Mathematics

Mathematics
Department Chair: Matthew Ando
Department Office: 273 Altgeld Hall, 1409 West Green, Urbana
Phone: 333-3350
www.math.uiuc.edu

MATH 012  Algebra  credit: 3 hours.
Rapid review of basic techniques of factoring, rational expressions, equations and inequalities; functions and graphs; exponential and
logarithm functions; systems of equations; matrices and determinants; polynomials; and the binomial theorem. Credit not applicable
toward graduation in certain curricula. Prerequisite: 1.5 units of high school algebra; 1 unit of high school geometry.

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<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>39581</td>
<td>Lecture-Discussion</td>
<td>B1</td>
<td>09:00 AM - 10:50 AM</td>
<td>MWF</td>
<td>1 - Illini Hall</td>
<td>Aydin-Mullen, Y</td>
</tr>
</tbody>
</table>

Seats are reserved for LAS Access and Achievement Program students, specifically Undeclared students until December 1,
and then seats will open for LAS EOP and PAP students. If you do not meet this requirement, please contact the Access and
Achievement Program Office in 112 English Building to be placed on the waiting list. We will continue to do as we have in the past-
maintain a paper waiting list in our office at 112 English Building.

MATH 103  Theory of Arithmetic  credit: 4 hours.
Analyses of the mathematical issues and methodology underlying elementary mathematics in grades K-5. Topics include sets,
arithmetic algorithms, elementary number theory, rational and irrational numbers, measurement, and probability. There is an emphasis
on problem solving. Priority registration will be given to students enrolled in teacher education programs leading to certification in
elementary or childhood education. Prerequisite: MATH 012 or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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<tr>
<th>CRN</th>
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<th>Time</th>
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<th>Location</th>
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<td>37821</td>
<td>Laboratory</td>
<td>AB1</td>
<td>11:00 AM - 12:40 PM</td>
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<td>14 - Illini Hall</td>
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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.
### MATH 115  **Preparation for Calculus**  credit: 3 hours.

Reviews trigonometric, rational, exponential, and logarithmic functions; provides a full treatment of limits, definition of derivative, and an introduction to finding area under a curve. Intended for students who need preparation for MATH 220, either because they lack the content background or because they are not prepared for the rigor of a university calculus course. Credit is not given for both MATH 115 and either MATH 014 or MATH 114. Credit is not given for MATH 115 if credit for either MATH 220 or MATH 221 has been earned. Prerequisite: An adequate ALEKS placement score as described at [http://math.illinois.edu/ALEKS/](http://math.illinois.edu/ALEKS/), demonstrating knowledge of the topics of MATH 012.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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<td>MWF</td>
<td>151 - Everitt Laboratory</td>
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Quant Reasoning I course.
Placement in this course requires a minimum score of 50% on a U of I ALEKS placement test taken between September 14, 2012 and January 18, 2013. For details see [http://math.illinois.edu/ALEKS/](http://math.illinois.edu/ALEKS).

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<td>X2</td>
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Quant Reasoning I course.
Restricted to Liberal Arts & Sciences.
Placement in this course requires a minimum score of 50% on a U of I ALEKS placement test taken between September 14, 2012 and January 18, 2013. For details see [http://math.illinois.edu/ALEKS/](http://math.illinois.edu/ALEKS). Seats are reserved for LAS Access and Achievement Program students, specifically Undeclared students until December 1, and then seats will open for LAS EOP and PAP students. If you do not meet this requirement, please contact the Access and Achievement Program Office in 112 English Building to be placed on the waiting list. We will continue to do as we have in the past-maintain a paper waiting list in our office at 112 English Building. Restricted to EOP - Obligatory, Pres Award Program Recip, or AAP - Undeclared students.

### MATH 117  **Elementary Mathematics**  credit: 4 hours.

Analyses of the mathematical issues and methodology underlying elementary mathematics in grades 6-8. Topics include the Real number system and field axioms, sequences and series, functions and math modeling with technology, Euclidean and non-Euclidean geometry, probability and statistics. Priority registration will be given to students enrolled in teacher education programs leading to certification in elementary education. Prerequisite: MATH 012 or equivalent.

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Quant Reasoning I course.
Quant Reasoning I course.
Restricted to Early Childhood Education or Elementary Education or Pre-Early Chld/Elem Ed/Spec Ed major(s).
Open to Elementary Education, Early Childhood and Pre-Teacher Ed ONLY.

MATH 119  Ideas in Geometry  credit: 3 hours.
General education course in mathematics, for students who do not have mathematics as a central part of their studies. The goal is to convey the spirit of mathematical thinking through topics chosen mainly from plane geometry. Prerequisite: Two units of high school algebra; one unit of high school geometry; or equivalent.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.

MATH 124  Finite Mathematics  credit: 3 hours.
Introduction to finite mathematics for students in the social sciences; introduces the student to the basic ideas of logic, set theory, probability, vectors and matrices, and Markov chains. Problems are selected from social sciences and business. Prerequisite: MATH 012 or an adequate ALEKS score.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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<td>T</td>
<td>341 - Altgeld Hall</td>
<td>Rezvani, S</td>
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Quant Reasoning I course.
Restricted to students in the College of ACES until November 26, 2012. Other students are invited to add the class starting on that day. This section has a blended format in which half of the content is delivered in lecture and half is delivered on-line. See http://www.math.uiuc.edu/timetable/ for course details.

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<td>C2</td>
<td>08:00 AM - 09:20 AM</td>
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<td>341 - Altgeld Hall</td>
<td>Rezvani, S</td>
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<td>141 - Altgeld Hall</td>
<td>Santana, M</td>
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**MATH 161  Statistics  credit: 3 hours.**
Same as STAT 100. See STAT 100.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.

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<td>37493</td>
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<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>THEAT - Lincoln Hall</td>
<td>Fireman, E</td>
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</table>
MATH 181  **A Mathematical World**  credit: 3 hours.
Introduction to selected areas of mathematical sciences through application to modeling and solution of problems involving networks, circuits, trees, linear programming, random samples, regression, probability, inference, voting systems, game theory, symmetry and tilings, geometric growth, comparison of algorithms, codes and data management. Prerequisite: Three years of high school mathematics, including two years of algebra and one year of geometry.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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<tr>
<td>46843</td>
<td>Lecture-Discussion</td>
<td>D2</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>140 - Henry Administration Bldg</td>
<td>Eid, A</td>
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</table>

Quant Reasoning I course. Not intended for Engineering or Graduate College.

| 47119| Lecture-Discussion      | E1      | 01:00 PM - 02:50 PM | MWF  | 137 - Henry Administration Bldg | Rochford, A|


| 46845| Lecture-Discussion      | F1      | 02:00 PM - 02:50 PM | MWF  | 145 - Altgeld Hall              | Wong, Y    |

Quant Reasoning I course. Not intended for Engineering or Graduate College.

| 51553| Lecture-Discussion      | P1      | 11:00 AM - 12:50 PM | TR   | 1 - Illini Hall                 | Aydin-Mullen, Y |

Quant Reasoning I course. Restricted to Liberal Arts & Sciences.
Seats are reserved for LAS Access and Achievement Program students, specifically Undeclared students until November 17, and then seats will open for LAS EOP and PAP students. If you do not meet this requirement, please contact the Access and
Achievement Program Office in 112 English Building to be placed on the waiting list. We will continue to do as we have in the past- maintain a paper waiting list in our office at 112 English Building. Restricted to AAP - Undeclared students.

MATH 199  **Undergraduate Open Seminar**  credit: 1 TO 5 hours.
Approved for both letter and S/U grading. May be repeated.

