, INBY, ISOM, ME, MIME, MGMT, MKTG, NASC, PHYS, PSLS, and TE; plus BIOL 2150 to 2180, 3000 to 4000; ECON 1150, 1200, 2000 to 4990; EECS 1100 to 4990.

To obtain a Bachelor of Art degree in degree in mathematics, students must complete MATH 1860 (or 1840 or 1930), 1890 (or 2890), 2850 (or 2950), and 3190 and follow one of the following concentrations for a total of at least 35 hours.

1. Pure Mathematics

a. The following are required: MATH 2860, 4330, 4820, and 4880.
b. Two courses must be completed from MATH 4300, 4450, 4540, or 4830.
c. The remaining course work may be chosen from courses at the 3000 or 4000 level approved by the Adviser.

2. Applied Mathematics

a. The following are required: MATH 3320 or 4330, 2860, 4300 or 4350, and 4820 or 4880.
b. One of the following two-semester sequences must be completed: MATH 4710 and 4720 or 4740 and 4750.
c. The remaining course work may be chosen from courses at the 3000 or 4000 level approved by the Adviser.

3. Statistics

a. The following courses are required: MATH 3610, 3620, 4350, 4600, 4610, 4680, and 4690.

4. Mathematics with Computer Science

a. The following are required: MATH 2860, 4380, 4710, 3320 or 4330, 4820 or 4880, and 4350 or 4390 or 4720.
b. The remaining course work may be chosen from courses at the 3000 or 4000 level approved by the Adviser.
c. A minimum total of 18 hours in related area courses should be taken from EECS 1100 to 4990. At least two of these courses should be from EECS 2550 or at the 3000 or 4000 level approved by the Adviser.

Related Courses in Bachelor of Arts

The 18 semester hours of related area course work (at 2000 to 4000 levels) should be chosen according to the interests of the student in view of his or her anticipated career in mathematics. The B.A. degree is awarded to those students who choose a related area in the humanities or social sciences, such as economics, foreign language, philosophy and psychology, or education.

Choices include courses numbered 2000 to 4990 for the following departments: AMST, ARTH, COMM, DST, FILM, GEPL, GLST, HIST, HON, LST, PHIL, PSC, PSY, REL, SOC, THR, WGST; or courses numbered 3000 to 4990 for the following departments: CLC, ENGL, FREN, GERM, HUM, JAPN, LAT, LING, SPAN; plus AFST 2100 to 4990, ANTH 2100 to 4990, ART 1080 to 4990, ECON 1150, 1200, 2000 to 4000, FLAN 3440, MUS 2260, 2270, 2280, 2410, 2420, 2610, 2620, 3000 to 4000, excluding MUS 3010, 3020, 3030, 3040, 3050, 3090, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3800, 4800.

Minor in Mathematics

To obtain a minor in mathematics, a minimum of 22 hours in mathematics must be completed. The 22 hours must include MATH 1860, 1890 (or 2890), 2850 and one of 3610, 2860 or 4680. The remaining hours must be courses that are acceptable toward a major in mathematics and must be approved by an Adviser in the department of mathematics.

Honors in Mathematics

A. **Admission:** Students are normally admitted to departmental honors after completing the honors calculus sequence MATH 1920, 1930, 2950, and 3820 or Honors sections of MATH 1850,1860, 2850, and 2860. Students may also be admitted to the program at the discretion of the Math Majors Committee and should consult the departmental Undergraduate Adviser.

B. Requirements: Graduation with honors in mathematics depends upon doing a substantial amount of work in mathematics beyond the requirements of the bachelor's degree. To graduate with departmental honors in mathematics a student must ordinarily maintain a GPA in mathematics greater than 3.5 and write an expository paper on a topic in mathematics that demonstrates knowledge of the subject matter significantly beyond the expectations of the student's course work. The research and writing of the paper is conducted under the supervision of a faculty member with an interest in the subject, and as a part of fulfilling this requirement the student must enroll in either the junior or senior reading class, MATH 3920 or MATH 4920, that counts as an elective in the major. The actual details of the student's program are determined by consulting with the Department's honors adviser and the student's topic supervisor.

Department of Physics and Astronomy

Lawrence S. Anderson-Huang, Chair
Jacques G. Amar, Associate Chair
Scott A. Lee, undergraduate and honors Adviser, physics and astronomy
Song Cheng, graduate program Director
Sanjay Khare, coordinator, Renewable Energy minor

Degrees Offered

The department of physics and astronomy offers courses of study leading to the Bachelor of Science degree in physics, the Bachelor of Arts in physics and the Bachelor of Arts in astronomy. (see astronomy section earlier in this catalog)

Advanced Placement

Students with a score of 3, 4 or 5 on the Physics B test will receive credit for PHYS 2070 and 2080. Students with a score of 3, 4 or 5 on the Physics C Mechanics test will receive credit for PHYS 2130; students with a score of 3, 4 or 5 on the Physics C Electricity and Magnetism test will receive credit for PHYS 2140.

