**COURSE NAME AND NUMBER:**
Math 302-3 Mathematical Communication and the Transition to Higher Mathematics

**Prerequisite:** 221 (Linear Algebra) and 250 (Calculus II) with grades of C or better.

**Course Description:** A course in communicating mathematical ideas with a special emphasis on reading, writing, and critiquing mathematical proofs. Topics include logic, proofs, set theory, relations, functions. Additional illustratory topics will be drawn from linear algebra, number theory, complex variables, and geometry. Prerequisite: 221 and 250 with grades of C or better.

**Course Objectives:**
The emphasis is on writing and presenting proofs. Upon completion of this course, the student should be able to:

- Determine the truth value of a proposition using truth tables.
- Construct proofs involving quantifiers, negations and logical connectives, using appropriate proof techniques (direct proof, proof by contradiction, contrapositive, inductive, etc.).
- Perform basic set operations, including extended set operations on indexed families of sets.
- Apply appropriate counting principles to finite sets.
- Recognize whether or not a given relation is an equivalence relation, order relation, function.
- Construct the partition determined by an equivalence relation and conversely.
- Construct the graph of a relation.
- Construct new functions from old by various techniques.
- Determine whether or not a given function is injective, surjective, bijective.
- Demonstrate an understanding of equivalent sets and a rudimentary knowledge of cardinality.
- Present correct proofs in writing and orally.
- Critique proofs, recognizing flaws in the logic and offering corrections as needed.


You can probably purchase a 1st or 2nd edition very inexpensively through your favorite source for new and used texts. I will plan to write out all the homework problems in full and post them to D2L so having
an old edition should work for you. Chapter and Section numbers MIGHT be different, but you should easily be able to figure out where we are.

**TOPICS/SECTIONS/DAYS:**
The plan is to cover the following material from the text.

The most important objective is for the student to develop the habit of careful and axiomatic thinking and the skill of careful and logically correct proof-writing.

Times devoted to each segment are approximate.

<table>
<thead>
<tr>
<th>Chapter 0 Communicating Mathematics</th>
<th>reading assignment</th>
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<td>1.5 – Partitions of Sets</td>
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<td>1.6 – Cartesian Products of Sets</td>
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<tr>
<td><strong>Chapter 2 Logic</strong></td>
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<td>2.2 – The Negation of a Statement</td>
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<td>2.3 – The Disjunction and Conjunction of Statements</td>
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<td>2.5 – More on Implications</td>
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<td>2.6 – The Biconditional</td>
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<td>2.7 – Tautologies and Contradictions</td>
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<td>2.8 – Logical Equivalence</td>
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<td>2.9 – Some Fundamental Properties of Logical Equivalence</td>
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<tr>
<td>2.10 – Quantified Statements</td>
<td>5 days</td>
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<td>2.11 – Characterizations of Statements (OMIT)</td>
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<tr>
<td><strong>Chapter 3 Direct Proof and Proof by Contrapositive</strong></td>
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<td>3.1 – Trivial and Vacuous Proofs</td>
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<td>3.3 – Proof by Contrapositive</td>
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<td>3.4 – Proof by Cases</td>
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<td>3.5 – Proof Evaluations (READING ASSIGNMENT)</td>
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<td><strong>Chapter 4 More on Direct Proof and Proof by Contrapositive</strong></td>
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<td>4.1 – Proofs Involving Divisibility of Integers</td>
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<td>4.2 – Proofs Involving Congruence of Integers</td>
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<td>4.3 – Proofs Involving Real Numbers</td>
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<td>4.4 – Proofs Involving Sets</td>
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<tr>
<td>4.5 – Fundamental Properties of Set Operations</td>
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<tr>
<td>4.6 – Proofs Involving Cartesian Products of Sets</td>
<td>3 days</td>
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</tbody>
</table>
Chapter 5 Existence and Proof by Contradiction
5.1 – Counterexamples
5.2 – Proof by Contradiction
5.3 – A Review of Three Proof Techniques
5.4 – Existence Proofs
5.5 – Disproving Existence Statements 3 days