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Instructor Approval Required

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<tr>
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<td>TR</td>
<td>341 - Altgeld Hall</td>
<td>Ahlgren, S</td>
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Credit Hours: 3 hours
Camp Honors/Chanc Schol course.
Special Topic: Numbers. For Chancellor's Scholars only; other may only enroll with the consent of the instructor and the Campus Honors Program. The course is not open to students who have taken a math class at the 300 level or above (with the exception of Math 415).
Restricted to Chancellor's Scholar-CHPHonors students.

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<tr>
<td>49060</td>
<td>Lecture-Discussion</td>
<td>FTM</td>
<td>03:00 PM - 03:50 PM</td>
<td>W</td>
<td>343 - Altgeld Hall</td>
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Credit Hours: 1 hours
Restricted to Pre Teacher Ed Student students.

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<tr>
<td>53557</td>
<td>Discussion/Recitation</td>
<td>JMD</td>
<td>03:00 PM - 04:50 PM</td>
<td>T</td>
<td>173 - Altgeld Hall</td>
<td>Bonnell, C</td>
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Credit Hours: 1 hours
Departmental Approval Required
For Math 285 Merit Workshop students only. Students must register for Math 285 section D2 (CRN 48599). For further information see [http://www.math.uiuc.edu/timetable/](http://www.math.uiuc.edu/timetable/)

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Credit Hours: 1 hours
Departmental Approval Required
For Math 115 Merit Workshop students only. Departmental approval required. For further information see [http://www.math.uiuc.edu/timetable/](http://www.math.uiuc.edu/timetable/)

MATH 210  **Theory of Interest**  credit: 3 hours.
Study of compound interest and annuities; applications to problems in finance. Prerequisite: MATH 231 or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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<tr>
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<td>11:00 AM - 12:20 PM</td>
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<td>1092 - Lincoln Hall</td>
<td>Feng, R</td>
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</table>
Quant Reasoning II course.
Restricted to students majoring in Actuarial Science until November 26, 2012. Students interested in transferring to the major may register for the class on that day once the restriction is lifted.

MATH 213  Basic Discrete Mathematics  credit: 3 hours.
Beginning course on discrete mathematics, including sets and relations, functions, basic counting techniques, recurrence relations, graphs and trees, and matrix algebra; emphasis throughout is on algorithms and their efficacy. Credit is not given for both MATH 213 and CS 173. Prerequisite: MATH 220 or MATH 221, or equivalent.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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<td>37828</td>
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<td>B1</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>140 - Henry Administration Bldg</td>
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Quant Reasoning II course.

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<td>MWF</td>
<td>143 - Altgeld Hall</td>
<td>Zhou, G</td>
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Quant Reasoning II course.

MATH 220  Calculus  credit: 5 hours.
First course in calculus and analytic geometry; basic techniques of differentiation and integration with applications including curve sketching; antidifferentiation, the Riemann integral, fundamental theorem, exponential and trigonometric functions. Credit is not given for both MATH 220 and either MATH 221 or MATH 234. Prerequisite: An adequate ALEKS placement score as described at http://math.illinois.edu/ALEKS/, demonstrating knowledge of topics of MATH 115. Students with previous calculus experience should consider MATH 221.
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Quantitative Reasoning I

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<td>Andersen, N</td>
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Quant Reasoning I course.
Departmental Approval Required
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

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<td>Discussion/Recitation</td>
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<td>01:00 PM - 02:50 PM</td>
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Quant Reasoning I course.
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### Placement Information

Placement in this course requires a minimum score of 70% on a U of I ALEKS placement test taken between September 14, 2012 and January 18, 2013. For details see [http://math.illinois.edu/ALEKS](http://math.illinois.edu/ALEKS).

### Course Details

**MATH 225  Introductory Matrix Theory**  credit: 2 hours.

Systems of linear equations, matrices and inverses, determinants, and a glimpse at vector spaces, eigenvalues and eigenvectors. Credit is not given for both MATH 225 and any of MATH 125, MATH 410, or MATH 415. Prerequisite: MATH 220 or MATH 221; or equivalent.

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MATH 231  Calculus II  credit: 3 hours.
Second course in calculus and analytic geometry: techniques of integration, conic sections, polar coordinates, and infinite series.
Prerequisite: MATH 220 or MATH 221.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.
Departmental Approval Required
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

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Quant Reasoning I course.
**Quant Reasoning I course.**
For Unit One and other LLC students.
Restricted to Garner Leadership Program, Global Crossroads, Health Professions Lv Lrn Comm, Intersections, Innovations LLC, Unit One, Weston Explorer Program, or Women in Math/Science/Engr Prg students.

### MATH 234 Calculus for Business I  
Credit: 4 hours.
Introduction to the concept of functions and the basic ideas of the calculus. Credit is not given for both MATH 234 and either MATH 220 or MATH 221. Prerequisite: An adequate ALEKS placement score as described at http://math.illinois.edu/ALEKS/, demonstrating knowledge of the topics of MATH 012.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Placement in this course requires a minimum score of 50% on a U of I ALEKS placement test taken between September 14, 2012 and January 18, 2013. New freshmen and new transfer students who earned 50% on their FIRST attempt at the Placement Exam between April 15, 2012 and September 13, 2012, may also enroll. For details see http://math.illinois.edu/ALEKS.

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Quant Reasoning II course.
Departmental Approval Required
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

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Quant Reasoning II course.
Departmental Approval Required
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

MATH 241  **Calculus III**  credit: 4 hours.

Third course in calculus and analytic geometry including vector analysis: Euclidean space, partial differentiation, multiple integrals, line integrals and surface integrals, the integral theorems of vector calculus. Credit is not given for both MATH 241 and MATH 292. Prerequisite: MATH 231.

This course satisfies the General Education Criteria for a: Quantitative Reasoning II

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<td>Song, R</td>
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Quant Reasoning II course.

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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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Quant Reasoning II course.
Departmental Approval Required
Not intended for Graduate - Urbana-Champaign.
This is an Honors course.

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<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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Quant Reasoning II course.

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Quant Reasoning II course.
Departmental Approval Required
Not intended for Graduate - Urbana-Champaign.
This is an Honors course.

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<th>Location</th>
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</table>

Quant Reasoning II course.

MATH 249  **Honors Supplement**  credit: 1 hours.
Supplemental credit hour for honors courses with additional material or special projects. Prerequisite: Concurrent registration in a specially designated honors section and consent of department.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
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</table>

Requires concurrent registration in Math 231 D1H.
Must enroll concurrently in MATH 231 46047.

MATH 285  **Intro Differential Equations**  credit: 3 hours.
Techniques and applications of ordinary differential equations, including Fourier series and boundary value problems, and an introduction to partial differential equations. Intended for engineering majors and others who require a working knowledge of differential equations. Credit is not given for both MATH 285 and any of MATH 284, MATH 286, MATH 441. Prerequisite: MATH 241.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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Quant Reasoning II course.
<table>
<thead>
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<th>CRN</th>
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<tr>
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<td>48605</td>
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<td>MWF</td>
<td>245 - Altgeld Hall</td>
<td>Chousionis, V</td>
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</table>
MATH 286  **Intro to Differential Eq Plus**  credit: 4 hours.

Techniques and applications of ordinary differential equations, including Fourier series and boundary value problems, linear systems of differential equations, and an introduction to partial differential equations. Covers all the MATH 285 plus linear systems. Intended for engineering majors and other who require a working knowledge of differential equations. Credit is not given for both MATH 286 and any of MATH 284, MATH 285, MATH 441. Prerequisite: MATH 241.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</tbody>
</table>

Quant Reasoning II course.
Registration is restricted to students majoring in Electrical and Computer Engineering. This restriction will be removed during the morning of Monday, January 7. Students interested in transfer to ECE should be in contact with ece-advisor@illinois.edu.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
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<th>Instructor</th>
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</table>

Quant Reasoning II course.
Registration is restricted to students majoring in Electrical and Computer Engineering. This restriction will be removed during the morning of Monday, January 7. Students interested in transfer to ECE should be in contact with ece-advisor@illinois.edu.

