COURSE IMPLEMENTATION DATE: September 2006
COURSE REVISED IMPLEMENTATION DATE:
COURSE TO BE REVIEWED: November 2009
(Four years after UPAC final approval date) (MONTH YEAR)

# OFFICIAL COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Science, Health, & Human Services / Mathematics & Statistics**

| **MATH 339** | | **3** |
|---|---|---|
| COURSE NAME/NUMBER | FORMER COURSE NUMBER | UCFV CREDITS |

**Introduction to Applied Algebraic Systems**
COURSE DESCRIPTIVE TITLE

## CALENDAR DESCRIPTION:

This course is an introduction to some of the fundamental structures of modern algebra: groups, rings and fields, with special attention to applications. The emphasis will be on polynomial rings, finite fields, and various concrete groups such as symmetry groups and permutation groups. Applications covered including error-correcting codes, enumeration techniques, and geometric construction arguments.

PREREQUISITES: **Math 265 with a C or better and Math 221.**
COREQUISITES:

SYNONYMOUS COURSE(S)
(a) Replaces: _____ *(Course #)*
(b) Cannot take: _____ *(Course #)* for further credit.

SERVICE COURSE TO: _____ *(Department/Program)* _____ *(Department/Program)*

TOTAL HOURS PER TERM: **60**
STRUCTURE OF HOURS:

| | | |
|---|---|---|
| Lectures: | **45** | Hrs |
| Seminar: | **15** | Hrs |
| Laboratory: | | Hrs |
| Field Experience: | | Hrs |
| Student Directed Learning: | | Hrs |
| Other (Specify): | | Hrs |

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT: **25**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **annually**

| | | |
|---|---|---|
| WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only) | ☒ Yes | ☐ No |
| WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department) | ☐ Yes | ☐ No |
| TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE: | ☐ Yes | ☒ No |

AUTHORIZATION SIGNATURES:

Course Designer(s): Greg Schlitt / Robin Endelman
Chairperson: Gillian Mimmack *(Curriculum Committee)*
Department Head: Gillian Mimmack
Dean: Jacalyn Snodgrass
UPAC Approval in Principle Date:
UPAC Final Approval Date: November 25, 2005

**LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:**

This course will serve as an introduction to the fundamental structures of modern algebra (groups, rings and fields) and to applications of those structures in mathematics as well as in other disciplines. It differs from a classical course in that the settings will be kept as concrete as possible, and the level of abstraction and generality relatively low.

As two motivating examples:

(1) While the students will learn what an abstract ring is, a significant amount of time will be spent studying polynomial rings and applications (construction of finite fields, error-correcting codes, for example)

(2) While the students will learn what an abstract group is, a significant amount of time will be spent studying concrete groups (permuatation groups, matrix groups, symmetry groups) and their applications (counting arguments, for example).

Thus successful students will:

(1) Be familiar with the definitions and elementary theories of the following algebraic structures: groups, rings and fields. They will be able to read and comprehend arguments involving these structures (and on their own establish elementary results and construct elementary examples) and be able to accurately perform calculations.

(2) Know how these structures can be applied to solve problems and construct examples in areas inside and outside mathematics, for example: error-correcting codes, Latin squares, geometric constructions, counting arguments.

(3) Be able to communicate their understanding in written and oral form.

Successful students will be adequately prepared for a $4^{th}$ year course in the abstract theory of groups/rings and fields which covers a significant amount of the basic theory.

**METHODS:**

The course will be primarily lecture-based, along with student seminar presentations.

**PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):**

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

**METHODS OF OBTAINING PLAR:**

Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

**TEXTBOOKS, REFERENCES, MATERIALS:**

[Textbook selection varies by instructor. An example of texts for this course might be:]

The textbook is chosen by a departmental curriculum committee. Recommended text is:

Ivring, R.S. (2004) Integers, Polynomials, and Rings: A Course in Algebra. Springer Verlag.

**SUPPLIES / MATERIALS:**

**STUDENT EVALUATION:**

[An example of student evaluation for this course might be:]

| | |
|---|---|
| Assignments | 25% |
| Term tests | 35% |
| Final exam | 40% |

Students must obtain at least 40% on the final exam in order to receive credit for this course.

**COURSE CONTENT:**

[Course content varies by instructor. An example of course content might be:]

Review of basic number theory (primes, divisibility, modular arithmetic) (Topics covered in Math 265)

Rings and Fields

Examples already known: integers, reals, matrices, polynomials, etc.

Definitions and further examples

Subrings/Subfields/Ideals

Polynomial rings: the algebra of polynomials (over integers, rationals, reals, complexes, finite fields), roots, factorization, irreducibility tests.

Review of vector sUPAC es

Extension fields: Fundamental Theorem of Algebra, Splitting fields Field isomorphisms

Finite fields; structure and subfield structure.

Applications: Latin squares, error-correcting codes, geometric constructions, etc.

Groups

Examples: symmetry groups, dihedral groups,  etc.

Definitions and further examples (including  matrix groups)

Subgroups

Cyclic groups

Permutation groups, parity

Cosets and Lagrange's theorem

Group actions

Orbit stabilizer theorem and applications to counting

Burnside's theorem and applications to counting