Chapter 6 Mathematical Induction
6.1 – The Principle of Mathematical Induction
6.2 – A More General Principle of Mathematical Induction
6.3 – Proof by Minimum Counterexample
6.4 – The Strong Principle of Mathematical Induction 3 days

Chapter 7 Prove or Disprove (READING ASSIGNMENT)
7.1 – Conjectures in Mathematics
7.2 – Revisiting Quantified Statements
7.3 – Testing Statements

Chapter 8 Equivalence Relations
8.1 – Relations
8.2 – Properties of Relations
8.3 – Equivalence Relations
8.4 – Properties of Equivalence Classes
8.5 – Congruence Modulo \( n \)
8.6 – The Integers Modulo \( n \) 5 days

Chapter 9 Functions
9.1 – The Definition of Function
9.2 – The Set of All Functions from \( A \) to \( B \)
9.3 – One-to-One and Onto Functions
9.4 – Bijective Functions
9.5 – Composition of Functions
9.6 – Inverse Functions
9.7 – Permutations 5 days

Chapter 10 Cardinalities of Sets
10.1 – Numerically Equivalent Sets
10.2 – Denumerable Sets
10.3 – Uncountable Sets
10.4 – Comparing Cardinalities of Sets (May be omitted)
10.5 – The Schroeder-Bernstein Theorem (May be omitted) 3 days

Chapter 11 Proofs in Number Theory
11.1 – Divisibility Properties of Integers
11.2 – The Division Algorithm
11.3 – Greatest Common Divisors
11.4 – The Euclidean Algorithm
11.5 – Relatively Prime Integers
Grading
Your grade will be based on two class tests (50 minutes each) a two-hour, cumulative final exam, and homework.

Your total points will come from:
- 200 points (final exam),
- 200 points for class tests (100 points for each of two class tests) and
- 100 points for homework.
Total: 500 points

It should not be necessary to remind you that attendance affects your grade. More than three absences, EXCUSED OR OTHERWISE, throughout the semester will result in a reduced grade. If \( m \) is the actual number of class meetings and \( p \) is the number of classes you are present, arriving on time and not leaving early, and if \( p < m - 3 \), your point total will be multiplied by \( \frac{p}{m-3} \).

The grading scale will be the standard scale:
- A: 90% and up
- B: 80% to 89%
- C: 70% to 79%
- D: 60% to 69%
- F: 0 to 59%

INCOMPLETE POLICY (Undergraduate only)
An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or graduation, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of F and the grade will be computed in the student’s grade point average. For more information please visit: http://registrar.siu.edu/grades/incomplete.html

Homework
- Homework will be assigned regularly and collected weekly.
- Submit your homework at the beginning of class.
- Late homework is not accepted.
- Please mark your name clearly. Writing your name on all sheets is a wise idea.
- Please staple your pages together.
- Please do not turn in sheets with frayed and crumpled edges.
- Show ALL your work! Both the quality and the correctness of the mathematical writing are important.
- Your work must be your own. In an academic setting, there is absolutely no tolerance for plagiarism. Submitting someone else’s work as your own is grounds for an F in the course, and possibly more severe academic action.
**Class tests**
Class tests will be announced at least one week in advance. Tentatively they are scheduled for
- the week of Sept. 21 and

**Final examination**
The final exam will be cumulative. The date and time are determined by the University. According to the Examination Schedule posted at [http://registrar.siu.edu/pdf/examfall15.pdf](http://registrar.siu.edu/pdf/examfall15.pdf), since our class meets at 3:00 pm on MWF, our exam is scheduled for

**Friday December 18th, 2015, 2:45-4:45 PM**

**Important Dates**
Last day to add a class without instructor AND Dean’s approval: **Sunday, August 30**
Last date to drop for full refund: **Sunday, September 6**
Labor Day Holiday – NO CLASSES: Monday, September 7
FALL break – NO CLASSES: Saturday, Oct. 10 – Tuesday, Oct. 13
Last date to drop for “W” grade: **Sunday, November 1**
Veteran’s Day Holiday – NO CLASSES: Wednesday, November 11
Thanksgiving Break – NO CLASSES: Wednesday Nov. 25 – Sunday, Nov. 29
Final Exam week: Monday, December 14 – Friday, December 18.

