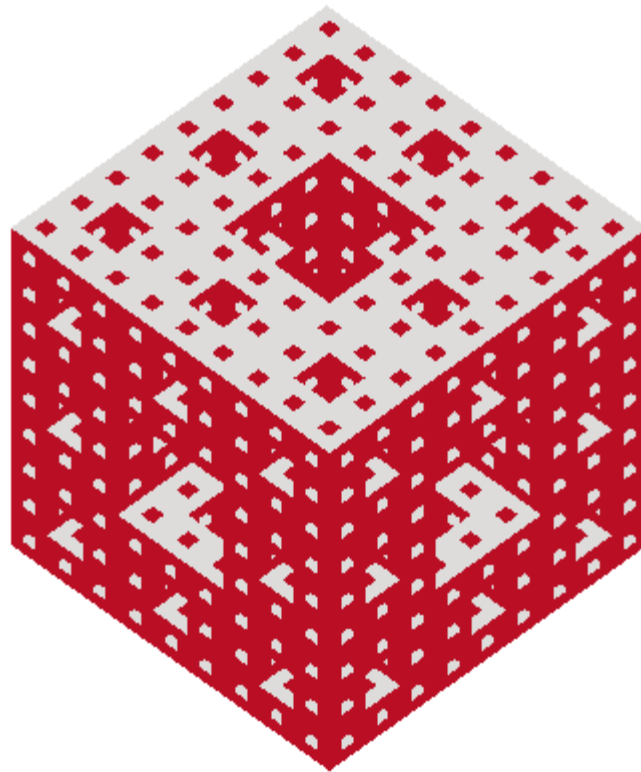


**Undergraduate Handbook  
B.S. in Applied Mathematics  
B.S.+M.S. in Applied Mathematics**



**Department of Applied Mathematics**  
**<http://www.iit.edu/csl/am/>**

# Department of Applied Mathematics

(Spring 2012)

## I. General Information

### 1.1 Introduction

This handbook is intended to be a useful resource for all Applied Mathematics (AM) undergraduates and their advisors. The aim of this document is to provide a dynamic source of information relating to the changes and updates in the AM undergraduate curriculum.

Illinois Institute of Technology was originally founded in 1940, when the Armour Institute (est. 1893) merged with the Lewis Institute (est. 1895). Ever since the inception of this university, degree programs in Mathematics have been awarded at both the undergraduate and the graduate level. The Applied Mathematics department at IIT was formed relatively recently – in the year 1998. The first undergraduates admitted to the AM program began their studies in the year 2000.

Since the undergraduate advising guidelines contained herein are subject to frequent changes, please be certain to always refer to the most current advising publication whenever specific questions arise regarding the undergraduate AM curriculum.

The AM Department takes academic advising very seriously and considers the conscientious, careful advising of its majors to be crucial to both their success at the undergraduate level as well as to their future planning for professional or academic careers. Therefore, it is important for all AM advisors to make time available for sessions with all of their advisees during every advance registration period, and also during each week preceding the start of a new academic term. Academic advisory sessions may be formally scheduled by the student or they may occur without appointment during the advisor's posted office hours. Advising is also frequently done via email. The advance registration period is the month of April for the summer and fall terms, and it is the month of November for the spring semester. If an advisor is on leave or out of the office for some reason, then arrangements must be made through the Department Coordinator for another advisor to assist in the advising process.

### 1.2 Administration of the AM Undergraduate Programs

The AM faculty is responsible for creating, maintaining and implementing the major curriculum for the Bachelor of Science Degree in Applied Mathematics. A committee of AM faculty, called the Undergraduate Studies Committee (UGSC), is granted authority to assess student performance, recommend program changes, approve course substitutions and to award credit for special projects. IIT's administrative departments, such as the Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)), may consult with the UGSC when deciding issues which have implications for the undergraduate curriculum in mathematics. Any changes or deviations to the AM Undergraduate Advising Guidelines and its policies must be approved by the UGSC. The chair of this committee is the associate chair of the department. All other members of the committee serve one-year appointments while the department chair serves as ex-officio member. The department chair and associate chair have executive authority in the day-to-day administration of the undergraduate AM programs.

### 1.3 Key Contacts

Fred Hickernell – Department Chair, [hickernell@iit.edu](mailto:hickernell@iit.edu)

Greg Fasshauer – Associate Chair, [fasshauer@iit.edu](mailto:fasshauer@iit.edu)

Gladys Collins – Department Coordinator, [collinsg@iit.edu](mailto:collinsg@iit.edu)

### 1.4 Definition of Program of Study

It is especially important for both the advisor and the student to be aware of which edition of the IIT Bulletin (i.e., the university’s undergraduate program catalog) will serve as that student’s “official bulletin.” The degree requirements specified in that particular bulletin are the ones which will form the basis for the contract between the student and the university.

The official bulletin for students who began their careers at IIT as first year freshmen is always that which was current upon their initial enrollment at the university. The following table lists which bulletin applies to which entry semester.

| <b>Freshman semester</b> | <b>Undergraduate Bulletin</b> |
|--------------------------|-------------------------------|
| Fall 2001-Spring 2004    | green                         |
| Fall 2004-Spring 2006    | dark gray                     |
| Fall 2006-Spring 2008    | red                           |
| Fall 2008-Spring 2010    | red and gray                  |
| since Fall 2010          | white                         |

The official bulletin for transfer students is determined by the Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)) and is indicated on their Transfer Credit Evaluation form.

It is extremely important for each student to follow precisely all of the provisions that are detailed in his/her official bulletin in order to make certain that all requirements for graduation are met. Since some degree requirements have changed over the years, students who reference two different editions of the bulletin may not necessarily fulfill their specific graduation requirements.

In the rare occurrence of a programming change that has implications for current AM majors, the department’s advisors or associate chair will convey the relevant news to all of the affected students as soon as possible and will also post this information on the department web site.

The Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)) periodically audits each student’s program of study based solely on his/her official bulletin and those specific changes authorized by the UGSC. A student may request such an audit any time after having accumulated about 60 credit hours of course work.

## II. Programs of Study

### 2.1 Faculty Advising Information

All undergraduate students have advising requirements. Each semester a new so-called “alternate PIN” is provided to the student by his or her advisor. Once the student has consulted with his/her advisor about next semester’s schedule of classes, the advisor passes the alternate PIN on to the student who is then able to register for classes through

the MyIIT portal. Registration changes (such as dropping or adding classes) can be made in the same manner using the current semester's alternate PIN.