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Time</th>
<th>Days</th>
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</table>

Quant Reasoning II course.
Registration is restricted to students majoring in Electrical and Computer Engineering. This restriction will be removed during the morning of Monday, January 7. Students interested in transfer to ECE should be in contact with ece-advisor@illinois.edu.

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<tr>
<th>CRN</th>
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</table>

Quant Reasoning II course.
Registration is restricted to students majoring in Electrical and Computer Engineering. This restriction will be removed during the morning of Monday, January 7. Students interested in transfer to ECE should be in contact with ece-advisor@illinois.edu.

MATH 290  **Symbolic Computation Lab**  credit: 1 hours.

Laboratory component to courses using a symbolic programming package. Prerequisite: Consent of department; concurrent registration in a designated section of a mathematics course with symbolic computation component. May be taken only once for credit.

<table>
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<th>Type</th>
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</table>

Students from Math 231 Mathematica section B8, 46028, may enroll in this section. Must enroll concurrently in MATH 231 46028.
<table>
<thead>
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<th>CRN</th>
<th>Type</th>
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<th>Days</th>
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</table>

Students from Math 231 Mathematica section D8, 46048, may enroll in this section. Must enroll concurrently in MATH 231 46048.

Students from Math 286 Mathematica section B8, 48952, may enroll in this section. Must enroll concurrently in MATH 286 48952.

Students from Math 241 Mathematica section C8, 46075, may enroll in this section. Must enroll concurrently in MATH 241 46075.

Students from Math 241 Mathematica section X8, 46076, may enroll in this section. Must enroll concurrently in MATH 241 46076.

Students from Math 285 Mathematica section F8, 48605, may enroll in this section. Must enroll concurrently in MATH 285 48605.

Students from Math 285 Mathematica section G8, 48606, may enroll in this section. Must enroll concurrently in MATH 285 48606.

Students from Math 415 Mathematica section G83, 37984, may enroll in this section. Must enroll concurrently in MATH 415 37984.

MATH 299  **Topics in Mathematics**  credit: 1 TO 4 hours.
Topics course; see Class Schedule or department office for current topics. May be repeated in the same or subsequent semesters to a maximum of 8 hours. Prerequisite: MATH 220 or MATH 221; consent of instructor.

<table>
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<th>CRN</th>
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<th>Instructor</th>
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<tbody>
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<td>-</td>
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</table>

Credit Hours: 1 hours
MATH 347  **Fundamental Mathematics**  credit: 3 hours.
Fundamental ideas used in many areas of mathematics. Topics will include: techniques of proof, mathematical induction, binomial coefficients, rational and irrational numbers, the least upper bound axiom for real numbers, and a rigorous treatment of convergence of sequences and series. This will be supplemented by the instructor from topics available in the various texts. Students will regularly write proofs emphasizing precise reasoning and clear exposition. Credit is not given for both MATH 347 and MATH 348. Prerequisite: MATH 231.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
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<td>Lecture-Discussion</td>
<td>C1</td>
<td>10:00 AM - 10:50 AM</td>
<td>MWF</td>
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</table>

Quant Reasoning II course.
Math 347 is restricted to Mathematics and Math/CS majors until November 26, 2012. Contact mathadvising@illinois.edu if you have questions.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
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Quant Reasoning II course.
Departmental Approval Required
Not intended for Graduate - Urbana-Champaign.
Honors section. Requires department approval.

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Quant Reasoning II course.
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<th>Instructor</th>
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Quant Reasoning II course.
Math 347 is restricted to Mathematics and Math/CS majors until November 26, 2012. Contact mathadvising@illinois.edu if you have questions.

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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</table>

Quant Reasoning II course.
Math 347 is restricted to Mathematics and Math/CS majors until November 26, 2012. Contact mathadvising@illinois.edu if you have questions.

MATH 348  **Fundamental Mathematics-ACP**  credit: 4 hours.
Course is identical to MATH 347 except for the additional writing component. Credit is not given for both MATH 348 and MATH 347. Prerequisite: MATH 231 and completion of the campus Composition I general education requirement.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II
Advanced Composition

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
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Advanced Composition, and Quant Reasoning II course.

MATH 357  Numerical Methods I  credit: 3 hours.
Same as CS 357. See CS 357.

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Credit Hours: 3 hours

MATH 362  Probability with Engrg Applic  credit: 3 hours.
Same as ECE 313. See ECE 313.

<table>
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<th>Time</th>
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<tr>
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<td>Discussion/Recitation</td>
<td>C</td>
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<td>MWF</td>
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<td>Viswanath, P</td>
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| Credit Hours: 3 hours

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</table>
| Credit Hours: 3 hours

MATH 370  Actuarial Problem Solving  credit: 1 hours.
Methods and techniques of solving problems in actuarial mathematics for advanced students intending to enter the actuarial profession. Approved for S/U grading only. May be repeated in the same or separate terms to a maximum of 4 hours. Prerequisite: Consent of instructor.

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MATH 357  Numerical Methods I  credit: 3 hours.
Same as CS 357. See CS 357.

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<td>Hirani, A</td>
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Credit Hours: 3 hours

MATH 362  Probability with Engrg Applic  credit: 3 hours.
Same as ECE 313. See ECE 313.

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</table>
| Credit Hours: 3 hours
### MATH 390  **Individual Study**  credit: 0 TO 3 hours.
Guided individual study of advanced topics not covered in other courses. May be repeated to a maximum of 8 hours. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

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Instructor approval required.

### MATH 402  **Non Euclidean Geometry**  credit: 3 OR 4 hours.
Historical development of geometry; includes tacit assumptions made by Euclid; the discovery of non-Euclidean geometries; geometry as a mathematical structure; and an axiomatic development of plane geometry. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 241; MATH 347 or MATH 348, or equivalent; or consent of instructor.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
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<tr>
<th>CRN</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Quant Reasoning II course.
Restricted to NDEG:Grad Nondegree-CE/UIUC or NDEG:Undergrad Nondeg-CE/UIUC.
Online & Continuing Education (OCE) restrictions and assessments apply, see http://www.oce.illinois.edu. Enrollment in this course section is restricted to off-campus, non-degree seeking students. In addition, all students wishing to enroll need the instructor’s approval which will be based on a review of their preparation. Please e-mail Prof. George Francis at gfrancis@uiuc.edu to request approval. This course is not available to high school students. The prerequisites are Calculus III (vectors) and Math 347 or an equivalent course on mathematical discourse and proof. The course webpage for Math 402 can be viewed at: http://new.math.uiuc.edu/math402
Graduate - Urbana-Champaign OCE Tuition $380.00 per Bill Hour, Undergrad - Urbana-Champaign OCE Tuition $347.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 403  Euclidean Geometry  credit: 3 OR 4 hours.
Selected topics from geometry, including the nine-point circle, theorems of Cera and Menelaus, regular figures, isometries in the plane, ordered and affine geometries, and the inversive plane. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 241; MATH 347 or 348, or equivalent; or consent of instructor.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II
MATH 405  **Teacher's Course**  credit: 3 OR 4 hours.
In-depth, advanced perspective look at selected topics covered in the secondary curriculum. Connects mathematics learned at the university level to content introduced at the secondary level. Intended for students who plan to seek a secondary certificate in mathematics teaching. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 241; MATH 347 or MATH 348, or equivalent; or consent of instructor.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Restricted to mathematics majors admitted to the Secondary Education Minor. Contact advising@math.uiuc.edu for questions. Open to both undergraduate and graduate students. Restricted to Second School Teaching students.

<table>
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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Restricted to mathematics majors admitted to the Secondary Education Minor. Contact advising@math.uiuc.edu for questions.
Instructor approval forms available in 313 Altgeld Hall.

