Course Change Request

New Course Proposal

Date Submitted: 03/22/22 5:37 pm

Viewing: MATH 433 : Algebraic Geometry

Last edit: 04/01/22 8:57 am

Changes proposed by: csausvil

In Workflow

1. **MATH Chair**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Undergraduate
5. Registrar-Courses
6. Banner

Approval Path

1. 03/22/22 6:01 pm Maria Emelianenko (memelian): Approved for MATH Chair

Are you completing this form on someone else's behalf?

No

Effective Term: Fall 2022

Subject Code: MATH - Mathematics

Course Number: 433

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Algebraic Geometry

Banner Title: Algebraic Geometry

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable:

May be only taken once for credit, limited to 3 attempts (N3)

Max Allowable Credits: 9

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

C or better in Math 321

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Integrates topics from algebra directly into the geometric context through the study of algebraic varieties. Methods require the use of fields, rings, ideals to describe geometric objects. Topics include affine varieties, Hilbert's Basis Theorem, Gröbner bases, Buchberger's Criterion and Algorithm, parametrizations, Hilbert's Nullstellensatz, and the Algebra-Geometry Dictionary.

Justification:

What: Creating a new course, Algebraic Geometry.

Why: We are looking to expand our upper division course offerings in pure mathematics. This will also support a potential future concentration in pure mathematics for the Mathematical Sciences BS degree.

Does this course cover material which crosses into another department? No

Learning Outcomes:

1. Students will learn to read and write proofs in the subject of algebraic-geometry.
2. Students will learn to read and write pseudo-code and algorithms concerning algebraic and geometric concepts.
3. Students will learn to present advanced mathematical material.
4. Students will learn to do computations using polynomial data.
5. Students will learn to visualize algebraic constructions.
6. Students will learn to understand geometric concepts utilizing polynomial functions.

Attach Syllabus

AGSyllabus-Generic.pdf

Additional Attachments

Staffing:

Potential faculty for this course include, but are not limited to, Rebecca Goldin, David Carchedi, Neil Epstein, Sean Lawton and Rebecca R.G.(Rebhuhn-Glanz).

Relationship to Existing Programs:

This course would expand the offerings of the Mathematics BS degree.

Relationship to Existing Courses:

To our knowledge are no other similar courses at the university.

Additional Comments:

Reviewer Comments

Key: 17597

General Syllabus

Department of Mathematical Sciences

Algebraic Geometry

Proposed Course Number: Math 433

Suggested Text: Cox, Little, O'Shea, "Ideals, varieties, and algorithms. An introduction to computational algebraic geometry and commutative algebra.*"* Fourth edition. Undergraduate Texts in Mathematics. Springer, 2015. ISBN: 978-3-319-16720-6; 978-3-319-16721-3. This text has won the Steele Prize for outstanding mathematical writing.

General Description: Algebraic Geometry is a way to view rings and other algebraic objects as geometric objects. It is also a way to use algebraic methods to study naturally geometric objects (that happen to be "varieties"). This interplay between algebra and geometry gives rise to a useful and power theory that has applications in many areas of science as well as other areas of mathematics. With the computational power offered by modern computers this subject is now more relevant and useful. Algorithmic and computational aspects of this vast theory make it accessible at the undergraduate level. This course covers the foundational definitions and theorems of affine varieties and polynomials rings over abstract fields and important computational tools surrounding them.

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Learning Objectives:

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Prerequisite Courses: Math 321

Assessment: Students will be assessed on homework, presentations, projects, or exams. These will be determined by the instructor.

Grading: Possible grading scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60% . + or – *may* be attached to the grade for the upper or lower 2 points in each range.

Electronic Devices (such as laptops, cell phones, etc.)**:** Please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism and may result *penalties.*

Disabilities: Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University.

All academic accommodations must be arranged through that office. It is the student's responsibility to get exam accommodation forms signed and turned in at least one week before the exams.

If you are seeking accommodations, please visit https://ds.gmu.edu/ for detailed information, or email: ods@gmu.edu.

Academic Integrity: It is expected that students adhere to the George Mason University Honor Code as it relates to integrity regarding coursework and grades. The Honor Code reads as follows:

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this: Student members of the George Mason University community pledge not to cheat, plagiarize, steal and/or lie in matters related to academic work.

More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at: https://oai.gmu.edu.

Diversity: In this course, we seek to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own. See the following URL for more information:

https://stearnscenter.gmu.edu/knowledge-center/general-teaching-resources/mason-diversity-statement/

Privacy: Students must use their GMU email account to receive important University information, including messages related to this class. *I will not correspond to anyone in this course over email if they do not use their official GMU email.*

Week by Week:

Date	Lecture Topic
Week 1	Polynomials, Ideals & Affine Space

Week 2	Affine Varieties, Parametrizations
Week 3	Orderings on Monomials & Division Algorithm
Week 4	Monomial Ideals & Dickson's Lemma
Week 5	Hilbert Basis Theorem & Gröbner Bases
Week 6	Properties of Gröbner Bases & Buchberger's Algorithm
Week 7	Refinements & Improvements of Buchberger's Algorithm
Week 8	Elimination & Extension Theorems & Implicitization
Week 9	Singular Points & Envelopes & Resultants
Week 10	Hilbert's Nullstellensatz
Week 11	Radical Ideals, Ideal-Variety Correspondence
Week 12	Sums, Products & Intersections of Ideals
Week 13	Zariski Closures, Ideal Quotients, Saturations
Week 14	Irreducible Varieties & Prime Ideals & Irreducible Decomposition of a Variety