Students should therefore remember their alternate PIN for the entire semester.

Advisors obtain the alternate PIN via the Banner channels or the UG Academic Affairs Faculty channel in MyIIT.

## 2.2 Semester Plans

An eight semester program of study very similar to that outlined in section 2.3 below can be found in each of the IIT Bulletins currently in use. This program plan should be viewed only as a general guide toward fulfilling all the degree requirements in a reasonable and timely manner. Keep in mind that the actual semester that a particular AM major enrolls in any specified course may deviate from this plan due to the individual's specific circumstances and needs. For example, a student may be ahead of the plan because of earned AP credits, transfer credits, or summer school credits. The online DegreeWorks system (accessible through the MyIIT portal) should be used to devise a personalized program of study. The Curriculum Worksheet found in the Appendix may also be used for this purpose.

## 2.3 Freshmen/Transfer Students Admitted in Fall 2012 or later

| <b>First semester</b>    |          | <b>Second semester</b>   |          | <b>Third semester</b>    |          | <b>Fourth semester</b>    |            |
|--------------------------|----------|--------------------------|----------|--------------------------|----------|---------------------------|------------|
| MATH 100                 | 3        | MATH 152                 | 5        | MATH 251                 | 4        | MATH 252                  | 4          |
| MATH 151                 | 5        | MATH 230                 | 3        | MATH 332                 | 3        | MATH 350                  | 3          |
| CS 104                   | 2        | CS 115                   | 2        | Minor subject            | 3        | Minor subject             | 3          |
| Science elective         | 3        | PHYS 123                 | 4        | Science elective         | 3        | Science elective          | 3          |
| HUM 100-level            | 3        | Hum. or Soc. Sci. elect. | 3        | Hum. or Soc. Sci. elect. | 3        | Hum. or Soc. Sci. elect.  | 3          |
|                          | <hr/> 16 |                          | <hr/> 17 |                          | <hr/> 16 |                           | <hr/> 16   |
| <b>Fifth semester</b>    |          | <b>Sixth semester</b>    |          | <b>Seventh semester</b>  |          | <b>Eighth semester</b>    |            |
| MATH 430 or 454          | 3        | MATH 402                 | 3        | MATH 400                 | 3        | Appl. Math. elective      | 3          |
| MATH 475                 | 3        | Appl. Math. elective     | 3        | Appl. Math. Elective     | 3        | Appl. Math. elective      | 3          |
| Appl. Math. elective     | 3        | Appl. Math. elective     | 3        | Minor subject            | 3        | I PRO 497                 | 3          |
| Minor subject            | 3        | Minor subject            | 3        | Hum. or Soc. Sci. elect. | 3        | Hum. or Soc. Sci. elect.  | 3          |
| Hum. or Soc. Sci. elect. | 3        | I PRO 397                | 3        | Free elective            | 3        | Free elective             | 3          |
| Free elective            | 3        |                          |          |                          |          |                           |            |
|                          | <hr/> 18 |                          | <hr/> 15 |                          | <hr/> 15 |                           | <hr/> 15   |
|                          |          |                          |          |                          |          | <b>Total credit hours</b> | <b>128</b> |

## 2.4 Program Worksheet

As mentioned above, students are strongly encouraged to utilize the DegreeWorks software found in the Academic tab of their MyIIT portal to plan their curriculum. Alternatively, students may choose to record their course credits on the Curriculum Worksheet included in the Appendix of this handbook. Because the program of study requirements for each undergraduate student are dependent upon the semester and year in which he/she initially matriculated, it is highly recommended that both the student and the advisor either use DegreeWorks or maintain an up-to-date copy of the Curriculum worksheet for their personal records. Note that the worksheet includes further details regarding the rules and limitations of course selections. The same rules are also implemented in DegreeWorks. In addition, DegreeWorks allows the student to explore "what-if" scenarios such as adding a minor, a specialization, or even a second major (see

sections V-VII below). The “Planner” function in DegreeWorks provides students and advisors with a simple tool in a location easily accessible to both of them for planning out future semesters.

## **2.5 Course Substitutions**

Course substitutions may be allowed if all of the following conditions apply:

- A required course is neither currently being offered nor projected to be offered before the student’s anticipated graduation, nor is it available for independent study.
- A substitute course is available that satisfies the objectives of the student’s program of study.
- The General Education Requirements of the university are satisfied by the resulting program of study once the substitution has been made.
- The substitution is approved by the advisor and the UGSC, and documentation of this approval is sent to Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)).

## **2.6 Students not on Plan**

As previously noted, an AM major may have earned additional credits to place him/her ahead of the program of study plan described in the bulletin. In this case the student may be eligible for the accelerated combined BS/MS program (see Section 7.2 below).

It may also happen that an AM major falls behind the program plan in a given semester. In either case, DegreeWorks or the Program Worksheet along with the Course Projections chart included below should serve as a guide for the student and advisor in the selection of appropriate courses each term.

## **2.7 Students Performing Poorly**

IIT requires a minimum cumulative grade point average of 2.00 and a minimum grade point average of 2.00 in the student’s major department courses. Students who do not maintain these averages will be placed on academic probation. For more details see the IIT student handbook (available online at [http://www.iit.edu/student\\_affairs/handbook/](http://www.iit.edu/student_affairs/handbook/)). Attention is called to the fact that Applied Mathematics students whose major grade point averages are less than 2.30 at the end of any academic term may, at the discretion of the department, be refused permission to continue the program of study in this field.

## **III. Course Projections/Scheduling**

A Course Projections chart is included in Section IX of this handbook to provide students and advisors with some insight into when every 100 through 400-level AM class will be taught during the upcoming semesters. *These projections are tentative in nature and are subject to change* but they should clearly indicate to the reader the relative frequency and the periodicity with which the department plans to offer each math class. These projections are particularly important when planning a detailed, personalized program of study.

Since upper-level AM courses often require prerequisite knowledge gained from lower-level course work, the proper sequencing of major courses is critical to the student’s ability to successfully complete the degree requirements in eight semesters of work. Therefore, to avoid a delay in graduation, students should make every effort to be “on semester” during their sixth, seventh, and eighth semesters of study. This is because

many required upper-division AM courses are currently taught only once per academic year: during the “on semester” as indicated in the chart in Section IX.