MATH 408  **Actuarial Statistics I**  credit: 4 hours.
Same as STAT 408. See STAT 408.

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</table>

MATH 410  **Lin Algebra & Financial Apps**  credit: 3 OR 4 hours.
Emphasizes techniques of linear algebra and introductory and advanced applications to actuarial science, finance and economics. Topics include linear equations, matrix theory, vector spaces, linear transformations, eigenvalues and eigenvectors and inner product spaces. In addition, current research topics such as modeling, data mining, and generalized linear models are explored. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both...
MATH 410 and any of MATH 125, MATH 225, MATH 415 or MATH 416. Prerequisite: MATH 241; MATH 210 or FIN 221; or consent of instructor.

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Credit Hours: 3 hours
Restricted to students majoring in Actuarial Science until November 26, 2012. Non-majors interested in this course may register on that date.

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<td>Varodayan, D</td>
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</table>

Credit Hours: 4 hours
Departmental Approval Required
Restricted to Actuarial Science majors.

MATH 412  **Graph Theory**  credit: 3 OR 4 hours.
Examines basic concepts and applications of graph theory, where graph refers to a set of vertices and edges that join some pairs of vertices; topics include subgraphs, connectivity, trees, cycles, vertex and edge coloring, planar graphs and their colorings. Draws applications from computer science, operations research, chemistry, the social sciences, and other branches of mathematics, but emphasis is placed on theoretical aspects of graphs. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience or CS 373.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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<td>Stolee, D</td>
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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 413  **Intro to Combinatorics**  credit: 3 OR 4 hours.
Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, and block designs. Same as CS 413. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience.

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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

**MATH 414 Mathematical Logic**  credit: 3 OR 4 hours.

Introduction to the formalization of mathematics and the study of axiomatic systems; expressive power of logical formulas; detailed treatment of propositional logical and predicate logic; compactness theorem and Godel completeness theorem, with applications to specific mathematical theories; algorithmic aspects of logical formulas. Proofs are emphasized in this course, which can serve as an introduction to abstract mathematics and rigorous proof; some ability to do mathematical reasoning required. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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<tbody>
<tr>
<td>37956</td>
<td>Lecture-Discussion</td>
<td>D14</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>141 - Altgeld Hall</td>
<td>Hieronymi, P</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

**MATH 415 Applied Linear Algebra**  credit: 3 OR 4 hours.

Introductory course emphasizing techniques of linear algebra with applications to engineering; topics include matrix operations, determinants, linear equations, vector spaces, linear transformations, eigenvalues, and eigenvectors, inner products and norms, orthogonality, equilibrium, and linear dynamical systems. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 415 and any of MATH 125, MATH 225, MATH 410, or MATH 416. Prerequisite: MATH 241 or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
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<tbody>
<tr>
<td>37957</td>
<td>Lecture-Discussion</td>
<td>A13</td>
<td>08:00 AM - 08:50 AM</td>
<td>MWF</td>
<td>245 - Altgeld Hall</td>
<td>Ma, X</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
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<th>Instructor</th>
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<tr>
<td>37960</td>
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<td>08:00 AM - 08:50 AM</td>
<td>MWF</td>
<td>245 - Altgeld Hall</td>
<td>Ma, X</td>
</tr>
</tbody>
</table>
**Credit Hours: 4 hours**
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>37967</td>
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<td>C13</td>
<td>10:00 AM - 10:50 AM</td>
<td>MWF</td>
<td>245 - Altgeld Hall</td>
<td>Ma, X</td>
</tr>
</tbody>
</table>

**Credit Hours: 3 hours**
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

<table>
<thead>
<tr>
<th>Course</th>
<th>Type</th>
<th>Section</th>
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<tr>
<td>37970</td>
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**Credit Hours: 4 hours**
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
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<td>40670</td>
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<td>EGR</td>
<td>ARRANGED</td>
<td>-</td>
<td>-</td>
<td>Carpenter, B</td>
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</table>

Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, or NDEG:Grad Nondegree-CE-UIUC.
Restricted to online non-degree, online MCS, online MSME and online MS CE students. An extra substantive project is required for students enrolling for 4 hours. Online & Continuing Education (OCE) restrictions and assessments apply, see [http://www.oce.illinois.edu](http://www.oce.illinois.edu). For more details on this course section, please see [http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings](http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings).
OCE Tuition $1000.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Location</th>
<th>Instructor</th>
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<tr>
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<td>F13</td>
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<td>MWF</td>
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<td>Kedem, R</td>
</tr>
</tbody>
</table>

**Credit Hours: 3 hours**
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

<table>
<thead>
<tr>
<th>Course</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>37983</td>
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<td>MWF</td>
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</tr>
</tbody>
</table>

**Credit Hours: 4 hours**
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Time</th>
<th>Days</th>
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<tbody>
<tr>
<td>56172</td>
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</tbody>
</table>

**Credit Hours: 3 hours**
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

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<tr>
<th>Course</th>
<th>Type</th>
<th>Section</th>
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<td>Kedem, R</td>
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<tr>
<td>CRN</td>
<td>Type</td>
<td>Section</td>
<td>Time</td>
<td>Days</td>
<td>Location</td>
<td>Instructor</td>
</tr>
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<td>37984</td>
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<td>03:00 PM - 03:50 PM</td>
<td>MWF</td>
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<td>Watts, J</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date. Uses Mathematica courseware. See [http://www.math.uiuc.edu/timetable/](http://www.math.uiuc.edu/timetable/) for details.

<table>
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<tr>
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<td>Lecture-Discussion</td>
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<td>03:00 PM - 03:50 PM</td>
<td>MWF</td>
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<td>Watts, J</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.

<table>
<thead>
<tr>
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<th>Section</th>
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<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>53682</td>
<td>Lecture-Discussion</td>
<td>M13</td>
<td>09:30 AM - 10:50 AM</td>
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<td>245 - Altgeld Hall</td>
<td>Kavruk, A</td>
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</tbody>
</table>

Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>53683</td>
<td>Lecture-Discussion</td>
<td>M14</td>
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<td>245 - Altgeld Hall</td>
<td>Kavruk, A</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Restricted to Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>11:00 AM - 12:20 PM</td>
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<td>245 - Altgeld Hall</td>
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</tbody>
</table>

Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

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<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
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<th>Instructor</th>
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<tr>
<td>37974</td>
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<td>11:00 AM - 12:20 PM</td>
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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<td>Haboush, W</td>
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</tbody>
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Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

<table>
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<tr>
<th>CRN</th>
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<th>Days</th>
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<th>Instructor</th>
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<tr>
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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Days</th>
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<tbody>
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<td>Kavruk, A</td>
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Credit Hours: 3 hours
Math 415 is restricted to majors specifically requiring this course until November 28, 2012. Other majors are welcome to add the course on this date.

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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>Kavruk, A</td>
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</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 416  Abstract Linear Algebra  credit: 3 OR 4 hours.
Rigorous proof-oriented course in linear algebra. Topics include determinants, vector spaces over fields, linear transformations, inner product spaces, eigenvectors and eigenvalues, Hermitian matrices, Jordan Normal Form. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 416 and either MATH 410 or MATH 415. Prerequisite: MATH 241 or consent of instructor; MATH 347 is recommended.

<table>
<thead>
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<th>CRN</th>
<th>Type</th>
<th>Section</th>
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<th>Location</th>
<th>Instructor</th>
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<tr>
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<td>09:00 AM - 09:50 AM</td>
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<td>345 - Altgeld Hall</td>
<td>Robinson, D</td>
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Credit Hours: 3 hours
Restricted to Mathematics major(s).
Open to both undergraduate and graduate students.

