

COURSE OUTLINE

WINTER 2012

1. PURE MATHEMATICS 427, Number Theory

Lecture/Time: MWF 12:00-12:50 in MS 431

Instructor/Office/Phone/Email: Clifton Cunningham, MS 528, 220-6888, ccunning@ucalgary.ca

Office Hours: Monday and Friday, 14:00-15:00 or by appointment.

Blackboard course name: **PMAT 427 L01 - (Winter 2012) - Number Theory**

2. Prerequisites:

Pure Mathematics 315 or 317 or consent of the Division.

(see Section 3.5C of Faculty of Science www.ucalgary.ca/pubs/calendar/current/sc-3-5.html and Course Descriptions: www.ucalgary.ca/pubs/calendar/current/course-desc-main.html)

3. Grading:

The University policy on grading and related matters is described in sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course, the following weights will be used:

<i>Assignment</i>	[40 questions]	40 %
<i>Project</i>	[1]	20 %
<i>In-class presentation</i>	[1]	10 %
<i>Final exam</i>		30 %

The components above will be assigned a GPA score following the table below and will be combined with the indicated weights to produce an overall GPA and letter grade in the course. A passing grade in the Final Examination is essential for an overall grade of C- or better.

4.0	A+	Outstanding.
4.0	A	Excellent-superior performance, showing comprehensive understanding of subject.
3.7	A-	
3.3	B+	
3.0	B	Good - clearly above average performance with knowledge of subject matter generally complete.
2.7	B-	
2.3	C+	
2.0	C	Satisfactory - basic understanding of the subject matter.
1.7	C-	
1.3	D+	
1.0	D	Minimal pass - marginal performance; generally insufficient preparation for subsequent courses in the same subject.
0	F	Fail - unsatisfactory performance or failure to meet course requirements.

4. Missed Components of Term Work:

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in section 3.6: www.ucalgary.ca/pubs/calendar/current/sc-3-6.html. It is the student's responsibility to be familiar with these regulations. See also www.ucalgary.ca/pubs/calendar/current/e-3.html.

5. REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME ACTIVITY.

If you have a conflict with any out of class time activity, please inform your instructor at least one week in advance of the activity so that other arrangements may be made for you.

6. Textbook:

Elementary Number Theory, by William Stein, Undergraduate Texts in Mathematics, Springer Verlag, 2009. Available electronically and in paper from our library (a copy is available in the reserve collection). I also recommend the first five chapters of *A Classical Introduction to Modern Number Theory* (second edition), by Ireland and Rosen. Other sources will be recommended for specific topics as the course progresses.

7. Topics.

The course will treat the following topics and themes.

1.	Prime numbers. Euclidean Division Algorithm, Fundamental Theorem of Arithmetic, the sequence of primes.
2.	Linear Diophantine equations.
3.	Primes in selected number fields. Unique factorization.

4.	Congruences. Chinese Remainder Theorem.
5.	Arithmetic functions.
6.	Public Key Cryptography.
7.	The structure of the group of units in the ring of integers modulo N .
8.	Quadratic Reciprocity.
9.	Hasse's Local-Global Principle.
10.	Selected non-linear Diophantine equations.
11.	An introduction to elliptic curves.
12.	An introduction to L-functions.

- 8. Sage.** Computational aspects of number theory will be stressed throughout the course. To make this convenient, we will make heavy use of Sage, an open-source mathematical system that bears some similarity to commercial packages like Maple or Magma. Every student will be given an account on a Sage webserver running from the Department of Mathematics and Statistics. We will use Sage during lectures and you will be encouraged to use Sage in your assignments and projects, though not during the final exam (see below).
- 9. Homework.** During the lectures I will assign homework questions, some taken from the text, others taken from the lectures. Homework questions should be submitted during lecture (and on paper) 10 days after they are posed.
- 10. Project and Presentation.** You will be asked to work on a project or your own choosing (in consultation with me) perhaps with other students. You will also choose the presentation and final report deadline.
- 11. Examination Policy.** You will be given three hours to write the final exam, which will be scheduled by the Registrar. No aids are allowed during the final exam. Students should also read the Calendar, Section G, on Examinations: www.ucalgary.ca/pubs/calendar/current/g.html.

12. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **ACADEMIC MISCONDUCT** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under K. Student Misconduct (<http://www.ucalgary.ca/pubs/calendar/current/k.html>) to inform yourself of definitions, processes and penalties.
- (b) **ASSEMBLY POINTS in case of emergency during class time.** Be sure to **FAMILIARIZE YOURSELF** with the information at <http://www.ucalgary.ca/emergencyplan/assemblypoints>.
- (c) **ACADEMIC ACCOMMODATION POLICY.** Students with documentable disabilities are referred to the following links: Calendar entry on students with disabilities: <http://www.ucalgary.ca/pubs/calendar/current/b-1.html>
Disability Resource Centre: <http://www.ucalgary.ca/drc/>
- (d) **SAFEWALK:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call **220-5333** for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **FREEDOM OF INFORMATION AND PRIVACY:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, **students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page.** For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **STUDENT UNION INFORMATION:** VP Academic **Phone:** 220-3911 **Email:** suypaca@ucalgary.ca.
SU Faculty Rep. **Phone:** 220-3913 **Email:** sciencerep@su.ucalgary.ca **Website** <http://www.su.ucalgary.ca/>
Student Ombudsman: <http://www.ucalgary.ca/provosti/students/ombuds>
- (g) **INTERNET and ELECTRONIC COMMUNICATION DEVICE Information.** You can assume that in all classes that you attend, **your cell phone should be turned off.** Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