The schedule of classes taught each semester by the AM department is set by the associate chair and the chair of the department. The final version of which is due for submission to the Office of the Registrar by mid-February for the summer and fall terms and by mid-September for the spring term. Advisors are encouraged to inform the associate chair in advance of these due dates whenever an advisee has a specialized scheduling need. Similarly, any request from a student for a special course offering should be formally made to the associate chair *by the middle of the month which precedes the schedule’s due date*. Every attempt will be made to accommodate these special requests – if done so as described above. However, please know that it is extremely difficult for the department heads to make any changes in the course schedule once it has been finalized and submitted to the Registrar.

## **IV. Electives**

### **4.1 Applied Mathematics Electives**

Any applied mathematics course at the 300-level or higher (including MATH 491 and graduate MATH courses) except MATH 333, 425, 426, 474 and 525 may be used as an applied mathematics elective. Courses from other programs may not be used as applied mathematics electives. An exception to this rule may be granted only for students pursuing a double major in a related field (such as computer science, physics or engineering).

### **4.2 Humanities and Social Science Electives**

Humanities and Social Science Electives are required as part of the General Education Requirements. Check each course description in the current Schedule of Classes to ensure that it is marked as a valid humanities (**H**) or social sciences (**S**) elective. In particular, at least 6 hours each are required at the 300-level for humanities and social sciences courses. Moreover, for social sciences, at least 6 hours are required in one field and at least 2 different fields need to be covered. A total of 21 hours are required for humanities and social sciences combined. The current Schedule of Classes takes authority over the Bulletin in this regard. Foreign language classes can be taken to fulfill the Humanities requirements as long as they are at the 200-level or above and marked with an (**H**). Certain courses taken at Shimer College (<http://www.iit.edu/ugaa/shimer/index.shtml>) or VanderCook College of Music (<http://vandercook.edu/current/iit.asp>) may qualify as humanities or social science electives. Students should take care in the selection of electives that the communication (**C**) course requirements of IIT’s General Education Requirements are satisfied. Students must complete a minimum of 42 (**C**) credit hours. Of these, at least 15 hours must be in MATH (currently to be chosen from MATH 100, 151, 152, 230, 350, 430, 454, 476, 486, 487 and 491).

### **4.3 Free Electives**

The B.S. in applied mathematics allows for 9 hours of free electives. Free elective course material must not substantially duplicate material from other courses in the student’s program. The UGSC reviews all proposals for Special Projects or Undergraduate Research whether it is to satisfy a Free Elective requirement or substitute for a required course. A third IPRO can count as a Free Elective for all students except those with a freshman standing. However, an IPRO cannot count as both a free elective and either

IPRO I or IPRO II. Students are responsible for satisfaction of any course prerequisites for a free elective before taking the course. Some courses taken for a minor can also count as a free elective (see Minors section). Certain courses taken at VanderCook College of Music or Shimer College can count as free electives. Some courses may even qualify as humanities or social science courses. Please see here <http://www.iit.edu/ugaa/shimer/index.shtml> or contact the Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)) for further information.

## V. Minors

Every student in the applied mathematics B.S. degree program is required to declare an approved minor. Usually a minor consists of 5 related courses from departments other than applied mathematics. Please refer to the appropriate bulletin for detailed information as well as for the list of available minors (currently pp. 158-162). There is no requirement for students to declare a minor until they fill out an application for graduation form. However, if students wish to receive an accurate audit of their academic programs (see Miscellaneous, Section VIII) then they need to notify the Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)) of their minor (see Forms, Section IX). The unofficial DegreeWorks audit will also be inaccurate if the minor has not been declared. A student must petition the UGSC for permission to declare a minor not already listed as approved.

## VI. Specializations

In addition to the general B.S. degree in Applied Mathematics, the department offers 6 special five-course sequences that may be used as a guide for the selection of **mathematics electives** and will prepare the student for a career in

- business/finance,
- education,
- industrial research, or
- graduate school.

Choosing any of the following specializations is **optional**. If students wish to receive an accurate audit of their academic programs (see Miscellaneous, Section VIII) then they need to notify the Office of Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)) of their specialization (see Forms, Section IX).

### Specialization in Mathematical Finance

Program advisor: T. Bielecki

Students who choose this specialization may qualify for admission to the Master of Mathematical Finance program (see [http://www.iit.edu/mathematical\\_finance/](http://www.iit.edu/mathematical_finance/)) – a collaborative program between the Stuart School of Business and the Applied Mathematics Department. The objective of the MMF program is to provide individuals interested in pursuing careers in the finance industry with advanced education in theoretical, computational and business aspects of relevant quantitative methodologies.

Students are required to earn a **business minor** or an **entrepreneurship minor** (see the IIT Undergraduate Bulletin for details).

Students need to complete  
MATH 475 (Probability),

MATH 476 (Statistics),  
MATH 478 (Numerical Methods for Differential Equations),  
MATH 481 (Introduction to Stochastic Processes),  
MATH 485 (Introduction to Mathematical Finance).  
MATH 475 is required for all applied mathematics majors, the other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include  
MATH 461 (Fourier Series and Boundary Value Problems)  
MATH 477 (Numerical Linear Algebra)  
MATH 483 (Design and Analysis of Experiments)  
MATH 486 (Mathematical Modeling)  
MATH 489 (Partial Differential Equations)

### Specialization in Math Education

Program advisor: G. Fasshauer

Completion of the following 24 credit hour **education minor** will prepare students for the Illinois State Certification in Secondary Mathematics (grades 6-12) and Secondary Science: Biology, Chemistry, Physics (grades 6-12).

MSED 200 (Analysis of Classrooms)  
MSED 250 Curriculum/Foundations  
MSED 300 Instructional Methods /Strategies I  
MSED 320 Inquiry and Problem Solving  
MSED 350 Informal Education Practicum and Seminar  
MSED 400 Instructional Methods /Strategies II  
MSED 450 Professional Internship

Please note that MSED 450 is a 6-credit course focused on student teaching. A student enrolled in this course will spend the entire semester teaching at a local area school under the supervision of a classroom teacher and university supervisor. Therefore, enrollment in MSED 450 generally makes the student unavailable for enrollment in any concurrent weekday classes at IIT.