- **OUR FINAL EXAM IS Friday, December 18th, 2015, 2:45-4:45 PM**

*Students are advised to process drops and adds no later than the afternoon of the Friday prior to the deadline in case there is an issue with SalukiNet, an unanticipated hold on their account, etc. The University does not allow any leeway.

**Policy regarding electronic devices**
You will rarely, if ever, need to use a calculator in class. ALL electronic devices are to be turned OFF during class.

Exceptions:
1) If you are expecting an emergency call from a close family member, you may keep your cell phone on in vibrate mode. If the call comes in, please step out to take the call.
2) You may use a laptop or tablet instead of traditional paper and pen for taking notes.
3) Sometimes you might need to snap a photo of something on the board before it is erased. Just let me know.

IF I have occasion to remove a device from your possession during class time, it will be returned to you at the end of class and your record will be marked with an absence for the day.

**Emergency Procedures.** Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT’s website at [www.bert.siu.edu](http://www.bert.siu.edu), Department of Safety’s website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.
<table>
<thead>
<tr>
<th>Week of:</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>8/24/15-8/28/15</td>
<td>1.1-1.2 Sets and Subsets</td>
<td>1.3-1.4 Set operations; indexed collections of sets</td>
<td>1.5-1.5 Partitions of Sets and Cartesian Products Last day to add a class w/o Dean’s signature: Sun. 8/30</td>
</tr>
<tr>
<td>8/31/15-9/4/15</td>
<td>2.1-2.3 Statements, Negations, Disjunctions, Conjunctions</td>
<td>2.4-2.6 Implication and Biconditionals</td>
<td>2.7-2.8 Tautologies, contradictions; logical equivalence Last day to drop a class for full refund: Sun. 9/6</td>
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<tr>
<td>9/7/15-9/11/15</td>
<td>Labor Day – NO CLASSES</td>
<td>2.9 Fundamentals of Logical Equivalence</td>
<td>2.10 Quantified Statements</td>
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<tr>
<td>9/14/15-9/18/15</td>
<td>3.1-3.2 Trivial and Vacuous Proofs; Direct Proofs</td>
<td>3.3-3.4 Proof by Contrapositive; Proof by Cases</td>
<td>4.1-4.2 Proofs involving divisibility and congruence</td>
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<td>9/21/15-9/25/15</td>
<td>4.3-4.5 Proofs involving real numbers and sets</td>
<td>TEST 1 (tentative)</td>
<td>4.6 Proofs involving Cartesian Products of Sets</td>
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<td>9/28/15-10/2/15</td>
<td>5.1-5.2 Counterexamples and Proof by Contradiction</td>
<td>5.3 Review of Proof Techniques</td>
<td>5.4-5.5 Existence – prove or disprove</td>
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<td>10/12/15-10/16/15</td>
<td>Fall Break – NO CLASSES</td>
<td>8.1-8.2 Relations and Properties of Relations</td>
<td>8.3 Equivalence Relations</td>
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<tr>
<td>10/19/15-10/23/15</td>
<td>8.4 Properties of Equivalence Classes</td>
<td>8.5 Congruence Modulo ( n )</td>
<td>8.6 The Integers Modulo ( n )</td>
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<tr>
<td>10/26/15-10/30/15</td>
<td>TEST 2</td>
<td>9.1-9.2 Definition of function; the set of all functions from ( A ) to ( B )</td>
<td>9.3 One-to-One and Onto functions Last day to drop, no refund, W grade: Sun. 11/1</td>
</tr>
<tr>
<td>11/2/15-11/6/15</td>
<td>9.4 Bijective Functions</td>
<td>9.5 Composition of Functions</td>
<td>9.6-7 Inverse Functions; permutations</td>
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<tr>
<td>11/9/15-11/13/15</td>
<td>10.1 Numerically Equivalent Sets</td>
<td>Veterans Day – NO CLASSES</td>
<td>10.2 Denumerable Sets</td>
</tr>
<tr>
<td>11/16/15-11/20/15</td>
<td>10.3 Uncountable Sets</td>
<td>11.1 Divisibility Properties of Integers</td>
<td>11.2 The Division algorithm</td>
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<tr>
<td>11/30/15-12/4/15</td>
<td>11.4 The Euclidean Algorithm</td>
<td>11.5 Relatively Prime Integers</td>
<td>11.6 The Fundamental Theorem of Arithmetic</td>
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<td>12/7/15-12/11/15</td>
<td>Review</td>
<td>Review</td>
<td>Review</td>
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<tr>
<td>12/14/15-12/18/15</td>
<td>Finals Week. Our exam is Friday, December 18, 2:45-4:45 PM</td>
<td>Review</td>
<td>Review</td>
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</table>
SAFETY AWARENESS FACTS AND EDUCATION
Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: http://safe.siu.edu

