

COURSE OUTLINE

WINTER 2013

1. PMAT 427 - Number Theory

<u>Lec</u>	<u>Day</u>	<u>Time</u>	<u>Instructor</u>	<u>Office</u>	<u>Phone</u>	<u>Email</u>	<u>Office Hours</u>
01	M W F	12:00-12:50	C. Cunningham	MS 528	220-6888	ccunning@ucalgary.ca	M F 11:00-11:50

Blackboard course name: PMAT 427 Number Theory

2. **Prerequisites:** PMAT 315 or PMAT 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>Assignments</i>	[4]	40 %
<i>Midterm Test</i>	[1]	10 % (see #5.)
<i>Presentation and report</i>		30 %
<i>Final Exam</i>		20 % (To be scheduled by the Registrar)

The various components above will be assigned a percentage score and will be combined with the indicated weights to produce an overall percentage in the course. The conversion table between course percentage and letter grade will be provided at least one week before the withdrawal deadline.

A passing grade in the Final Examination is essential for an overall grade of C- or better.

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. **The mid-term test will be held Monday, 25 February, from 17:00 to 19:00.**

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:** no official textbook. Highly recommended reading: A Classical Introduction to Modern Number Theory, by Ireland and Rosen, Graduate Texts in Mathematics, Springer Verlag. Strongly Recommended reading: Elementary Number Theory, by William Stein.

7. **Examination Policy:** Closed book; no aids allowed. Students should also read the Calendar, Section G, on Examinations: www.ucalgary.ca/pubs/calendar/current/g.html

8. In this course, the quality of your writing in homework and reports will be a factor in the evaluation of these assignments. See also <http://www.ucalgary.ca/pubs/calendar/current/e-2.html>.

Week	Dates	Topics
1.	9, 11 January	Overview of some famous problems in number theory, including Fermat's Last Theorem; Gaussian Integers; primes as sums of two squares; Pythagorean Triples; rational points on conics
2.	14, 16, 18 January	A review of some algebra: Unique factorization, Primes and Irreducible elements in integral domains; Euclidean Domains; Ideals; principal ideal domains
3.	21, 23, 25 January	Riemann Zeta function; Arithmetic functions; Dirichlet series; Mobius function; Euler totient function; divisor counting function; prime counting function; prime number theorem

4.	28, 30 January, 1 February	Congruences; Euler's rule; Fermat's little theorem; solving linear equations mod n ; p -adic integers
5.	4, 6, 8 February	Sun Ze theorem; adelic integers
6.	11, 13, 15 February	Hensel's lemma; Hasse-Minkowski Principle
		Reading Week!
7.	25, 27 February, 1 March	Unit group of $\mathbb{Z}/n\mathbb{Z}$; structure for case $n=p^e$. Mid-term test: 17:00-19:00, 25 February; no class this day.
8.	4, 6, 8 March	Quadratic Reciprocity! Gauss sums
9.	11, 13, 15 March	Algebraic numbers and algebraic integers; more Gauss sums
10.	18, 20, 22 March	Finite fields
11.	25, 27 March	Characters; orthogonality relations; more Gauss sums; Jacobi sums; counting formulas
12.	1, 3, 5 April	Elliptic curves; Tate modules
13.	8, 10, 12 April	Reduction of elliptic curves; remarks on the proof of Fermat's Last Theorem
	15 April	Remarks on modern research in number theory
Exam	19-30 April	3 hour exam, to be scheduled by the Registrar's office

9. 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 (FOIPPA). 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:** suvpaca@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/provost/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.

**COURSE OUTLINE
ADDENDUM -- GRADING
WINTER 2013**

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Each piece of work submitted by the student will be assigned a letter grade. The final grade for the course will be a weighted grade point average of the individual letter grades, using the weighting factors in the table above.

A passing grade in the Final Examination is essential for an overall grade of C- or better.