Requirements for the Bachelor of Science in Physics

The B.S. in physics consists of a core program that all students must complete and a choice of one concentration with additional requirements as listed below. The core program contains 22 hours of physics courses and 30 hours of related-area courses; the concentration must contain an additional 21 hours of physics and related courses. Another nine hours of courses from natural sciences, mathematics, or engineering are recommended.

Core physics courses: PHYS 2130, 2140, 3150, 3310, 3320 and 3410 are required. With department approval, a student may substitute PHYS 2070, 2080 and 2100 for PHYS 2130 and 2140. The introductory course PHYS 1910 is also strongly recommended for all physics majors.

Related courses: CHEM 1230 and 1280, one of MATH 1830, 1850 or 1920, one of MATH 1840, 1860, or 1930, one of MATH 1890, or 2890, one of MATH 2850, 2880, or 2950, one of MATH 3820, 3860 or 3880, and seven additional hours from major-level courses in biology, chemistry, or environmental sciences are required.

Concentrations
The student must choose one of the following concentrations:

Physics: PHYS 3180, 3610, 4210, 4230, 4240, 4310, and either 4580 or 4780.

Astrophysics: PHYS 3610, 4210, 4230 and 4240, and ASTR 4810, 4820 and 4880.

Applied Physics: PHYS 3610, 4210, 4230, 4240, 4510, and either 4580 or 4780, plus three hours of appropriate courses from physics or engineering, chosen with the Adviser's approval.

Biomedical Physics: PHYS 3180, 3610, 4130, 4230, 4240, 4430, 4440, and 4780; and related courses BIOL 2150 and 2160, plus KINE 2510, 2520, 2530 and 2540 (or alternate sequence KINE 2460, 2470, 2560, and 2570)

In addition to the above requirements, students should consider at least three of the following optional courses: ASTR 4810, 4820 and 4880; PHYS 4130, 4510 and 4620; MATH 3190, 4300, 4740 and 4750.

Requirements for the Bachelor of Arts in Physics
The B.A. in physics consists of 34 hours in the department of physics and astronomy, 12 hours of calculus, and at least 12 additional hours in the natural sciences and mathematics, chosen with the Adviser's approval. This program is intended to provide the flexibility required by students who wish to pursue interdisciplinary studies, or prepare for careers in teaching or other professions requiring a fundamental understanding of the physical sciences.

Recommended introductory course: PHYS 1910 is strongly recommended.

Fundamental physics sequence: Either the sequence PHYS 2130-2140 (10 hours) or the sequence PHYS 2070-2080-2100 (12 hours) is required.

Other required physics courses: The intermediate level courses PHYS 3180, 3310, 3320, 3410 and either 3610 or 4620.

Elective courses in the major: At least nine hours of additional physics or astronomy courses numbered above 4000 are also required.

Required mathematics courses: One of MATH 1830, 1850 or 1920, one of MATH 1840, 1860 or 1930, and one of MATH 2850 or 2950 are required.

Other courses in related areas: At least 12 hours of other courses must be taken in natural sciences, with the selection approved by the student's Adviser. Examples of appropriate choices include BIOL 2150, 2160, 2170 and 2180; CHEM 1230, 1240, 1280 and 1290; and EEES, 2010 and 2100.

Requirements for the Bachelor of Arts in Astronomy
Please refer to the astronomy section earlier in this catalog.

Minor in Physics or Astrophysics
Students seeking a minor in physics or astrophysics must complete at least 22 hours of course work in physics as follows:

Required for both minors:
PHYS 2130 and 2140 or 2070, 2080 and 2100; 3180 and 3310.
Required for the physics minor:
PHYS 3320 and one physics course numbered above 3400.
Required for the astrophysics minor: ASTR 4810 and 4820.
Students must maintain a minimum GPA of 2.0 for all course work in the minor. Candidates for the minor must have their course work verified and approved by a departmental Adviser or Chair prior to making formal application for graduation.