DISABILITY POLICY
Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements. http://disabilityservices.siu.edu/

SALUKI CARES
The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu

Additional Resources Available:
SALUKINET: https://salukinet.siu.edu
ADVISEMENT: http://advisement.siu.edu
SIU ONLINE: http://online.siu.edu

In addition, all kinds of useful information is available at http://pvcaa.siu.edu/_common/documents/syllabus%20attachments/Syllabus%20Attachment%20Fall%202015.pdf

For your convenience, a copy is provided with this document. Please consider the environment before printing!
Syllabus Attachment

Fall 2015

http://pvcca.siu.edu/

IMPORTANT DATES *
Semester Class Begins ........................................... 08/24/2015
Last day to add a class (without instructor permission) ................. 08/30/2015
Last day to withdraw completely and receive a 100% refund ........... 09/06/2015
Last day to drop a course using SalukiNet ................................ 11/01/2015
Last day to file diploma application (for name to appear in Commencement program) ........................................... 09/18/2015
Final examinations ............................................ 12/14–12/18/2015

Note: For outreach, internet, and short course dropped dates, visit Registrar’s Academic Venues page: http://registrar.siu.edu

FALL SEMESTER HOLIDAYS
Labor Day Holiday 09/07/2015
Fall Break 10/06–10/12/2015
Veterans Day Holiday 11/11/2015

WITHDRAWAL POLICY – Undergraduate only
Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit http://registrar.siu.edu/pdf/undergraduateCatalog1314.pdf

INCOMPLETE POLICY – Undergraduate only
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REPEAT POLICY
An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A, B, C, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. See full policy at http://registrar.siu.edu/pdf/undergraduateCatalog1314.pdf

GRADUATE POLICIES
Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit http://gradschool.siu.edu/about/siugrad/catalog/index.html

DISABILITY POLICY
Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements. Contact Disability Services: 618-453-1314
http://disabilityservices.siu.edu/

PLAGIARISM CODE

MORRIS LIBRARY HOURS
http://www.lib.siu.edu/about

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INCLUSIVE EXCELLENCE
SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well as an essential preparation for any career. For more information please visit: http://www.inclusiveexcellence.siu.edu/

LEARNING AND SUPPORT SERVICES
Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

Tutoring: http://tutoring.siu.edu/
Math Labs: http://tutoring.siu.edu/math_tutoring/index.html

WRITING CENTER
The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit http://writes.siu.edu/

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY
Our office’s main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. For more information visit: http://diversity.siu.edu/

Additional Resources Available:

SALUKINET: https://salukinet.siu.edu/cp/home/displayLogin

ADVISEMENT: http://advisement.siu.edu/

SIU ONLINE: http://online.siu.edu/

Fall 2015 R.O. Rourke