<table>
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<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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</tbody>
</table>

Credit Hours: 4 hours
Departmental Approval Required
Not intended for Graduate - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>54410</td>
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<td>D13</td>
<td>11:00 AM - 11:50 AM</td>
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Credit Hours: 3 hours
Restricted to Mathematics major(s).
Open to both undergraduate and graduate students.

<table>
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<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<th>Instructor</th>
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</table>

Credit Hours: 4 hours
Departmental Approval Required
Not intended for Graduate - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.
<table>
<thead>
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<th>CRN</th>
<th>Type</th>
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<th>Location</th>
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<tbody>
<tr>
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</tbody>
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Credit Hours: 3 hours  
Departmental Approval Required  
Not intended for Graduate - Urbana-Champaign.  
Honors section.

<table>
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<tr>
<th>CRN</th>
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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</tbody>
</table>

Credit Hours: 4 hours  
Departmental Approval Required  
Not intended for Graduate - Urbana-Champaign.  
Honors section.

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<tr>
<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>M13</td>
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<td>143 - Altgeld Hall</td>
<td>Dutta, S</td>
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</tbody>
</table>

Credit Hours: 3 hours  
Restricted to Mathematics major(s).  
Open to both undergraduate and graduate students.

<table>
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<tr>
<th>CRN</th>
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<tbody>
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</tbody>
</table>

Credit Hours: 4 hours  
Departmental Approval Required  
Not intended for Graduate - Urbana-Champaign.  
Instructor approval forms available in 313 Altgeld Hall.

**MATH 417 Intro to Abstract Algebra**  
credit: 3 OR 4 hours.

Prerequisite: Either MATH 416 or one of MATH 410, MATH 415 together with one of MATH 347, MATH 348, CS 373; or consent of instructor.

This course satisfies the General Education Criteria for a:  
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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Credit Hours: 3 hours  
Quant Reasoning II course.

<table>
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<th>Section</th>
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<th>Location</th>
<th>Instructor</th>
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<td>Lerman, E</td>
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</tbody>
</table>

Credit Hours: 4 hours  
Quant Reasoning II course.  
Departmental Approval Required  
Not intended for Graduate - Urbana-Champaign.  
Instructor approval forms available in 313 Altgeld Hall.
### MATH 425  **Honors Advanced Analysis**  credit: 3 hours.
A theoretical treatment of differential and integral calculus in higher dimensions. Topics include inverse and implicit function theorems, submanifolds, the theorems of Green, Gauss and Stokes, differential forms, and applications. As part of the honors sequence, this course will be rigorous and abstract. No graduate credit. Approved for honors grading. Prerequisite: MATH 424 and either MATH 415 or MATH 416, and consent of the department.

<table>
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<tr>
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<td>140 - Henry Administration Bldg</td>
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</table>

### MATH 428  **Honors Topics in Mathematics**  credit: 3 hours.
A capstone course in the Mathematics Honors Sequences. Topics will vary. As part of the honors sequence, this course will be rigorous and abstract. No graduate credit. Approved for honors grading. May be repeated in the same or separate terms to a maximum of 12 hours. Prerequisite: Consent of the department.

<table>
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<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>48286</td>
<td>Lecture-Discussion</td>
<td>G</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>147 - Altgeld Hall</td>
<td>D'Angelo, J</td>
</tr>
</tbody>
</table>

Topic: A Capstone Course in Analysis. We will discuss Fourier series, Hilbert spaces, Fourier transforms, and geometric inequalities. The course will weave together much of undergraduate analysis into a coherent whole. Students in Math, Physics, and Engineering
are all welcome. Prerequisites: Real analysis (447, 424 or equivalent), Linear Algebra (415 or 416). Some familiarity with ordinary
differential equations and complex variables is useful but not required.

MATH 432  **Set Theory and Topology**  credit: 3 OR 4 hours.
Informal set theory, cardinal and ordinal numbers, and the axiom of choice; topology of metric spaces and introduction to general
topological spaces. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance.
Prerequisite: MATH 347 or MATH 348 or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>47169</td>
<td>Lecture-Discussion</td>
<td>X13</td>
<td>12:00 PM - 12:50 PM</td>
<td>MWF</td>
<td>140 - Henry Administration Bldg</td>
<td>Solecki, S</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>47170</td>
<td>Lecture-Discussion</td>
<td>X14</td>
<td>12:00 PM - 12:50 PM</td>
<td>MWF</td>
<td>140 - Henry Administration Bldg</td>
<td>Solecki, S</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Departmental Approval Required

MATH 439  **Philosophy of Mathematics**  credit: 3 OR 4 hours.
Same as PHIL 439. See PHIL 439.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>40541</td>
<td>Lecture-Discussion</td>
<td>G</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>1051 - Lincoln Hall</td>
<td>Arana, A</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<td>Lee, S</td>
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</tbody>
</table>

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.
Graduate Section

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>UG</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>1051 - Lincoln Hall</td>
<td>Arana, A</td>
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<td></td>
<td></td>
<td>Lee, S</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.
Undergraduate Section

MATH 441  **Differential Equations**  credit: 3 OR 4 hours.
Basic course in ordinary differential equations; topics include existence and uniqueness of solutions and the general theory of linear
differential equations; treatment is more rigorous than that given in MATH 285. 4 hours of credit requires approval of the instructor
and completion of additional work of substance. Credit is not given for both MATH 441 and any of MATH 284, MATH 285, MATH 286.
Prerequisite: MATH 241. Recommended: MATH 347 or MATH 348.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>57915</td>
<td>Lecture-Discussion</td>
<td>D13</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>345 - Altgeld Hall</td>
<td>La Nave, G</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Math 441 is restricted to majors requiring this course until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>57920</td>
<td>D14</td>
<td>La Nave, G</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>345 - Altgeld Hall</td>
<td>4 hours</td>
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</tbody>
</table>

Credit Hours: 4 hours
Departmental Approval Required
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>39478</td>
<td>G13</td>
<td>Palmore, J</td>
<td>03:00 PM - 03:50 PM</td>
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<td>443 - Altgeld Hall</td>
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</tbody>
</table>

Credit Hours: 3 hours
Math 441 is restricted to majors requiring this course until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
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<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>39479</td>
<td>G14</td>
<td>Palmore, J</td>
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<td>MWF</td>
<td>443 - Altgeld Hall</td>
<td>4 hours</td>
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</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>54416</td>
<td>M13</td>
<td>Hur, M</td>
<td>09:30 AM - 10:50 AM</td>
<td>TR</td>
<td>1 - Illini Hall</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Math 441 is restricted to majors requiring this course until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
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<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>54417</td>
<td>M14</td>
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<td>09:30 AM - 10:50 AM</td>
<td>TR</td>
<td>1 - Illini Hall</td>
<td>4 hours</td>
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</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>38014</td>
<td>X13</td>
<td>Manfroi, A</td>
<td>12:00 PM - 12:50 PM</td>
<td>MWF</td>
<td>345 - Altgeld Hall</td>
<td>3 hours</td>
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</tbody>
</table>

Credit Hours: 3 hours
Math 441 is restricted to majors requiring this course until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Lecture-Discussion</th>
<th>Instructor</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>38016</td>
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<td>Manfroi, A</td>
<td>12:00 PM - 12:50 PM</td>
<td>MWF</td>
<td>345 - Altgeld Hall</td>
<td>4 hours</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