Minor in Renewable Energy (This is an interdisciplinary minor)
The Minor in Renewable Energy (MRE) has been established as an interdisciplinary minor program. It is designed for students in the STEM areas majoring in the following departments: Physics and Astronomy, Chemistry, Environmental Sciences, Biology, Mathematics, MIME, Chemical and Environmental Engineering, Electrical Engineering and Computer Science, Civil Engineering and Bioengineering. Students with other majors can enroll in the MRE provided they complete the prerequisite courses. The goal of the minor is to expose students to quantitative analyses of the use of energy in human societies, its consequences and environmental impacts. A primary focus will be on the advantages and complexities of introducing renewable energy resources. Students will be required to take at least one course in the social, political, and economic ramifications of the use of energy in general and renewable energy in particular. An internship is required to enhance the practical training of students
Course requirements are as follow: Students must complete at least 21 hours of coursework selected as follows: Four required courses
- PHYS 3400 Physical Principles of Energy Sources for Humans 3 credit hours
- EEES 2200/GEPL 2200 Climate Change 3 credit hours
- CHEM 3810 Chemistry of Sustainable Energy Resources 3 credit hours
- PHYS 4940 Internship in Renewable Energy 3 credit hours

Select one from
- PSC 4340 Environmental Policy 3 credit hours
- ECON 3240 Environmental Economics 3 credit hours

Select two of the following
- PHYS 4400 Varieties of Solar Energy 3 credit hours
- MIME 4980 Renewable Energy 3 credit hours
- CHEE/BIOE 4980 Biofuels 3 credit hours
- CHEE 4980 Fuel Cells and the Hydrogen Economy 3 credit hours

Prerequisites: PHYS 2080 General Physics II or higher, CHEM 1240 General Chemistry II, both courses under CHEE 4980 require MATH 1850 Single Variable Calculus I.

Honors in Physics and Astronomy
Qualified juniors and seniors may be invited to work for the citation “honors in physics and astronomy.”

A. Admission: The Honors Program in the department of physics and astronomy is open to physics majors and may be taken concurrently with College Honors. Admission to the program is based upon the student’s academic achievement (at least a 3.0 GPA overall; at least a 3.3 GPA in the major), recommendations of previous instructors and an interview with the departmental honors officer. A petition for entrance into the program normally should be made before the end of the sophomore year.

B. Requirements: In order to remain in the program and graduate with departmental honors, the students must maintain at least a 3.0 cumulative GPA and a at least a 3.3 GPA in the major. In addition to the normal requirements for a physics undergraduate major, the student must successfully complete six hours of physics with honors in courses numbered above 3320*, six hours of math at or above the 3000 level and three hours of PHYS 4910. PHYS 4910 is independent research and requires a written thesis and presentation of an oral report upon completion of work. The oral report and written thesis will strongly influence the granting of the honors citation.
**ASTR 4810, 4820 may count toward this requirement.*

Department of Biological Sciences
Brian P. Ashburner, 2001, Associate Dean and Associate professor
B.A., St. Anselm College; Ph.D. Loyola University of Chicago
Tomer Avidor-Reiss, 2012, Associate professor
B.S. Hebrew University; Ph.D. Weizmann Institute of Science
Bruce Bamber, 2006, Associate professor
B.Sc., University of Calgary; Ph.D., University of Washington
Deborah Chadee, 2005, Associate professor
B.S., University of Manitoba; Ph.D., University of Manitoba
Maria Diakonova, 2006, Associate professor
Sc.B., M.S., Leningrad State University; Ph.D., Russian Academy of Sciences
Fan Dong, 2002, professor
M.D., Suzhou Medical College; Ph.D., Erasmus University
Rafael Garcia-Mata, 2012, Assistant professor
B.S. Universidad Nacional de Mar del Plata; PhD, University of Alabama at Birmingham
John Gray, 1998, Associate professor
B.Sc. (Hons), University College Cork; Ph.D., Purdue University
Patricia R. Komuniecki, 1985, professor, vice provost for graduate affairs and dean, college of graduate studies B.A., Newton College (Boston College); M.A., Mount Holyoke College; Ph.D., University of Massachusetts
Richard W. Komuniecki, 1980, Distinguished University Professor
A.B., Holy Cross College; M.S., Ph.D., University of Massachusetts
Malathi Krishnamurthy, 2010, Assistant professor
B.S., M.S., University of Delhi; Ph.D., Jawaharlal Nehru University
Douglas W. Leaman, 2001, professor and chair
B.S., M.S., The Ohio State University, Ph.D., University of Missouri
Scott M. Leisner, 1993, professor
B.S., University of Wisconsin; Ph.D., Purdue University
Guofa Liu, 2008, Associate professor
M.B., Suzhou Medical College; M.S., Beijing Medical University; Ph.D., Shanghai Second Medical University
Song-Tao Liu, 2007, Associate professor
B.S., Wuhan University; Ph.D., Shanghai Institute of Biochemistry
John Plenefisch, 1996, Associate professor and associate chair
B.S., University of Connecticut; Ph.D., Massachusetts Institute of Technology
Anthony Quinn, 2001, Associate professor
B.A., Mid-American Nazarene College, M.S., University of Missouri - Saint Louis, Ph.D., University of Oklahoma Health Science Center
Lirim Shemshedini, 1993, professor
B.S., University of Michigan; Ph.D., University of Vermont
William Taylor, 2003, Associate professor
B.S., University of Winnipeg; Ph.D., University of Manitoba
Deborah Vestal, 2002, Associate professor
B.S., Bowling Green State University; Ph.D., Syracuse University