Students need to complete 5 of the following courses:

MATH 300 (Perspectives in Analysis),  
MATH 410 (Number Theory),  
MATH 420 (Geometry),  
MATH 430 (Applied Algebra),  
MATH 453 (Combinatorics),  
MATH 454 (Graph Theory),  
MATH 475 (Probability),  
MATH 476 (Statistics),  
MATH 486 (Mathematical Modeling).

MATH 430 or 454, and 475 are required for all applied mathematics majors. The other courses count toward MATH electives. Courses not chosen for the specialization are recommended as additional electives.

### Specialization in Applied Analysis

Program advisor: J. Duan

Applied analysis is one of the foundations for interdisciplinary applied mathematics. The principles of analysis are applied to such areas as partial differential equations, dynamical systems and numerical analysis. The basic framework, concepts and techniques of modern mathematical analysis are essential for modeling, analysis and simulation of complicated phenomena in engineering and science.

Students need to complete

MATH 400 (Real Analysis),  
MATH 402 (Complex Analysis),  
MATH 461 (Fourier Series and Boundary Value Problems),  
MATH 488 (Ordinary Differential Equations and Dynamical Systems),  
MATH 489 (Partial Differential Equations).

MATH 400 and 402 are required for all applied mathematics majors. The other three courses count toward MATH electives.

Closely related courses which are recommended as additional electives include

MATH 478 (Numerical Methods for Differential Equations)  
MATH 486 (Mathematical Modeling)

Recommended minors include: physics, or one of the engineering minors.

### Specialization in Computational Mathematics

Program advisor: X. Li

The use of computation/simulation as a third alternative to theory and experimentation is now common practice in many branches of science and engineering. Many scientific problems that were previously inaccessible have seen tremendous progress from the use of computation (e.g., many-body simulations in physics and chemistry, simulation of semi-conductors, etc.). Researchers and scientists in these areas must have a sound training in the fundamentals of computational mathematics and become proficient in the use and development of new algorithms and analytical techniques as they apply to modern computational environments.

Students need to complete

MATH 350 (Introduction to Computational Mathematics),  
MATH 435 (Linear Optimization) or MATH 461 (Fourier Series and Boundary Value Problems),  
MATH 476 (Statistics),  
MATH 477 (Numerical Linear Algebra),  
MATH 478 (Numerical Methods for Differential Equations).

MATH 350 is required for all applied mathematics majors. The other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include

MATH 435\* (Linear Optimization)  
MATH 461\* (Fourier Series and Boundary Value Problems)

MATH 486 (Mathematical Modeling)  
MATH 488 (Ordinary Differential Equations and Dynamical Systems)  
MATH 489 (Partial Differential Equations)

\* Only if not already counted as a required course.

Recommended minors include: artificial intelligence, computational structures, or software engineering.

### Specialization in Discrete Applied Mathematics

Program advisor: M. Pelsmajer

Discrete applied mathematics is a fairly young branch of mathematics and is concerned with using combinatorics, graph theory, optimization, and portions of theoretical computer science to attack problems in engineering as well as the hard and soft sciences.

Students need to complete

MATH 332 (Elementary Linear Algebra),  
MATH 430 (Applied Algebra),  
MATH 435 (Linear Optimization),  
MATH 453 (Combinatorics),  
MATH 454 (Graph Theory).

MATH 332 and MATH 430 or 454 are required for all applied mathematics majors. The other three courses count toward MATH electives.

Closely related courses which are recommended as additional electives include

MATH 410 (Number Theory)  
MATH 431 (Applied Algebra II)

Recommended minors include: artificial intelligence, computational structures, or computer networking.

### Specialization in Stochastics

Program advisor: I. Cialenco

Stochastics at IIT includes traditional statistics (the methods of data analysis and inference) and probability (the modeling of uncertainty and randomness). However, also included are other areas where stochastic methods have been becoming more important in recent years such as stochastic processes, stochastic integration, stochastic dynamics, stochastic partial differential equations, probabilistic methods for analysis, mathematical finance, discrete mathematics, and computational methods for stochastic systems.

Students need to complete

MATH 475 (Probability),  
MATH 476 (Statistics),  
MATH 481 (Introduction to Stochastic Process),  
MATH 485 (Introduction to Mathematical Finance),  
MATH 488 (Ordinary Differential Equations and Dynamical Systems).

MATH 475 is required for all applied mathematics majors, the other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include

MATH 453 (Combinatorics)

MATH 483 (Design and Analysis of Experiments)

MATH 486 (Mathematical Modeling)

## **VII. Double Degrees**

### **7.1 Two BS Degrees**

While AM students frequently obtain a double degree in AM and PHYS, or AM and CS, other combinations are also possible. These double degrees can generally be obtained with one extra semester or two summer semesters of coursework if students make an appropriate selection of free electives. Students who enter with AP credit will need less additional time to complete the requirements. A student who wishes to receive a double degree must complete all the required courses for each major as listed in the appropriate bulletin. Note that the IIT requirement of a minimum of 15 additional credit hours of work for the second degree will be met for any of these combinations if the second major coincides with the declared AM minor. No additional general education courses or IPROs are required. Required courses in one major may be used to satisfy electives in the second major. Students wishing to pursue double degrees must consult with the department's associate chair.

### **7.2 Combined BS-MS Degrees in Applied Mathematics**

A typical MS degree requires 2 years after the BS degree. This newly approved program combination can potentially reduce the time to an MS degree by up to at least one year for bright students with sufficient AP or transfer credits. Detailed information about this program (including a sample program of study) can be found on the department website at [http://www.iit.edu/csl/am/programs/undergrad/dual\\_degree.shtml](http://www.iit.edu/csl/am/programs/undergrad/dual_degree.shtml). You may also contact the associate chair or director of graduate studies (currently Prof. Xiaofan Li, [lix@iit.edu](mailto:lix@iit.edu)).

## **VIII. Miscellaneous Information**

### **8.1 Closed Courses**

When a course enrollment capacity is reached, the course will become closed to other students. Students who take advantage of advance registration have a much better chance of avoiding such a situation. Whenever possible, the AM department will try (admission not guaranteed) to accommodate all students and admit them into a closed class using the following guidelines:

- There is a legitimate need to get into the closed section
- There is enough physical space in the classroom
- There is enough equipment to accommodate all students
- The additional headcount will not create a burden to the instructor.