MATH 442  Intro Partial Diff Equations  credit: 3 OR 4 hours.
Introduces partial differential equations, emphasizing the wave, diffusion and potential (Laplace) equations. Focuses on understanding the physical meaning and mathematical properties of solutions of partial differential equations. Includes fundamental solutions and transform methods for problems on the line, as well as separation of variables using orthogonal series for problems in regions with
boundary. Covers convergence of Fourier series in detail. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: One of MATH 284, MATH 285, MATH 286, MATH 441.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38018</td>
<td>Lecture-Discussion</td>
<td>B13</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>445 - Altgeld Hall</td>
<td>Zharnitsky, V</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Math 442 is restricted to majors requiring this course until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38019</td>
<td>Lecture-Discussion</td>
<td>B14</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>445 - Altgeld Hall</td>
<td>Zharnitsky, V</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Restricted to Engineering Mechanics or Mathematics major(s). Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 444  Elementary Real Analysis  credit: 3 OR 4 hours.
Careful treatment of the theoretical aspects of the calculus of functions of a real variable; topics include the real number system, limits, continuity, derivatives, and the Riemann integral. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 444 and MATH 447. Prerequisite: MATH 241; MATH 347 or MATH 348, or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>58909</td>
<td>Lecture-Discussion</td>
<td>G13</td>
<td>03:00 PM - 03:50 PM</td>
<td>MWF</td>
<td>143 - Altgeld Hall</td>
<td>Nikolaev, I</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Quant Reasoning II course.
Math 444 is restricted to Mathematics and Math & Computer Science majors until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>58910</td>
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<td>G14</td>
<td>03:00 PM - 03:50 PM</td>
<td>MWF</td>
<td>143 - Altgeld Hall</td>
<td>Nikolaev, I</td>
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</tbody>
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Credit Hours: 4 hours
Quant Reasoning II course.
Departmental Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
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<tbody>
<tr>
<td>38021</td>
<td>Lecture-Discussion</td>
<td>P13</td>
<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>341 - Altgeld Hall</td>
<td>Hinkkanen, A</td>
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</tbody>
</table>

Credit Hours: 3 hours
Quant Reasoning II course.
Math 444 is restricted to Mathematics and Math & Computer Science majors until November 26, 2012. Other students are welcome to add the course on that date.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38022</td>
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<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>341 - Altgeld Hall</td>
<td>Hinkkanen, A</td>
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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 446  **Applied Complex Variables**  credit: 3 OR 4 hours.

For students who desire a working knowledge of complex variables; covers the standard topics and gives an introduction to integration by residues, the argument principle, conformal maps, and potential fields. Students desiring a systematic development of the foundations of the subject should take MATH 448. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 446 and MATH 448. Prerequisite: MATH 241.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>53611</td>
<td>Online</td>
<td>EGR</td>
<td>ARRANGED -</td>
<td>-</td>
<td>-</td>
<td>Peressini, A</td>
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</table>

Credit Hours: 4 hours
Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, or NDEG:Grad Nondegree-CE-UIUC.
Restricted to online non-degree, online MCS, online MSME and online MS CE students. Online & Continuing Education (OCE) restrictions and assessments apply, see [http://www.oce.illinois.edu](http://www.oce.illinois.edu). For more details on this course section, please see [http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings](http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings)
OCE Tuition $1000.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

<table>
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<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>58520</td>
<td>Lecture-Discussion</td>
<td>F13</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>143 - Altgeld Hall</td>
<td>Rosenblatt, J</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Open to both undergraduate and graduate students.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>Lecture-Discussion</td>
<td>F14</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>143 - Altgeld Hall</td>
<td>Rosenblatt, J</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Departmental Approval Required
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

MATH 447  **Real Variables**  credit: 3 OR 4 hours.

Careful development of elementary real analysis including such topics as completeness property of the real number system; basic topological properties of n-dimensional space; convergence of numerical sequences and series of functions; properties of continuous functions; and basic theorems concerning differentiation and Riemann integration. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 447 and MATH 444. Prerequisite: MATH 241 or equivalent; junior standing; MATH 347 or MATH 348, or equivalent experience; or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38030</td>
<td>Lecture-Discussion</td>
<td>C13</td>
<td>10:00 AM - 10:50 AM</td>
<td>MWF</td>
<td>143 - Henry Administration Bldg</td>
<td>D'Angelo, J</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Open to both undergraduate and graduate students.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
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<tbody>
<tr>
<td>38031</td>
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<td>C14</td>
<td>10:00 AM - 10:50 AM</td>
<td>MWF</td>
<td>143 - Henry Administration Bldg</td>
<td>D'Angelo, J</td>
</tr>
</tbody>
</table>
Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall beginning on the first day of Spring semester.

MATH 448  Complex Variables  credit: 3 OR 4 hours.
For students who desire a rigorous introduction to the theory of functions of a complex variable; topics include Cauchy's theorem, the residue theorem, the maximum modulus theorem, Laurent series, the fundamental theorem of algebra, and the argument principle. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 448 and MATH 446. Prerequisite: MATH 447.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
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<tbody>
<tr>
<td>38033</td>
<td>Lecture-Discussion</td>
<td>P13</td>
<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>441 - Altgeld Hall</td>
<td>Tumanov, A</td>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>TR</td>
<td>441 - Altgeld Hall</td>
<td>Tumanov, A</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 450  Numerical Analysis  credit: 3 OR 4 hours.
Same as CS 450, CSE 401 and ECE 491. See CS 450.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>31440</td>
<td>Lecture-Discussion</td>
<td>B3</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>1310 - Digital Computer Laboratory</td>
<td>Hirani, A</td>
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</table>

Credit Hours: 3 hours

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>31443</td>
<td>Lecture-Discussion</td>
<td>B4</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>1310 - Digital Computer Laboratory</td>
<td>Hirani, A</td>
</tr>
</tbody>
</table>

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

MATH 453  Elementary Theory of Numbers  credit: 3 OR 4 hours.
Basic introduction to the theory of numbers. Core topics include divisibility, primes and factorization, congruences, arithmetic functions, quadratic residues and quadratic reciprocity, primitive roots and orders. Additional topics covered at the discretion of the instructor include sums of squares, Diophantine equations, continued fractions, Farey fractions, recurrences, and applications to primality testing and cryptography. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 241 or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II
<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>38037</td>
<td>Lecture-Discussion</td>
<td>D13</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>341 - Altgeld Hall</td>
<td>Reznick, B</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

<table>
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<th>Type</th>
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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
<thead>
<tr>
<th>CRN</th>
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</table>

Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

<table>
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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 461  **Probability Theory**  credit: 3 OR 4 hours.

Introduction to mathematical probability; includes the calculus of probability, combinatorial analysis, random variables, expectation, distribution functions, moment-generating functions, and central limit theorem. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Credit is not given for both MATH 461 and either MATH 408 or ECE 313.

Prerequisite: MATH 241 or equivalent.

<table>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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<th>CRN</th>
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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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<th>CRN</th>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

Credit Hours: 3 hours
Open to both undergraduate and graduate students.

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, or NDEG:Grad Nondegree-CE-UIUC.
Restricted to online non-degree, online MCS, online MSME and online MS CE students. An extra substantive project is required for students enrolling for 4 hours. Online & Continuing Education (OCE) restrictions and assessments apply, see http://www.oce.illinois.edu. For more details on this course section, please see http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings.
OCE Tuition $1000.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.

Restricted to MS: Civil Engr - Online - UIUC, MCS:Computer Sci Online -UIUC, MS:Mechanical Engineering -UIUC, or NDEG:Grad Nondegree-CE-UIUC.
Restricted to online non-degree, online MCS, online MSME and online MS CE students. An extra substantive project is required for students enrolling for 4 hours. Online & Continuing Education (OCE) restrictions and assessments apply, see http://www.oce.illinois.edu. For more details on this course section, please see http://online.engineering.illinois.edu/current-students/course-information/spring-2013-credit-course-offerings.
OCE Tuition $1000.00 per Bill Hour, and OCE Fees $50.00 per Bill Hour.
MATH 463  Statistics and Probability I  credit: 4 hours.
Same as STAT 400. See STAT 400.

<table>
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MATH 464  **Statistics and Probability II**  credit: 3 OR 4 hours.
Same as STAT 410. See STAT 410.