Emeritus Faculty
William L. Bischoff Jr., 1972, professor emeritus, 2007
B.A., M.A., Miami University; Ph.D., University of North Carolina
Charles Creutz, 1973, professor emeritus, 2010
A.B., Columbia University; M.S., Ph.D., University of Pennsylvania
Ernest Dubrul, 1974, professor emeritus, 2010
H.A.B., Xavier University; Ph.D., Washington University
Louis Glatzer, 1973, professor emeritus, 1999
A.B., Dartmouth College; M.S., North Carolina State University; Ph.D., The University of Texas - Austin
Lloyd A. Jones, 1972, professor emeritus, 1999
B.S., M.S., The Ohio State University; Ph.D., Purdue University
Woon H. Jyung, 1964, professor emeritus, 1993
B.S., Seoul National University; M.S., Ph.D., Michigan State University
Harold H. Lee, 1967, professor emeritus, 1999
A.B., Oklahoma Baptist University; M.S., Ph.D., University of Tennessee
Clifford J. Smith, 1965, professor emeritus, 1993
B.S., Cornell University; Ph.D., University of Maryland

Lecturer
Sally Harmych, 2006, Associate Lecturer
B.S., Ph.D. University of Toledo
Brenda Leady, 1993, Lecturer
B.S.,Ph.D., University of Toledo
Robert Steven, 2006, Associate Lecturer
B.Sc., Ph.D., University of Toronto

Department of Chemistry& Biochemistry
Jared L. Anderson, 2005, Professor
B.S., South Dakota State University; Ph.D., Iowa State University
Peter R. Andreana, 2012, Associate Professor
B.S., Brock University; Ph.D., Wayne State University
John J. Bellizzi, **III**, 2008, Assistant Professor
S.B., Massachusetts Institute of Technology; M.S., Ph.D., Cornell University
Terry P. Bigioni, 2006, Associate Professor
B.Sc., M.Sc., University of Toronto; Ph.D., Georgia Institute of Technology
Eric W. Findsen, 1988, Associate Professor
B.S., Michigan State University; M.S., University of California; Ph.D., University of New Mexico
Dean M. Giolando, 1988, Professor
B.S., Rochester Institute of Technology; Ph.D., University of Illinois
Xiche Hu, 1998, Associate Professor
B.S., M.S., Wuhan University; Ph.D., Wayne State University
Dragan Isailovic, 2008, Associate Professor
Diploma – Physical Chemistry, University of Belgrade, Serbia; Ph.D., Iowa State University
Andrew D. Jorgensen, 1988, Associate Professor
B.S., Quincy College; Ph.D., University of Illinois – Chicago
Ajith Karunarathne, 2014, Assistant Professor
B.S., University of Sri Jayewardenepura; Ph.D., Michigan State University
Jon R. Kirchhoff, 1989, Distinguished University Professor
B.S., State University of New York - Cortland; Ph.D., Purdue University
Cora Lind-Kovacs, 2003, Professor and Associate Chair
Prediploma, Bergische Universität Wuppertal; M.S., Ph.D., Georgia Institute of Technology
Mark R. Mason, 1998, Associate Professor
B.S., Bowling Green State University; Ph.D., Iowa State University

Timothy C. Mueser, 2000, Associate Professor
B.S., Eureka College; Ph.D., University of Nebraska
Donald R. Ronning, 2005, Associate Professor
B.S., University of Minnesota; Ph.D., Texas A & M University
Joseph A. R. Schmidt, 2004, Associate Professor
B.S., Kansas State University; Ph.D., University of California-Berkeley
Steven J. Sucheck, 2005, Associate Professor
B.S., University of Toledo; Ph.D., University of Virginia
Ronald E. Viola, 2000, Distinguished University Professor and Chair
B.S., Fordham University; M.S., Ph.D., Pennsylvania State University
Kana Yamamoto, 2008, Assistant Professor
B.S., M.S., Nagoya University, Japan; Ph.D., University of California-Berkeley
Jianglong Zhu, 2010, Associate Professor
B.S., M.S., Tianjin University; Ph.D., Boston University

