

EXISTING COURSE ADOPTION PROCEDURE (ECAP)
REVISED PROCEDURE FOR BRINGING COURSES OFF THE MASTER COURSE
LIST

Drafted by Curriculum Committee, Indiana University East
Sept. 2002

Please fill out the following form when sending courses to the Curriculum Committee for consideration:

PART 1:

Course number: Math M415

Course Title: Elementary Complex Variables

Credit hours: 3.0

Division offering: NSM

Faculty member submitting this proposal: Markus Pomper

PART 2:

Have you contacted all campuses in the IU system who are currently teaching this course and examined their methods of teaching this course? (you should consult the office of the Vice Chancellor of Academic Affairs for help in contacting campuses and procuring sample syllabi)

Yes

Below, please list all those campuses which teach the course in question:

Bloomington
South Bend
Kokomo
North West

PART 3:

Please provide the following elements to the model framework as required by the University Faculty Council (you may attach additional pages):

1) Describe the course content and your rationale for bringing it forward:

Course description from Master Course Inventory

P: M311. Algebra and geometry of complex numbers, elementary functions of a complex variable, power series, integrations, calculus of residues, conformal mapping. Application to physics.

More detailed description

The course is the first course in complex variables.

The first fourth of the course focuses on the basic definitions. We begin with a brief review of the complex number system, operations in the complex number system, polar representation of complex numbers and deMoivre's formula. This is followed by the definition of analytic functions, harmonic functions and the Cauchy-Riemann equations.

Approximately one fourth of the course material will focus on differentiation and integration of analytic functions. Topics covered include Cauchy's Theorem and its consequences (eg, Maximum Modulus Principle, Liouville's Theorem and Winding Number).

Roughly one third of the course material deals with power-series representation of functions of complex numbers. A brief review of series and their convergence is followed by Taylor series of analytic function. This includes series of analytic functions, pointwise convergence, uniform convergence and the Weierstrass M-test. The concept of analytic functions and Taylor Series representation is then extended to meromorphic functions and their Laurent Series expansion. Topics included in the study of meromorphic functions are the classification of singularities into removable singularities, poles of n-th degree, and essential singularities. Applications include the theory of residues, and techniques for evaluating indefinite integrals on the real line.

The course concludes with a brief overview of additional topics, which may include conformal mappings and Riemann Surfaces.

2) Describe the course's placement in the program, including its intended audience and any prerequisites.

This course is intended for students in Mathematics (BA in NSM with concentration in Mathematics), or for students in Secondary Education in Mathematics. These students would typically take this course late in their undergraduate career, probably in their Senior year. Since this course may be offered as a distance education course, it is very likely that active high school teachers who wish to broaden their understanding of mathematics or post-baccalaureate students preparing for graduate studies would take this course.

3) List the anticipated student learning objectives and outcomes.

Educated persons should have achieved depth of knowledge in one field of studies.

Knowledge of the topics in Complex Analysis listed above is clearly an advanced topic in undergraduate mathematics and therefore constitutes depth of knowledge in a field of study.

4) Discuss any special features of the course (eg. a service learning component)

None

5) **Attach a proposed syllabus for the course as it would be taught on the IU East campus.**

PART 4:

Representatives of your Division need to examine the sample syllabi and other materials from these campuses and determine whether your approach will be comparable. Please describe below your Division's final determination on this point and provide the chair's signature.

I approve the above-mentioned course as following the model framework given by other campuses in the IU system.

Division Chair

Date

Math M415 – Elementary Complex Variables Course Syllabus (Typical)

(Directory about Instructor)
(Class Policies, Grading Policies, etc).

Textbook: Marsden, J, and Hoffman, M., Basic Complex Analysis, Third Edition, 1999.

Official Course Description: Algebra and geometry of complex numbers, elementary functions of a complex variable, power series, integrations, calculus of residues, conformal mapping.

This course is the first course in complex variables. The objective is to familiarize you with the basic concepts of complex variables, including properties of complex numbers and the Complex Plane. We will study topic including continuity, differentiation of complex functions. Most of the attention will be focused on analytic functions, their properties and representation as power series, meromorphic functions and applications to residues.

Tentative Class Schedule

	Section	Topics
Week 1	1.1	Introduction to Complex Numbers
	1.2	Properties of Complex Numbers
Week 2	1.3	Some Elementary Functions
	1.4	Continuous Functions
Week 3	1.4 ctd	ctd.
	1.5	Basic Properties of Analytic functions
Week 4	1.6	Differentiation of Analytic functions
	2.1	Contour Integrals
Week 5	2.1 ctd	Contour Integrals
	2.2	Cauchy's Theorem
Week 6	2.3	Cauchy's Theorem
	2.4	Cauchy's Integral Formula
Week 7	2.5	Maximum Modulus Theorem
	3.1	Convergent Series of Analytic Functions
Week 8	3.1 ctd	ctd.
		Midterm (Covers Ch. 1-2).
Week 9	3.2	Power Series and Taylor's Theorem
	3.2 ctd	ctd.
Week 10	3.3	Laurent Series and Classification of Singularities
	3.3 ctd.	ctd.
Week 11	4.1	Calculus of Residues
	4.2	Residue Theorem
Week 12	4.3	Evaluation of Definite Integrals
	4.3 ctd.	ctd.
Week 13	5.1	Conformal Mappings
	5.2	Fractional Linear and Schwarz Transforms
Week 14	6.1	Analytic Continuation and Riemann Surfaces
		Review
		Final Exam

