Course Change Request

New Course Proposal

Date Submitted: 03/22/22 5:31 pm

Viewing: MATH 421 : Abstract Algebra II

Last edit: 03/22/22 5:31 pm

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: 421

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Abstract Algebra II

Banner Title: Abstract Algebra II

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):

Grade of 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:

Expands on the algebraic structure of groups from the first course in abstract algebra to introduce rings and fields. All three structures are explored via Galois theory, which shows the vital interconnectivity of the three structures, and how this can be applied to obtain deep theorems about the symmetries among roots of a polynomial. Topics include: rings, ideals, homomorphisms, polynomial rings, factorization, divisibility, vector spaces, extension fields (algebraic and transcendental), the fundamental theorem of field theory, splitting fields, classification of finite fields, constructible numbers, impossibility theorems for angle trisection and circle squaring, the fundamental theorem of Galois theory, and solvability of polynomials by radicals.

Justification:

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 BS Math degree.

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

Learning Outcomes:

1. Students will learn to read and write proofs concerning fields and rings.
2. Students will learn to present advanced mathematical material.
3. Students will learn to do computations.
4. Students will learn to understand how symmetry via the Galois group and its subgroups correspond to field extensions.

Attach Syllabus

AA2Syllabus-Generic.pdf

Additional Attachments

Staffing:

Potential faculty for this course include, but are not limited to, Geir Agnarsson, 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:

This course would come after and expand on the content from Math 321. To our knowledge there are no other similar courses at the university.

Additional Comments:

Reviewer Comments

Key: 17596

GEORGE MASON UNIVERSITY

General Syllabus

Department of Mathematical Sciences

Abstract Algebra II

Proposed Text: Contemporary Abstract Algebra, 9th Edition, Joseph Gallian, ISBN: 978-1305657960

Proposed Course Number: Math 421

Prerequisites: Grade of C or better in MATH 321.

Course Description: Galois Theory is one of the most beautiful and powerful ideas in mathematics. One can perhaps trace the invention of Lie Theory, with its many applications throughout natural science and its revolutionary redefinition of geometry itself, to the attempt to create a Galois theory with differential equations instead of algebraic ones. The idea that symmetry controls the theory of fields was revolutionary and powerful. This course continues where Math 321 left off expanding on the theory of rings and fields working up to the fundamental theorems, definitions, examples, and consequences of Galois Theory. Highlights include the famous insolvability of the quintic and the impossibility of squaring a circle or trisecting an angle.

(Catalog) Description: Expands on the algebraic structure of groups from the first course in abstract algebra to introduce rings and fields. All three structures are explored via Galois theory, which shows the vital interconnectivity of the three structures, and how this can be applied to obtain deep theorems about the symmetries among roots of a polynomial. Topics include: rings, ideals, homomorphisms, polynomial rings, factorization, divisibility, vector spaces, extension fields (algebraic and transcendental), the fundamental theorem of field theory, splitting fields, classification of finite fields, constructible numbers, impossibility theorems for angle trisection and circle squaring, the fundamental theorem of Galois theory, and solvability of polynomials by radicals.

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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	Rings and Examples

Week 2	Subrings and Ideals
Week 3	Homomorphisms and Isomorphism Theorems
Week 4	Polynomial Rings & Factorization
Week 5	Divisibility in Integral Domains
Week 6	Fields and Vector Spaces, & Extension Fields
Week 7	The Fundamental Theorem of Field Theory
Week 8	Splitting Fields & Algebraic Extensions
Week 9	Classification of Finite Fields
Week 10	Constructible Numbers & Angle-Trisectors & Circle-Squarers
Week 11	Fundamental Theorem of Galois Theory
Week 12	Fundamental Theorem of Galois Theory
Week 13	Solvability of Polynomials by Radicals
Week 14	Insolvability of a Quintic

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