Lecturers
Claire Cohen, 2007, Lecturer
B.S., University of Massachusetts; Ph.D., Cornell University
Edith P. Kippenhan, 2006, Lecturer
B.S., University of Maryland; Dipl.-Chem., Universität des Saarlandes, Germany
Kristi Mock, 2013, Lecturer
B.S., Ph.D., The University of Toledo
Elizabeth Zhurova, 2013, Lecturer
B.S., M.S., Mendeleev University of Chemical Technology; Ph.D., Karpov Institute of Physical Chemistry
James R. Zubricky, III, 2008, Associate Lecturer
B.S., M.S., Bowling Green State University

Visiting Assistant Professor
Wendell P. Griffith, 2007, Assistant Professor
B.S., Grambling State University; Ph.D., University of Massachusetts

Emeritus Faculty
John Chrysochoos, 1967, Professor Emeritus, 2004
Diploma of Chemistry, University of Athens; M.S., Ph.D., University of British Columbia
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B.S., Central State College; Ph.D., Oklahoma State University
James L. Fry, 1969, Professor Emeritus, 1999
B.S., Bowling Green State University; Ph.D., Michigan State University
Max O. Funk, 1978, Distinguished University Professor Emeritus, 2013
B.S., The Pennsylvania State University; Ph.D., Duke University
James E. Gano, 1967, Professor Emeritus, 2000
B.S., Miami University; M.S., Ph.D., University of Illinois
Nina I. McClelland, 2004, Professor Emerita
B.S., M.S., University of Toledo; MPH, Ph.D., University of Michigan; DSc, University of Toledo
Robert J. Niedzielski, 1965, Professor Emeritus, 1999
B.S., Aquinas College; M.S., Ph.D., University of Illinois
Gordon A. Parker, 1965, Professor Emeritus, 1992
B.S., University of Michigan; M.S., Ph.D., Wayne State University
A. Alan Pinkerton, 1984, Professor Emeritus, 2014
Grad. RIC, Brighton College of Tech; Ph.D., University of Alberta
Lancelot C.A. Thompson, 1958, Professor Emeritus, 1988
B.S., Morgan State University; Ph.D., Wayne State University
Frank Walmsley, 1962, Professor Emeritus, 1987
B.S., University of New Hampshire; Ph.D., University of North Carolina

Department of Environmental Sciences
Richard Becker, 2008, Associate professor
B.A., Washington University; M.A., Washington University; Ph.D., Western Michigan University
Jonathan M. Bossenbroek, 2005, Associate professor
B.S., Calvin College; M.S., University of Wisconsin; Ph.D., Colorado State University
Thomas Bridgeman, 2006, Associate professor
B.S., Miami University; M.S., The Ohio State University; Ph.D., University of Michigan
Mark J. Camp, 1976, Associate professor
B.S., M.S., The University of Toledo; Ph.D., The Ohio State University
Todd D. Crail, 2012, Lecturer
B.A. Bluffton University; M.S., Ph.D. The University of Toledo
Daryl F. Dwyer, 2001, Associate professor and director, Stranahan Arboretum
B.S., Wilkes College; M.A., State University of New York at Buffalo; Ph.D., Michigan State University
Timothy G. Fisher, 2003, Professor and chair
B.S., University of Alberta; M.S., Queen's University; Ph.D., University of Calgary
Johan F. Gottgens, 1993, Professor and associate chair
B.S., M.S., Utrecht University; Ph.D., University of Florida
Scott A. Heckathorn, 2003, Professor
B.S., Wichita State University; M.S., Ph.D., University of Illinois
David E. Krantz, 2001, Associate professor
B.S., College of William and Mary; M.S., Ph.D., University of South Carolina
James A. Martin-Hayden, 1994, Associate professor
B.A., University of Maine; M.S., Ph.D., University of Connecticut
Christine M. Mayer, 2003, Professor
B.S., M.S., University of Illinois at Urbana - Champaign; Ph.D., Cornell University
Daryl L. Moorhead, 1999, Professor
B.S., The Ohio State University; M.S., Texas A&M University; Ph.D., University of Tennessee
Song Qian, 2012, Assistant professor
B.S. Tsinghua University; M.S. Nanjing University; M.S., Ph.D. Duke University
William Von Sigler, 2003, Associate professor
B.S., Purdue University; Ph.D., Purdue University
Alison L. Spongberg, 1994, Professor
B.A., Ohio Wesleyan University; M.A., Temple University; Ph.D., Texas A&M University
Carol A. Stepien, 2004, Distinguished University Professor and director of the Lake Erie Research Center
B.S., Bowling Green State University; M.S., Ph.D., University of Southern California
Donald J. Stierman, 1994, Associate professor
B.S., State University of New York - Brockport; M.S., Ph.D., Stanford University
Michael N. Weintraub, 2005, Associate professor
B.A., Bard College; M.A., Ph.D., University of California at Santa Barbara
EMERITUS FACULTY
Stuart L. Dean, 1967, Professor emeritus, 1993
B.S., M.S., Ph.D., West Virginia University
Lou Glatzer, 1973, Professor emeritus, 1999
A.B., Dartmouth College; M.S., North Carolina State University; Ph.D., The University of Texas - Austin
Stephen L. Goldman, 1971, Professor emeritus, 2007
B.S., Brooklyn College; M.A., Ph.D., University of Missouri
James A. Harrell, 1979, Professor emeritus, 2009
B.S., California State University - Fullerton; M.S., University of Oklahoma; Ph.D., University of Cincinnati
Craig B. Hatfield, 1964, Professor emeritus, 1999
B.S., M.A., Ph.D., Indiana University

