

New Course Request

Indiana University

IUPUI

Campus

Check Appropriate Boxes:

Undergraduate credit

Graduate credit

Professional credit

1. School/Division School of Science 2. Academic Subject Code Math

3. Course Number 45400 (must be cleared with University Enrollment Services) 4. Instructor Morton

5. Course Title Galois Theory

Recommended Abbreviation (Optional) Galois Theory

(Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Spring 2010

7. Credit Hours: Fixed at 3 or Variable from _____ to _____

8. Is this course to be graded S-F (only)? Yes _____ No X

9. Is variable title approval being requested? Yes _____ No X

P: MATH 45300.

10. Course description (not to exceed 50 words) for Bulletin publication: An introduction to Galois Theory, covering both its origins in the theory of roots of polynomial equation and its modern formulation in terms of abstract algebra. Topics include field extension extensions and their symmetries, ruler and compass constructions, solvable groups, and the solvability of polynomial equations by radical operation.

11. Lecture Contact Hours: Fixed at 3 or Variable from _____ to _____

12. Non-Lecture Contact Hours: Fixed at 0 or Variable from _____ to _____

13. Estimated enrollment: 10-20 of which 0 percent are expected to be graduate students.

14. Frequency of scheduling: Every Semester Will this course be required for majors? No

15. Justification for new course: It will give majors an additional 2-course sequence to choose.

16. Are the necessary reading materials currently available in the appropriate library? Yes


17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant. Only with graduate level algebra class 55300.

Overlap is necessary and desirable.

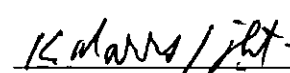
19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:


Department Chairman/Division Director

Date 11-11-2009

Approved by:


Dean

Date 11-17-09

Date _____
Dean of Graduate School (when required)

Date _____
Chancellor/Vice-President

Date _____
University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

Print Form

DEPARTMENT Mathematical Sciences

EFFECTIVE SESSION Fall 2010

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- | | |
|--|---|
| <input type="checkbox"/> 1. New course with supporting documents | <input type="checkbox"/> 7. Change in course attributes (department head signature only) |
| <input checked="" type="checkbox"/> 2. Add existing course offered at another campus | <input type="checkbox"/> 8. Change in instructional hours |
| <input type="checkbox"/> 3. Expiration of a course | <input type="checkbox"/> 9. Change in course description |
| <input type="checkbox"/> 4. Change in course number | <input type="checkbox"/> 10. Change in course requisites |
| <input type="checkbox"/> 5. Change in course title | <input type="checkbox"/> 11. Change in semesters offered (department head signature only) |
| <input type="checkbox"/> 6. Change in course credit/type | <input type="checkbox"/> 12. Transfer from one department to another |

PROPOSED:

EXISTING:

Subject Abbreviation MATH

Subject Abbreviation MATH

Course Number 45400

Course Number 45400

Long Title Galois Theory

Short Title Galois Theory

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED

Check All That Apply:

Summer Fall Spring

CAMPUS(ES) INVOLVED

Calumet N. Central
 Cont Ed Tech Statewide
 Ft. Wayne W. Lafayette
 Indianapolis

CREDIT TYPE

1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
 Minimum Cr. Hrs. _____
 (Check One) To Or
 Maximum Cr. Hrs. _____
3. Equivalent Credit: Yes No

COURSE ATTRIBUTES: Check All That Apply

- | | |
|--|---|
| <input type="checkbox"/> 1. Pass/Not Pass Only | <input type="checkbox"/> 6. Registration Approval Type |
| <input type="checkbox"/> 2. Satisfactory/Unsatisfactory Only | Department <input type="checkbox"/> Instructor <input type="checkbox"/> |
| <input type="checkbox"/> 3. Repeatable | 7. Variable Title <input type="checkbox"/> |
| Maximum Repeatable Credit: _____ | 8. Honors <input type="checkbox"/> |
| <input type="checkbox"/> 4. Credit by Examination | 9. Full Time Privilege <input type="checkbox"/> |
| <input type="checkbox"/> 5. Special Fees | 10. Off Campus Experience <input type="checkbox"/> |