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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<tr>
<th>CRN</th>
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</table>

Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.

MATH 465  **Analysis of Variance**  credit: 3 OR 4 hours.
Same as STAT 424. See STAT 424.

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.

MATH 469  **Methods of Applied Statistics**  credit: 3 OR 4 hours.
Same as STAT 420. See STAT 420.

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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Credit Hours: 3 hours
MATH 472  **Actuarial Theory II**  credit: 3 OR 4 hours.
Continuation of MATH 471. Emphasis is on multiple-life functions. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 471.

<table>
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<tr>
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Credit Hours: 3 hours

MATH 473  **Fundamental Algorithms**  credit: 0 TO 4 hours.
Same as CS 473 and CSE 414. See CS 473.

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Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.
This section is for UNDERGRADUATE students.

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Credit Hours: 3 hours

MATH 478  **Actuarial Modeling** credit: 3 OR 4 hours.
Considers the specification and evaluation of various types of actuarial models. Examines severity, frequency, and compound distributions useful in modeling the insurance loss process. Credibility theory is also discussed. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: MATH 408, MATH 461 or MATH 463; credit or concurrent registration in MATH 409 or MATH 464.

<table>
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<tr>
<th>CRN</th>
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Credit Hours: 3 hours

MATH 482  **Linear Programming** credit: 3 OR 4 hours.
Rigorous introduction to a wide range of topics in optimization, including a thorough treatment of basic ideas of linear programming, with additional topics drawn from numerical considerations, linear complementarity, integer programming and networks, polyhedral methods. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 410, MATH 415, or MATH 416.

<table>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

<table>
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<th>CRN</th>
<th>Type</th>
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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 487  **Advanced Engineering Math** credit: 3 OR 4 hours.
Complex linear algebra, inner product spaces, Fourier transforms and analysis of boundary value problems, Sturm-Liouville theory. Same as ECE 493. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: One of MATH 284, MATH 285, MATH 286, MATH 441.

<table>
<thead>
<tr>
<th>CRN</th>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.
MATH 488  Math Methods In Engineering  credit: 3 OR 4 hours.
Matrices, determinants, bounds and approximations to eigenvalues, introduction to linear operator theory and inner product spaces, orthogonal expansions, and Fourier transforms. 4 hours of credit requires approval of the instructor and department with completion of additional work of substance. Prerequisite: MATH 241 or equivalent.

MATH 489  Dynamics & Differential Eqns  credit: 3 OR 4 hours.
Studies mathematical theory of dynamical systems, emphasizing both discrete-time dynamics and nonlinear systems of differential equations. Topics include: chaos, fractals, attractors, bifurcations, with application to areas such as population biology, fluid dynamics and classical physics. Basic knowledge of matrix theory will be assumed. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: One of MATH 284, MATH 285, MATH 286, MATH 441.

MATH 490  Advanced Topics in Mathematics  credit: 1 TO 4 hours.
Deals with selected topics and applications of mathematics; see Class Schedule or department office for current topics. May be repeated with approval. Prerequisite: Consent of instructor.
MATH 493  **Statistical Computing**  credit: 3 OR 4 hours.
Same as STAT 428. See STAT 428.

<table>
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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>36197</td>
<td>Lecture-Discussion</td>
<td>M1U</td>
<td>01:00 PM - 01:50 PM</td>
<td>MWF</td>
<td>253 - Mechanical Engineering Bldg</td>
<td>Zhong, W</td>
</tr>
</tbody>
</table>

Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.

MATH 496  **Honors Seminar**  credit: 3 hours.
Careful study of a selected area of mathematics, carried out either deductively from axioms or inductively through problems; subject matter varies with instructor. No graduate credit. May be repeated to a maximum of 6 hours. Prerequisite: Consent of Mathematics Honors Committee.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>40657</td>
<td>Lecture-Discussion</td>
<td>F1H</td>
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<td>MWF</td>
<td>243 - Altgeld Hall</td>
<td>Reznick, B</td>
</tr>
</tbody>
</table>

MATH 499  **Introduction Graduate Research**  credit: 1 hours.
Seminar is required of all first-year graduate students in Mathematics. It provides a general introduction to the courses and research work in all of the areas of mathematics that are represented at the University of Illinois at Urbana-Champaign. Approved for S/U grading only. May be repeated to a maximum of 2 hours. Prerequisite: Graduate standing or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
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<td>38152</td>
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<td>H1</td>
<td>04:00 PM - 04:50 PM</td>
<td>W</td>
<td>245 - Altgeld Hall</td>
<td>Laugesen, R</td>
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</tbody>
</table>

MATH 501  **Abstract Algebra II**  credit: 4 hours.

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<th>Days</th>
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</table>
MATH 511  **Algebraic Geometry**  credit: 4 hours.
Properties of affine and projective varieties defined over algebraically closed fields; rational mappings, birational geometry and divisors, especially on curves and surfaces; introduction to the language of schemes; and Riemann-Roch theorem for curves. Prerequisite: MATH 501.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
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<tr>
<td>38163</td>
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<td>P1</td>
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<td>1057 - Lincoln Hall</td>
<td>Katz, S</td>
</tr>
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</table>

MATH 519  **Differentiable Manifolds II**  credit: 4 hours.
Vector bundles, principal bundles, connections, parallel transport, curvature, Chern-Weyl theory, Hodge-DeRham theory. Other topics may include Riemannian geometry, symplectic geometry, spin geometry, and harmonic maps. Prerequisite: MATH 518 or consent of instructor.

<table>
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<tr>
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<th>Time</th>
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<th>Instructor</th>
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<tr>
<td>49968</td>
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<td>TR</td>
<td>445 - Altgeld Hall</td>
<td>Kerman, E</td>
</tr>
</tbody>
</table>

MATH 525  **Topology**  credit: 4 hours.
Winding numbers, singular and de Rahm homology and cohomology in dimension zero and one, fixed point theorems, Jordan curve theorem, covering spaces, fundamental groups, classification of surfaces, van Kampen Theorem, singular homology, Eilenberg-Steenrod axioms, homology groups of surfaces. Prerequisite: MATH 417 and MATH 448 or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<tr>
<td>56588</td>
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<td>M1</td>
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<td>TR</td>
<td>441 - Altgeld Hall</td>
<td>Albin, P</td>
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</tbody>
</table>

MATH 527  **Homotopy Theory**  credit: 4 hours.
Homotopy groups, fibrations and cofibrations, Hurewicz theorem, obstruction theory, Whitehead theorem and additional topics perhaps drawn from Postnikov towers, Freudenthal suspension theorem, Blakers-Massey theorem, spectra. Prerequisite: MATH 526. MATH 501 is recommended but not required.

<table>
<thead>
<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
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<th>Instructor</th>
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<td>Lecture-Discussion</td>
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<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>345 - Altgeld Hall</td>
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</table>

MATH 530  **Algebraic Number Theory**  credit: 4 hours.
Further development of the theory of fields covering topics from valuation theory, ideal theory, units in algebraic number fields, ramification, function fields, and local class field theory. Prerequisite: MATH 500 or equivalent.
MATH 540  **Real Analysis**  credit: 4 hours.
Lebesgue measure on the real line; integration and differentiation of real valued functions of a real variable; and additional topics at discretion of instructor. Prerequisite: MATH 447 or equivalent.

MATH 541  **Functional Analysis**  credit: 4 hours.
Fundamental results in functional analysis; spectral theory of compact operators; further topics chosen by the instructor. Prerequisite: MATH 540.

MATH 542  **Complex Variables I**  credit: 4 hours.
Topics include the Cauchy theory, harmonic functions, entire and meromorphic functions, and the Riemann mapping theorem. Prerequisite: MATH 446 and MATH 447, or MATH 448.