Michael W. Phillips, 1975, Professor emeritus, 2010
B.S., North Carolina State University; Ph.D., Virginia Polytechnic Institute
Lon C. Ruedisili, 1974, Professor emeritus, 1993
B.S., M.S., Ph.D., University of Wisconsin
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A.B., Case Western Reserve University; Ph.D., University of Georgia

Department of Mathematics and Statistics
James D. Anderson, 1990, Assistant professor
B.S., The University of Akron; M.S., Purdue University
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B.S., University of Padova; M.S., Univerita' Bocconi; Ph.D., International School for Advanced Studies, Trieste, Italy
Zeljko Cuckovic, 1994, professor
B.S., M.S., University of Zagreb; Ph.D., Michigan State University
Paul R. Hewitt, 1990, Associate professor and chair
B.S., Michigan Technological University; Ph.D., Michigan State University
Rong Liu, 2009 assistant professor
B.S., Shandong University; M.S., University of North Texas; Ph.D., Michigan State University
Geoffrey K. Martin, 1989, Associate professor and Vice Provost/Director, Institutional Research
B.S., University of Connecticut; M.A., Ph.D., State University of New York - Stony Brook
Robert L. Ochs Jr., 1988, Associate professor
B.S., Ursinus College; M.S., The Pennsylvania State University; M.A., Ph.D., University of Delaware
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B.S., Harvey Mudd College; M.S., California Polytechnic University - Pomona; Ph.D., University of Wisconsin
Biao Ou, 1993, professor
B.S., M.S., Zhejiang University; Ph.D., University of Minnesota
Sonmez Sahutoglu, 2009, Associate professor
B.S., M.S., Middle East Technical University; Ph.D., Texas A&M University
Friedhelm Schwarz, 1984, professor
Diploma, University of Hanover; Ph.D., University of Bremen
Qin Shao, 2002, professor
B.S., M.S., Nankai University; Ph.D., The University of Georgia
Ivie Stein Jr., 1971, Associate professor
B.S., M.A., Long Beach State University; Ph.D., University of California at Los Angeles
Gerard Thompson, 1988, professor
B.Sc., King's College; M.S., Ph.D., University of North Carolina; Ph.D., Open University
Akaki Tikaradze, 2011, Assistant Professor
B.S., M.S., Tbilisi State University, Tbilisi, Georgia; M.S., Ph.D., University of Chicago, Chicago, Illinois
Mao-Pei Tsui, 2005, Associate professor
B.S., M.S., National Chao-Tung University; Ph.D., Brandeis University
H. Westcott Vayo, 1965, professor
B.S., Culver - Stockton College; M.S., Ph.D., University of Illinois
Denis White, 1984, professor
B.Sc., M.Sc., University of Toronto; M.S., Ph.D., Northwestern University
Donald B. White, 1993, professor
B.S., University of California - Los Angeles; M.S., Ph.D., University of California - Irvine
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B.S., M.S., University of Arizona; Ph.D., Rensselaer Polytechnic Institute
Mary F. Coughlin, 1969, professor emeritus, 1989
B.A., Marygrove College; M.S., St. Louis University; Ph.D., University of Michigan
Budmon R. Davis, l962, professor emeritus, 1989
B.S., Geneva College; M.A., Ph.D., University of Pittsburgh
Edward D. Ebert, 1947, professor emeritus, 1984
B.S., The University of Toledo; M.S., University of Iowa
Arnold A. Johanson, 1962, professor emeritus, 1987
A.B., Kenyon College; M.A., The Ohio State University; Ph.D., Case Institute of Technology
George J. Kertz, 1966, professor emeritus, 1999
A.B., Cardinal Glennon College; M.A., Ph.D., St. Louis University
Walter Lange, 1967, professor emeritus, 1989
M.Ed., Ed.S., The University of Toledo
Rao V. Nagisetty, 1974, professor emeritus, 2009
B.A., Andhra University; Ph.D., Stekloff Institute
Martin R. Pettet, 1981, professor, 2011
B.Sc., M.Sc., Toronto; M.Phil., Ph.D., Yale University
Temoleon G. Rousos, 1966, professor emeritus, 1986
B.Ed., The University of Toledo; M.A.Ed., Eastern Michigan University; M.A., Mathematics, Bowling Green State University; Ed.S., Ed.D., The University of Toledo
Paul Shields, 1974, professor emeritus, 1999
A.B., Colorado College; M.A., Ph.D., Yale University
Stephen E. Spielberg, 1963, professor emeritus, 1993
B.A., University of Pennsylvania; M.A., Ph.D., University of Minnesota
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B.A., Ph.D., University of Illinois; M.S., University of Chicago
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Henry C. Wente, 1971, Distinguished University Professor emeritus, 2009
A.B., A.M., Ph.D., Harvard University
Harvey E. Wolff, 1975, professor emeritus, 2010
B.A., University of Connecticut; M.A., Ph.D., University of Illinois