Admission to a closed section of a departmental course requires the approval of both the course instructor and the associate chair. Admission to a closed section of a course outside of the department requires the approval of that department. Before attempting to admit a student into a closed class, the advisor should make every effort to help the student construct an alternative schedule. Not wishing to take class at a particular time or

with a particular instructor is not a sufficient reason to get into a closed course. Every effort will be made to put those students with credible time conflicts into closed courses. Such students have priority.

A student wanting to be waitlisted for a closed course must do so through the myIIT portal. The system will offer the waiting list option if the CRN of a closed course is entered into the registration field.

Signatures from the instructor will not be accepted in the Registrar's Office for clearance.

## **8.2 ROTC**

The three ROTC programs are treated as minors. Each ROTC student has an ROTC advisor in his or her unit, and communication with that person can be helpful in resolving problems. The ROTC unit may require an AM signature on the student's "4-year plan", which advisors are authorized to provide after carefully checking the plan for AM requirements. ROTC courses do not count toward the maximum of 18 credit hours a student may carry (i.e., no course overload signature is needed from the Dean of the College of Science and Letters). ROTC individual study programs are developed with the assistance of the associate chair. ROTC students are exempt from one IPRO requirement so long as they remain in the ROTC program. If a student drops out of the ROTC program for any reason, he or she is required to make up that IPRO.

## **8.3 Co-op Program**

Students may seek permission to register for Co-op from the Career Management Center (<http://www.cmc.iit.edu/>) in the Galvin Library. Students interested in the co-op program should see the associate chair of the department for advice. Co-op experience does not count for academic credit, but students on co-op are considered to be in full-time status for the duration of their co-op for student visa purposes (international students) and student loan purposes. Students receiving scholarships are not supported during a co-op semester unless they are also taking regular courses. Students receiving financial aid are recommended to consult with their financial aid advisor to determine if any special rules apply during their co-op. If a student wishes to take courses during a co-op, the maximum recommended course load is 6 credit hours (full time co-op) or 12 credit hours (part-time co-op).

## **8.4 Summer Research**

More and more applied mathematics majors are interested in and participate in summer research projects. Such opportunities exist both at IIT and at other universities – often referred to as REUs (Research Experiences for Undergraduates). Information is available via IIT's ResearchWeb (<http://researchweb.iit.edu/>), from the Office of Undergraduate Research ([http://www.iit.edu/research/undergraduate\\_research/](http://www.iit.edu/research/undergraduate_research/)), and from individual professors.

## **8.5 Internships**

An internship is generally a full-time summer employment opportunity. Applications are available in the Career Management Center (<http://www.cmc.iit.edu/>). The Career Management Center sends applications to participating companies and administers the program.

## **8.6 Academic Audits**

All students should request an academic audit in their junior year (after completing about 60 credit hours) from Undergraduate Academic Affairs ([ugaa@iit.edu](mailto:ugaa@iit.edu)). The Minor and possible specialization needs to be noted on the Academic Program Audit Request form (see Forms, Section IX). Audits can be compared to curriculum worksheets and DegreeWorks to confirm accuracy.

## **8.7 Proficiency Exams**

The Registrar's Office allows credit by examination for coursework obtained through outside experience. It is at the discretion of the department offering the specific course as to whether or not a proficiency exam will be granted on the subject matter. Proficiency exams in 100 or 200-level MATH courses for students entering IIT can be arranged at the start of their first semester at IIT. The exam is administered at the discretion of the UGSC. The Credit by Examination Form may be obtained in the Office of the Registrar, and a per-credit-hour fee is charged for each examination.

## **8.8 Courses from Another School**

To obtain credit for a course taken at another school, a student must submit a petition (see Forms section) describing the request and obtain approval before starting the course. This process may take several weeks. The final 45 hours of course work must be completed in residence at IIT.

## **8.9 Study Abroad**

Students wishing to study abroad should contact the International Center (<http://studyabroad.iit.edu/index.php>) for information on universities with study abroad relationships with IIT. The application process should be initiated the year before the student wishes to study abroad. Students must verify their eligibility with their associate chair and the International Center.

## **8.10 Graduate Study**

Students wishing to pursue advanced degrees at IIT are encouraged to contact the Director of Graduate Studies, Professor Xiaofan Li ([lix@iit.edu](mailto:lix@iit.edu)). See also the dual BS-MS degree information in Section 7.2 above.

## **8.11 Math Club**

The Math Club promotes interest in the field of mathematics and provides fun and educational group activities that promote logical thinking and mathematical challenges. Interested students should contact the Math Club at [mathclub@iit.edu](mailto:mathclub@iit.edu), or visit the club's web pages at [http://www.iit.edu/csl/am/resources/undergrad/math\\_club.shtml](http://www.iit.edu/csl/am/resources/undergrad/math_club.shtml). The current faculty advisor is Professor Robert Ellis ([rellis@math.iit.edu](mailto:rellis@math.iit.edu)).

## **8.12 SIAM Student Chapter**

The *Society for Industrial and Applied Mathematics* (SIAM) supports a student chapter at IIT. Through this student chapter any applied mathematics student can become a free member of SIAM. One of the benefits of SIAM membership is a discount rate on SIAM-published books and conference fees. Similar to the Math Club, the SIAM chapter organizes various academic and social events throughout the year. The website for the

SIAM student chapter is <http://math.iit.edu/~siam>, and the current faculty advisors are Professors Igor Cialenco ([igor@math.iit.edu](mailto:igor@math.iit.edu)) and Xiaofan Li ([lix@iit.edu](mailto:lix@iit.edu)).

### 8.13 Numbers You Should Know

|  |          |
|--|----------|
| Science and Letters Dean's Office          | 567-3800 |
| Academic Resource Center (ARC)             | 567-5216 |
| Bursar's Office                            | 567-3794 |
| Career Management Center                   | 567-6800 |
| Disability Program                         | 567-5744 |
| Financial Aid Office                       | 567-7219 |
| Housing and Residential Services           | 567-5075 |
| International Center                       | 567-3680 |
| Public Safety                              | 808-6300 |
| Registrar's Office                         | 567-3100 |
| Spiritual Life                             | 567-3160 |
| Student Affairs (Dean of Students)         | 567-3081 |
| Student Center for Diversity and Inclusion | 567-5250 |
| Student Counseling Center                  | 567-5900 |
| Student Employment Office                  | 567-5729 |
| Student Health Center                      | 567-7550 |
| Undergraduate Academic Affairs             | 567-3300 |

If in doubt, check the online IIT phone book at <http://phonebook.iit.edu>.