ScheduleType	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	3	15	100
Recitation	_____	_____	_____	_____
Presentation	_____	_____	_____	_____
Laboratory	_____	_____	_____	_____
Lab Prep	_____	_____	_____	_____
Studio	_____	_____	_____	_____
Distance	_____	_____	_____	_____
Clinic	_____	_____	_____	_____
Experiential	_____	_____	_____	_____
Research	_____	_____	_____	_____
Ind. Study	_____	_____	_____	_____
Pract/Observ	_____	_____	_____	_____

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS): P: MATH 45300.

An introduction to Galois Theory, covering both its origins in the theory of roots of a polynomial equation and its modern formulation in terms of abstract algebra. Topics include field extensions and their symmetries, ruler and compass constructions, solvable groups, and the solvability of polynomial equations by radical operation.

***COURSE LEARNING OUTCOMES:**

This is a second course in abstract algebra. It is preceded by an abstract algebra course that is required of all pure math majors. It is for those students that are interested in algebra beyond the introductory course.

Calumet Department Head _____	Date _____	Calumet School Dean _____	Date _____
Fort Wayne Department Head _____	Date _____	Fort Wayne School Dean _____	Date _____
Indianapolis Department Head _____	Date <u>11-14-2009</u>	Indianapolis School Dean <u>CLANNY/PT</u>	Date <u>11-17-09</u>
North Central School Dean _____	Date _____	North Central Vice Chancellor for Academic Affairs _____	Date _____
West Lafayette Department Head _____	Date _____	West Lafayette College/School Dean _____	Date _____
_____	_____	West Lafayette Registrar _____	Date _____

Math 45400

Galois Theory

Text: *Exploratory Galois Theory*, by John Swallow.

Recommended: *Maple 13, Student Version* (available at the bookstore).

Prerequisite for the class: Math 45300.

Math 45400 is a continuation of Math 45300. It offers math majors an additional two-course sequence 45300-45400 to choose in fulfilling the requirements for the major.

Course Overview:

The topics in 45400 give a beautiful example of a modern mathematical development. Starting from the question of whether it is possible to solve a given equation by radicals (a major unsolved problem in the early 1800's), all the necessary algebraic tools are developed in order to answer the question. The answer highlights the beautiful interplay between different algebraic structures (groups of mappings and fields of numbers) that you studied in Math 45300. Along the way, several problems of classical geometry are also solved, including which regular polygons are constructible by straightedge and compass, and why it is impossible to trisect a general angle or square the circle using straightedge and compass.

This is an excellent course for anyone intending to go to graduate school or for prospective secondary teachers, since solving polynomial equations is a major topic of the high school math curriculum, and the solution of polynomials by radicals has a fascinating history.

Math 45400 Syllabus

The following syllabus is intended as a guide. We may change some of the topics, or spend more or less time on them, depending on the class.

Review of polynomial rings
Integral domains, Euclidean rings, and factorization
Fields and field extensions
Linear algebra over a field
Simple extensions, field degrees and the tower law
Ruler and compass constructions
The transcendence of π
Normality and separability
Field automorphisms, splitting fields, and normal closures
The Galois correspondence
Regular polygons and cyclotomy
Solution of cubic and quartic equations and computing their Galois groups
Insolvability of the quintic
The Sylow Theorems and the Fundamental Theorem of Algebra (if time permits)

Maple Assignments

There will be regular (every other week) computer assignments requiring the use of the *Maple* software. This software is installed on the computers in LD 225, the computer lab. The purpose of these projects is to give you experiences to expand your understanding and familiarity with the concepts, to verify ideas and proofs, and to help you develop your algebraic intuition. Each Maple project will be worth approximately 40 points.

The text we are using includes many Maple programs, and further programs are available on-line. You will be using some of these programs to construct non-trivial examples of the theory.

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Prerequisite for the class: Math 45300.

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