Retired Faculty
Mohamed S. El-Bialy, 1990, professor, 2013
Ph.D., University of Minnesota
Donald J. Greco, 1977, professor, 2008
B.A., The Ohio State University; M.Ed., Ph.D., The University of Toledo
L. Marie Hoover, 1984, Associate professor, 2008
B.A., Muskingum College; M.A., University of Michigan; Ph.D. The University of Toledo
Elaine I. Miller, 1986, Associate professor, 2010
A.S., Alpena College; B.S., M.A., Eastern Michigan University

Lecturers
Amrita Acharyya, 2014, lecturer
B.S., M.S., M.A., University of Calcutta (India); Ph.D., The University of Alabama
Katherine Bryant, 2010 associate lecturer
B.S., M.S., The University of Toledo
Jeongoo Cheh, 2014, lecturer
B.S., POSTECH (Pohang University of Science and Technology, Korea); Ph.D., University of Minnesota

Zhiwei Chen, 2011, lecturer
B.A. Central University of Finance and Economics, Beijing; Ph.D., University of Maryland
Vani Cheruvu, 2012, lecturer
M.Sc., M.Phil., University of Hyderabad (India), Ph.D., Indian Institute of Technology (Madras, India)
Katharine Fisher, 2005, associate lecturer
B.S., Queen's University, Kingston; M.S., University of Calgary
David Gajewski, 2011, lecturer
B.S., M.S., Ph.D., The University of Toledo
Kevin Gibbs, 2010, associate lecturer
B.S., M.A., Eastern Michigan University
Seung-Moon Hong, 2011, lecturer
B.S., M.S., Hanyang University (Seoul South Korea), Ph.D., University of Indiana
Nathaniel Iverson, 2011, lecturer
B.A., Simpson College, M.A., Ph.D., Bowling Green St. University
Paramasamy Karuppuchamy, 2012, lecturer
B.Sc., M.Sc., Madurai Kamaraj University, Ph.D., University of Madras, Chennai (India)
Trieu Le, 2012, lecturer
B.S. with Distinction in Mathematics, National University, Ho Chi Minh City, (Vietnam), Ph.D., University of Buffalo
Gregory Lewis, 2008, associate lecturer
M.Ed., The University of Toledo
Suzan Orra, 2009, associate lecturer
B.S., M.S., The University of Toledo
Minhui Paik, 2012, lecturer
B.S., Korea University (South Korea), M.S., Ph.D., Iowa State University
Matthew Sutherland, 2011, lecturer
B.S., Heidelberg College, M.A., Bowling Green St. University
Sibylle Weck-Schwarz, 2003, senior lecturer
M.S., Ph.D., University of Hannover
Syed Zaidi, 2003, senior lecturer
B.S., M.S., Punjab University Lahore; M.S., Emporia State University
Wenqi Zhao, 2014, lecturer
B.S., Namkai University; M.S., Ph.D., University of Texas at Austin

Retired Lecturers
David Beekley, 2004, associate lecturer, 2010
B.S.M.E., The University of Toledo; M.S.M.E., The University of Michigan
Chase Brady, 2010, associate lecturer
B.A., New College of Florida; M.S., University of Alaska, Fairbanks; M.S., Miami University
Theresa Myers, 2002, senior lecturer
B.A. SUNY College at Oneonta; M.Ed., The University of Toledo
Lawrence Shears, 2002, associate lecturer, 2010
B.S., The University of Toledo; M.A.T., Brown University
T. Munir Simon, 2002, senior lecturer, 2012
B.S., The University of Toledo; M.B.A., Rutgers University
Edward Stelnicki, 2002, associate lecturer, 2011
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Jacques G. Amar, 1997, professor and Associate chair
M.A., University of Rochester; Ph.D., Temple University
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B.S., California Institute of Technology; M.A., Ph.D., University of California - Berkeley