### 8.14 Advising Codes

Students registering for undergraduate research, special topics, or reading courses use the faculty advising code below in place of a course section number.

|            |     |             |     |
|------------|-----|-------------|-----|
| Adler      | 155 | Kaul        | 189 |
| Bielecki   | 160 | Li, Shuwang | 141 |
| Cialenco   | 191 | Li, Xiaofan | 158 |
| Duan       | 133 | Lubin       | 150 |
| Edelstein  | 152 | Lyashenko   | 101 |
| Ellis      | 188 | Maslanka    | 186 |
| Fasshauer  | 159 | Pelsmajer   | 198 |
| Hickernell | 115 | Tier        | 192 |
| Kang       | 193 | Weening     |     |

The advisor code for faculty with joint appointments in AM can be found by contacting their main departments: Reingold (CS), Nair and Rempfer (MMAE).

## IX. Forms

### 9.1 Forms, Petitions and Responsible Parties

| FORM   | AVAILABLE FROM   | APPROVAL/<br>SUBMISSION   |
|--|--|---|
| Registration                                       | Use your Academics tab in <a href="http://my.iit.edu">http://my.iit.edu</a> .  | Advisor (Dean if >18 hours and not ROTC)  |
| Add and Drop/Withdrawal                            | Use your Academics tab in <a href="http://my.iit.edu">http://my.iit.edu</a> . Paper forms also available at the Registrar's Office.  | Advisor, department offering course if late registration                            |
| Course Repeat                                      | Enter a petition in DegreeWorks at time of registration for course. Use your Academics tab in <a href="http://my.iit.edu">http://my.iit.edu</a> .  | Advisor/Dean (if received passing grade in original course).                        |
| Course Audit                                       | Submit a request to the Office of the Registrar ( <a href="mailto:registrar@iit.edu">registrar@iit.edu</a> ).  |   |
| Change of Grade                                    | Paper form submitted to Registrar's Office   | Course instructor/Dean  |
| Academic Program Audit                             | Undergraduate Academic Affairs (form at <a href="http://www.iit.edu/ugaa/services/academic_program_audit.shtml">http://www.iit.edu/ugaa/services/academic_program_audit.shtml</a> )            | Undergraduate Academic Affairs after completing 60 credit hours                     |
| Declaration of Minor                               | Undergraduate Academic Affairs (form at <a href="http://www.iit.edu/ugaa/services/academic_program_audit.shtml">http://www.iit.edu/ugaa/services/academic_program_audit.shtml</a> )            | Consult with Advisor, but no formal approval required                               |
| Declaration of optional Specialization(s)          | Undergraduate Academic Affairs (form at <a href="http://www.iit.edu/ugaa/services/academic_program_audit.shtml">http://www.iit.edu/ugaa/services/academic_program_audit.shtml</a> )            | Consult with Advisor, but no formal approval required                               |
| Application for Graduation                         | Undergraduate Academic Affairs (more info at <a href="http://www.iit.edu/graduation/">http://www.iit.edu/graduation/</a> )   | Undergraduate Academic Affairs ( <b>submit by 2<sup>nd</sup> week of semester</b> ) |
| Change of Major or Double Major                    | Undergraduate Academic Affairs (form at <a href="http://www.iit.edu/ugaa/services/change_declare_major.shtml">http://www.iit.edu/ugaa/services/change_declare_major.shtml</a> )                | Dept. Chair, submit to Undergraduate Academic Affairs                               |
| Petition for summer course transfer credit         | Undergraduate Academic Affairs (form at <a href="http://www.iit.edu/ugaa/services/student_petitions.shtml">http://www.iit.edu/ugaa/services/student_petitions.shtml</a> )                      | Undergraduate Academic Affairs ( <b>before the course begins</b> )                  |
| Credit by Proficiency Examination                  | Form may be obtained in the Office of the Registrar and a per-credit-hour fee is charged for each examination.   | Instructor, Dean, Dept. Chair of course requested                                   |
| Application for Reinstatement                      | Undergraduate Academic Affairs ( <a href="http://www.iit.edu/ugaa/services/reinstatement.shtml">http://www.iit.edu/ugaa/services/reinstatement.shtml</a> )                                     | Undergraduate Academic Affairs  |
| Co-op schedule                                     | Career Management Center ( <a href="http://www.cmc.iit.edu/">http://www.cmc.iit.edu/</a> )   | Co-op advisor/Company   |
| Leave of Absence or Withdrawal from the University | Undergraduate Academic Affairs (information at <a href="http://www.iit.edu/ugaa/services/withdrawal_leave_absence.shtml">http://www.iit.edu/ugaa/services/withdrawal_leave_absence.shtml</a> ) | Undergraduate Academic Affairs  |

## 9.2 Course Dependencies

The **required** AM courses have the following pre-requisites:

MATH 100 (Introduction to the Profession): none  
MATH 151 (Calculus I): placement  
MATH 152 (Calculus II): “C” or better in MATH 151 (or in MATH 149)  
MATH 230 (Introduction to Discrete Mathematics): none  
MATH 251 (Multivariate and Vector Calculus): MATH 152  
MATH 252 (Introduction to Differential Equations): MATH 152  
MATH 332 (Elementary Linear Algebra): MATH 251 (may be taken concurrently)  
MATH 350 (Introduction to Computational Mathematics): MATH 251, CS 104/105/115,  
MATH 252 (may be taken concurrently)  
MATH 400 (Real Analysis): MATH 251  
MATH 402 (Complex Analysis): MATH 251  
MATH 430 (Applied Algebra): MATH 230 or 332  
MATH 454 (Graph Theory and Applications): MATH 230, (MATH 251 or 252)  
MATH 475 (Probability): MATH 251

AM **electives** have the following pre-requisites:

MATH 300 (Perspectives in Analysis): MATH 251, 252  
MATH 410 (Number Theory): MATH 230  
MATH 420 (Geometry): instructor’s consent  
MATH 431 (Applied Algebra II): MATH 430  
MATH 435 (Linear Optimization): MATH 332  
MATH 453 (Combinatorics): MATH 230  
MATH 461 (Fourier Series and Boundary-Value Problems): MATH 251, 252  
MATH 476 (Statistics): MATH 475  
MATH 477 (Numerical Linear Algebra): MATH 350  
MATH 478 (Numerical Methods for Differential Equations): MATH 350  
MATH 481 (Introduction to Stochastic Processes): MATH 332/333, MATH 475  
MATH 483 (Design and Analysis of Experiments): MATH 476  
MATH 485 (Introduction to Mathematical Finance): MATH 475  
MATH 486 (Mathematical Modeling I): MATH 461  
MATH 487 (Mathematical Modeling II): MATH 252  
MATH 488 (Ordinary Differential Eqns & Dynamical Systems): MATH 251, 252  
MATH 489 (Partial Differential Equations): MATH 461

## 9.3 Frequency of Course Offering

Students may expect courses to be offered according to the following algorithm:

### Required courses:

- MATH 151, 152, 251, and 252 are offered **every semester** (all courses are also usually offered in the summer)
- MATH 100, 332, 400, 454 and 475 are offered **every fall semester**
- MATH 230, 350, and 402 are offered **every spring semester**
- MATH 430 is offered **every other fall semester**
- Many students view MATH 400 as a “hard” course and wait until their last year to take it. MATH 300 may serve as preparation for MATH 400.

- MATH 230 is equivalent to CS 330 and MATH 350 is equivalent to MMAE 350. Students may choose to take either version of these courses. However, CS 330 and MMAE 350 do not serve as (C) courses. Enrollment in the MATH sections is encouraged.

Elective courses:

The matrix on the next page gives a *tentative* schedule for elective courses through fall 2015.

Students wishing to request that a specific elective be offered should contact the associate chair *at least* one semester in advance.

Sometimes students wonder how our upper-level courses fit into the four main focus areas of the department. In addition to the optional specializations discussed in Section VI, the following list provides a rough guide:

| Focus area                       | Required courses     | Elective courses |
|----------------------------------|----------------------|------------------|
| <b>Applied Analysis</b>          | MATH 400             | MATH 461         |
|                                  | MATH 402             | MATH 478         |
|                                  |                      | MATH 486         |
|                                  |                      | MATH 488         |
|                                  |                      | MATH 489         |
| <b>Computational Mathematics</b> | MATH 350             | MATH 435         |
|                                  |                      | MATH 477         |
|                                  |                      | MATH 478         |
|                                  |                      | MATH 488         |
| <b>Discrete Methods</b>          | MATH 332             | MATH 410         |
|                                  | MATH 430 or MATH 454 | MATH 430*        |
|                                  |                      | MATH 431         |
|                                  |                      | MATH 435         |
|                                  |                      | MATH 453         |
|                                  |                      | MATH 454*        |
| <b>Stochastic Analysis</b>       | MATH 475             | MATH 453         |
|                                  |                      | MATH 476         |
|                                  |                      | MATH 481         |
|                                  |                      | MATH 483         |
|                                  |                      | MATH 485         |
|                                  |                      | MATH 486         |

\*if not used as required course

The following table provides a **tentative** schedule of courses for AM majors through fall of 2015. Changes are possible subject to staffing and enrollment constraints. The most recent version can be found on the applied mathematics department website ([http://www.iit.edu/csl/am/programs/tentative\\_sched.shtml/](http://www.iit.edu/csl/am/programs/tentative_sched.shtml/)).

|          | 2012<br>S | 2012<br>F | 2013<br>S | 2013<br>F | 2014<br>S | 2014<br>F | 2015<br>S | 2015<br>F |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| MATH 100 |           | X         |           | X         |           | X         |           | X         |
| MATH 151 | X         | X         | X         | X         | X         | X         | X         | X         |
| MATH 152 | X         | X         | X         | X         | X         | X         | X         | X         |
| MATH 230 | X         |           | X         |           | X         |           | X         |           |
| MATH 251 | X         | X         | X         | X         | X         | X         | X         | X         |
| MATH 252 | X         | X         | X         | X         | X         | X         | X         | X         |
| MATH 332 |           | X         |           | X         |           | X         |           | X         |
| MATH 350 | X         |           | X         |           | X         |           | X         |           |
| MATH 400 |           | X         |           | X         |           | X         |           | X         |
| MATH 402 | X         |           | X         |           | X         |           | X         |           |
| MATH 410 |           |           | X         |           |           |           | X         |           |
| MATH 430 |           | X         |           |           |           | X         |           |           |
| MATH 431 |           |           | X         |           |           |           |           |           |
| MATH 435 | X         |           |           |           | X         |           |           |           |
| MATH 453 | X         |           |           |           | X         |           |           |           |
| MATH 454 |           | X         |           | X         |           | X         |           | X         |
| MATH 461 |           |           |           | X         |           |           |           | X         |
| MATH 475 |           | X         |           | X         |           | X         |           | X         |
| MATH 476 | X         |           | X         |           | X         |           | X         |           |
| MATH 477 |           | X         |           | X         |           | X         |           | X         |
| MATH 478 | X         |           | X         |           | X         |           | X         |           |
| MATH 481 |           | X         |           | X         |           | X         |           | X         |
| MATH 483 |           | X         |           |           |           |           |           |           |
| MATH 485 |           | X         |           | X         |           | X         |           | X         |
| MATH 486 | X         |           |           |           | X         |           |           |           |
| MATH 488 |           |           | X         |           |           |           | X         |           |
| MATH 489 | X         |           |           |           | X         |           |           |           |

## B.S. in Applied Mathematics Requirements Worksheet

Student \_\_\_\_\_ ID \_\_\_\_\_ Full/Part-time

### Applied Mathematics

| Course                                | Hrs. | Semester |
|---------------------------------------|------|----------|
| MATH 100 (C)                          | 3    |          |
| MATH 151 (C)                          | 5    |          |
| MATH 152 (C)                          | 5    |          |
| MATH 230 (C)                          | 3    |          |
| MATH 251                              | 4    |          |
| MATH 252                              | 4    |          |
| MATH 332                              | 3    |          |
| MATH 350 (C)                          | 3    |          |
| MATH 400                              | 3    |          |
| MATH 402                              | 3    |          |
| MATH 430/454 (C)                      | 3    |          |
| MATH 475                              | 3    |          |
| MATH                                  | 3    |          |
| MATH                                  | 3    |          |
| MATH                                  | 3    |          |
| MATH                                  | 3    |          |
| MATH                                  | 3    |          |
|                                       |      |          |
|                                       |      |          |
| <b>Total hours (60 hours minimum)</b> |      |          |

This includes 18 hours of required electives.