MATH 551  **Dynamical Systems II**  credit: 4 hours.
A second course in the study of dynamical systems. Students who intend to do research in nonlinear dynamics are encouraged to take this course. A specific selection will be chosen from the following list to illustrate the theory and use of techniques from global analysis and nonlinear dynamics: (1) discrete dynamical systems, (2) global theory of ordinary differential equations, (3) Hamiltonian systems, (4) KAM theory, (5) bifurcation and stability, (6) Hopf index theory of vector fields, (7) Morse theory of gradient vector fields, (8) Lyapunov theory, (9) infinite dimensional dynamical systems, (10) structural stability. Prerequisite: Consent of instructor.

MATH 552  **Numerical Methods for PDEs**  credit: 4 hours.
Same as CS 555 and CSE 510. See CS 555.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<tr>
<td>50119</td>
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<td>N</td>
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<td>1105 - Siebel Center for Comp Sci</td>
<td>Olson, L</td>
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</table>

Credit Hours: 4 hours

**MATH 553  Partial Differential Equations  credit: 4 hours.**

Basic introduction to the study of partial differential equations; topics include: the Cauchy problem, power-series methods, characteristics, classification, canonical forms, well-posed problems, Riemann's method for hyperbolic equations, the Goursat problem, the wave equation, Sturm-Liouville problems and separation of variables, Fourier series, the heat equation, integral transforms, Laplace's equation, harmonic functions, potential theory, the Dirichlet and Neumann problems, and Green's functions. Prerequisite: Consent of instructor.

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<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>39528</td>
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<td>X1</td>
<td>12:00 PM - 12:50 PM</td>
<td>MWF</td>
<td>443 - Altgeld Hall</td>
<td>Tzirakis, N</td>
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</tbody>
</table>

**MATH 555  Nonlinear Anal & Part Diff Eq  credit: 4 hours.**

Course will provide students with the basic background in nonlinear analysis associated with partial differential equations. The specific topics chosen will be largely up to the instructor, but will cover such areas as existence and uniqueness techniques, nonexistence and finite time blow-up results, hyperbolic conservation laws, weak solutions, stability theory, nonlinear elliptic theory, regularity theory. May be repeated as topics vary. Prerequisite: Consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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<tr>
<td>38196</td>
<td>Lecture-Discussion</td>
<td>P1</td>
<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>143 - Altgeld Hall</td>
<td>Hur, M</td>
</tr>
</tbody>
</table>

**MATH 561  Theory of Probability I  credit: 4 hours.**

Mathematical foundations of probability and stochastic processes; probability measures, random variables, distribution functions, convergence theory, the Central Limit Theorem, conditional expectation, and martingale theory. Same as STAT 551. Prerequisite: MATH 541 or consent of instructor.

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<tr>
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<td>MWF</td>
<td>141 - Altgeld Hall</td>
<td>Kirkpatrick, K</td>
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</table>

**MATH 567  Topics in Actuarial Theory I  credit: 4 hours.**

Selected topics in advanced actuarial science. May be repeated to a maximum of 16 hours. Prerequisite: Consent of instructor.

<table>
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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<th>Location</th>
<th>Instructor</th>
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<td>03:00 PM - 04:20 PM</td>
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</tr>
</tbody>
</table>
MATH 568  **Topics in Actuarial Theory II**  credit: 4 hours.

Topics in mathematical theory of actuarial science beyond basic life contingencies, such as graduation of mortality tables, survival models, mathematics of demography. See Class Schedule or department office for current topics. A paper will generally be required. May be repeated to a maximum of 16 hours. Prerequisite: STAT 409 or STAT 410 or equivalent; credit or concurrent registration in MATH 471.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
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<th>Instructor</th>
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<tr>
<td>38193</td>
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<td>213 - Gregory Hall</td>
<td>Gorvett, R</td>
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</table>

MATH 571  **Model Theory**  credit: 4 hours.

Techniques for constructing models, including compactness and Lowenheim-Skolem theorems, unions of elementary chains, and omitting types construction; categorical theories; ultraproducts; saturated models; quantifier elimination; applications to algebraically closed fields, real closed fields, and other fundamental structures of mathematics. Prerequisite: MATH 570 or consent of instructor.

<table>
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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>445 - Altgeld Hall</td>
<td>Van Den Dries, L</td>
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</table>

MATH 573  **Recursive Function Theory**  credit: 4 hours.

Various characterizations of the class of recursive (i.e., computable) functions; the Church-Turing thesis; unsolvability of the halting problem; the recursion theorem and the enumeration theorem; relative computability, the jump operation, and the arithmetical hierarchy; recursively enumerable sets; degrees of unsolvability; and the priority method. Prerequisite: MATH 570 or consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tr>
<td>43398</td>
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<td>F1</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>343 - Altgeld Hall</td>
<td>Solecki, S</td>
</tr>
</tbody>
</table>

MATH 581  **Extremal Graph Theory**  credit: 4 hours.

Extremal problems and parameters for graphs. Distance and connectivity, matching and factors, vertex and edge colorings, perfect and imperfect graphs, intersection classes and intersection parameters, Turan's theorem, graph Ramsey theory, graph decomposition and other extremal problems. Same as CS 572. Prerequisite: MATH 580 or consent of instructor.

<table>
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<tr>
<th>CRN</th>
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<th>Days</th>
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<tr>
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<td>MWF</td>
<td>147 - Altgeld Hall</td>
<td>Kostochka, A</td>
</tr>
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</table>

MATH 584  **Methods of Combinatorics**  credit: 4 hours.

Combinatorial methods and other mathematical methods for combinatorial problems. Enumeration by bijections and generating functions, probabilistic methods for existence proofs and asymptotic analysis, randomized algorithms, Ramsey's theorem and related topics, combinatorial designs and their applications, geometric problems and methods. Same as CS 575. Prerequisite: MATH 580 or consent of instructor.
<table>
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<tr>
<th>CRN</th>
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<tr>
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<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>143 - Henry Administration Bldg</td>
<td>Balog, J</td>
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**MATH 595**  **Advanced Topics in Math**  credit: 1 TO 4 hours.
May be repeated in the same or separate semesters. Prerequisite: Consent of instructor.

<table>
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Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.

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Not intended for Undergrad - Urbana-Champaign.

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Credit Hours: 2 hours
Not intended for Undergrad - Urbana-Champaign.

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Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.

<table>
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Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.

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Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.

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Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.

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<th>Days</th>
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<tr>
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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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<tr>
<td>58450</td>
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<td>MWF</td>
<td>443 - Altgeld Hall</td>
<td>Kostochka, A</td>
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</tbody>
</table>

Credit Hours: 4 hours
Not intended for Undergrad - Urbana-Champaign.
Topic: Selected Topics in Graph Theory. See http://www.math.uiuc.edu/timetable/ for the full course description.

MATH 597  Reading Course  credit: 1 TO 8 hours.
Approved for both letter and S/U grading. May be repeated in the same or separate terms to a maximum of 8 hours. Prerequisite: Consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>10556</td>
<td>Independent Study</td>
<td>ARRANGED -</td>
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Instructor approval required.

MATH 598  Literature Seminar in Math  credit: 0 TO 4 hours.
Seminar on topics of current interest in mathematics. Students present seminars and discussions on various topics. See Class Schedule for current topics. Recommended for all Mathematics students. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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Credit Hours: 2 hours
Not intended for Undergrad - Urbana-Champaign.

<table>
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<th>Type</th>
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<tbody>
<tr>
<td>59706</td>
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<td>VNA</td>
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<td>241 - Altgeld Hall</td>
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Credit Hours: 1 hours

MATH 599  Thesis Research  credit: 0 TO 16 hours.
May be repeated. Approved for S/U grading only. Prerequisite: Consent of instructor.
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Instructor approval required.