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B.A., University of North Carolina-Chapel Hill; M.S., University of Colorado; Ph.D., University of Wisconsin
Karen S. Bjorkman, 1996, Distinguished University Professor, Dean
B.S., University of North Carolina-Chapel Hill; M.S., Ph.D., University of Colorado
Jillian Bornak, 2013, Lecturer
B.A., Syracuse University; M.S., Ph.D., New Mexico State University
Rupali Chandar, 2007, Associate professor
B.S., Haverford College, M.S., Ph.D., Johns Hopkins University
Song Cheng, 1993, Associate professor and Graduate Program director
B.Sc., Changsha Institute of Technology; Ph.D., Kansas State University
Robert W. Collins, 2004, Distinguished University Professor and NEG Endowed Chair of Silicate and Materials Science
B.A., Clark University; M.S., Ph.D., Harvard University
Michael Cushing, 2011, Assistant professor
B.S. Boston University, M.S., Ph.D., University of Hawaii
Xunming Deng, 1996, professor
M.S., Ph.D., University of Chicago
Randall J. Ellingson, 2008, Associate Professor
B.A., Carleton College; M.S., Ph.D., Cornell University
Steven R. Federman, 1988, professor
B.S., Polytechnic Institute of Brooklyn; M.S., Ph.D., New York University
Bo Gao, 1994, professor
B.S., Zhejiang University; M.S., Ph.D., University of Nebraska
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B.S., John Carroll University; M.S., Stanford University; Ph.D., California Institute of Technology
Victor G. Karpov, 2001, professor
Ph.D., Leningrad Polytechnic Institute
Sanjay V. Khare, 2004, Associate professor
Ph.D., University of Maryland
Thomas J. Kvale, 1986, professor and director of undergraduate research
B.A., Gustavus Adolphus College; M.S., Ph.D., University of Missouri - Rolla
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B.S., Bowling Green State University; M.S., Ph.D., University of Cincinnati
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B.S., California Institute of Technology; Ph.D., Cornell University
James F. Palmer, 2000, professor
M.S., Cornell University; M.S., Eastern Michigan University; M.S., University of Florida
Nikolas Podraza, 2011, Assistant professor
B.S., M.S., Pennsylvania State University, Ph.D., The University of Toledo
Kathy Shan, 2012, Lecturer
B.S., Marshall University; M.S., Ph.D., The University of Toledo
J.D. Smith, 2008, Assistant professor
S.B., Massachusetts Institute of Technology; M.S., Ph.D., Cornell University
Yanfa Yan, 2011, Ohio Research Scholar professor
B.S., M.S., Ph.D., Wuhan University

Emeritus Faculty

Brian G. Bagley, 1991, professor emeritus, 2008
B.S., M.S., University of Wisconsin - Madison; A.M., Ph.D., Harvard University
Randy G. Bohn, 1969, professor emeritus, 2003
B.S.E.P., The University of Toledo; Ph.D., The Ohio State University
Bernard W. Bopp, 1974, professor emeritus, 2010
B.A., New York University; Ph.D., The University of Texas
Alvin D. Compaan, 1987, distinguished university professor emeritus, 2009
A.B., Calvin College; M.S., Ph.D., University of Chicago

Larry J. Curtis, 1963, Distinguished University Professor emeritus, 2006
B.S., The University of Toledo; M.S., Ph.D., University of Michigan
Robert T. Deck, 1965, professor emeritus, 1993
B.A., LaSalle College; Ph.D., University of Notre Dame
Armand H. Delsemme, 1966, professor emeritus, 1988
M.S., M.E., Ph.D., Universite de Liege
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A.B., Marietta College; Ph.D., Cornell University
Philip B. James, 1990, Distinguished University Professor emeritus, 2006
B.S., Carnegie Mellon University; Ph.D., University of Wisconsin
Nancy D. Morrison, 1978, professor emeritus, 2010
B.A., Radcliffe College; M.S., Ph.D., University of Hawaii
Richard M. Schectman, 1961, professor emeritus, 1986
B.S., Lehigh University; M.S., The Pennsylvania State University; Ph.D., Cornell University
H. John Simon, 1972, professor emeritus, 1999
B.S., Tufts University; M.A., Ph.D., Harvard University
William Williamson Jr., 1965, professor emeritus, 1997
B.A., San Francisco State College; M.A., University of California; Ph.D., University of Colorado
Adolf N. Witt, 1967, Distinguished University Professor emeritus, 2006
Vordiplom, University of Hamburg; Ph.D., University of Chicago