### Humanities

| Course                               | Hrs. | Semester |
|--------------------------------------|------|----------|
| HUM 100-level (C)                    | 3    |          |
| (C)                                  | 3    |          |
| (C)                                  | 3    |          |
|                                      |      |          |
|                                      |      |          |
| <b>Total hours (9 hours minimum)</b> |      |          |

At least 6 hours at 300-level.

### Social Sciences

| Course                               | Hrs. | Semester |
|--------------------------------------|------|----------|
| (C)                                  | 3    |          |
| (C)                                  | 3    |          |
| (C)                                  | 3    |          |
|                                      |      |          |
|                                      |      |          |
| <b>Total hours (9 hours minimum)</b> |      |          |

At least 6 hours at 300-level. At least 6 hours in one field and at least 2 different fields.

**Note:** A total of **21 hours** are required for **humanities and social sciences combined**.

### Minor

| Course                                | Hrs. | Semester |
|---------------------------------------|------|----------|
|                                       | 3    |          |
|                                       | 3    |          |
|                                       | 3    |          |
|                                       | 3    |          |
|                                       | 3    |          |
| <b>Total hours (15 hours minimum)</b> |      |          |

5 related courses from departments other than applied mathematics.

### IPRO

| Course                               | Hrs. | Semester |
|--------------------------------------|------|----------|
| IPRO 397 (C)                         | 3    |          |
| IPRO 497 (C)                         | 3    |          |
|                                      |      |          |
| <b>Total hours (6 hours minimum)</b> |      |          |

### Computer Science

| Course                               | Hrs. | Semester |
|--------------------------------------|------|----------|
| CS 104 or CS 115                     | 2    |          |
| CS 115 or CS 116                     | 2    |          |
|                                      |      |          |
| <b>Total hours (4 hours minimum)</b> |      |          |

### Science

| Course                                | Hrs. | Semester |
|---------------------------------------|------|----------|
| PHYS 123                              | 4    |          |
|                                       | 3    |          |
|                                       | 3    |          |
|                                       | 3    |          |
| <b>Total hours (13 hours minimum)</b> |      |          |

13 hours for the gray bulletin or before.

### Free Electives

| Course                               | Hrs. | Semester |
|--------------------------------------|------|----------|
|                                      | 3    |          |
|                                      | 3    |          |
|                                      | 3    |          |
|                                      |      |          |
|                                      |      |          |
| <b>Total hours (9 hours minimum)</b> |      |          |

10 hours for the gray bulletin or before.

### Communications Requirement:

Minimum 42 hours of **C** courses, at least 15 in major courses and at least 15 in non-major courses. Place a **C** next to the courses used for Comm. Gen. Ed. Req.

## Notes on the B.S. in Applied Mathematics

**General note:** Courses marked in the IIT Bulletin as not applying to graduation for degrees in "engineering and the physical sciences" may not be used toward the B.S. in Applied Mathematics – this includes their use as free electives.

**Applied mathematics electives:** Any applied mathematics course at the 300-level or higher (including graduate MATH courses) except MATH 333, 425, 426, 474 and 525 may be used as an applied mathematics elective. Courses from other programs may not be used as applied mathematics electives.

**Minor:** A minor may be chosen from the specialized minors listed in the IIT Bulletin or may be formed from 15 hours of course work in one department. The latter option requires written approval from both the student's faculty advisor and the minor department.

**Humanities electives:** (AAH, *some* COM, HIST, LIT, PHIL) Humanities course work (courses marked with an **(H)** in the IIT Bulletin) must include at least 6 hours at the 300-level or above. Note that foreign language courses at the 200-level may be used to satisfy the 300-level requirement. This substitution requires written approval from the student's faculty advisor. All humanities courses carry the **(C)** for communications.

**Social sciences electives:** (ANTH, ECON (but not BUS), PS, PSYC, SOC) Social sciences course work (courses marked with an **(S)** in the IIT Bulletin) must include at least 6 hours at the 300-level or above. At least 6 hours of social sciences course work must be taken in one field and at least 3 hours in another field. All PS courses numbered above 300 require as prerequisites successful completion of at least one other course marked with an **(S)** and satisfaction of IIT's Basic Writing Proficiency Requirement (placement test or COM 101/111 – which does not count toward any degree). Most **(S)** courses also carry the **(C)**.

**Science electives:** Science electives may be chosen from engineering, the natural sciences (BIOL, CHEM (both ok without lab), and PHYS), or PSYC (limited to courses marked with an **(N)** in the IIT Bulletin). At least one course must be in a field other than physics. At least two sequential courses in a single field (CHEM124 followed by MS 201 also qualifies).

**IPROs:** One of the two required Inter-Professional Projects may be replaced for ROTC students (replaced with ROTC junior and senior required courses). Both of the two required Inter-Professional Projects might be replaced for full-time working students who can document interdisciplinary project work (replaced with applied mathematics elective and free elective). Co-Op cannot be used. A petition must be filed through the Office of Undergraduate Academic Affairs.

**Free electives:** The B.S. in applied mathematics allows for 9 hours of free electives.

**ROTC programs:** ROTC programs are considered to be minors and satisfy the requirements for minors listed above.

**Graduate and short courses:** Undergraduates may enroll in a 500-level graduate course with permission from the student's faculty advisor. Undergraduates cannot enroll in short courses.

**Communications General Education Requirement:** Minimum 42 hours of **(C)** courses as marked in IIT Bulletin of Undergraduate Programs, at least 15 hours in major courses (automatically satisfied by MATH100, MATH151, MATH152, and MATH230) and at least 15 hours in non-major courses. Almost all Humanities and Social Science electives will count towards the communications requirement.

**Academic Audits:** All students should request an academic audit in their junior year (after completing 60 credit hours) from Undergraduate Academic Affairs. Minors should be noted on the Academic Program Audit Request form. Audits can be compared to degree requirements worksheet to confirm accuracy.