

UNDERGRADUATE CURRICULUM PROPOSAL COVER SHEET

Title of Proposal – Must begin with Department Abbreviation:

MATH 355 and 455 course proposals (3550 and 4550 in the new four digit system)

Check One: Full Proposal or Information Item

Effective Date for Curricular Offering: August 2010

FROM: Edward Rozema, Mathematics, EMCS 415B, 423-4584 or 423-4545, edward-rozema@utc.edu
(proposal originator: include spokesperson's name, department, office number, telephone, e-mail)

Does this require new resources from the originating department or other department? No
Please include an explanation if yes.

Faculty of the originating department approved this proposal on October 9, 2009 (date),
by a vote of 24 aye votes; 0 nay votes; 0 abstentions; 9 eligible voting members absent.

The following have examined this proposal:

Dept Head/Director: John Graef [Signature] 10/18/09 Approve Neutral Disapprove*
Printed name Signature, date

College Curriculum Committee Date: _____ Vote: _____ Signature of Chair: _____

Spokespersons for Affected Departments:

Printed Name, Department	Signature, Date	Approve	Neutral	Disapprove*
<u>John Tucker, Biological & Earth Sciences</u>	<u>[Signature]</u> <u>10/22/09</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>Valerie C. Rutledge, Teacher Preparation Academy</u>	<u>[Signature]</u> <u>10/22/09</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Dean/Director: H. Burkenn [Signature] Approve Neutral Disapprove*

University Registrar: Linda Orth [Signature] 10/30/09 Approve Neutral Disapprove*
Printed name Signature, date Comments

Provost/Representative: Jocelyn Sanders [Signature] 11/2/09 Approve Neutral Disapprove*
Printed name Signature, date

Lab/studio fee requested:

Provost: Phil Oldham [Signature] Approve Disapprove*
Printed name Signature, date

*Those who disapprove may attach an explanation

ACTIONS on this proposal:	Curriculum Committee	Faculty Senate
Date the proposal was considered	_____	_____
Vote of the body:	_____	_____
Accepted as information item (indicate date)	_____	_____
Approved as submitted (indicate date)	_____	_____
Approved with amendments (amendments indicated and transmitted to all signatories above, date):	_____	_____
Signature of Chair:	_____	_____

To: Curriculum Committee (Undergraduate)
From: Department of Mathematics
Re: Math 355/455 Course Proposal
Date: October 12, 2009

Proposal. The Department of Mathematics proposes two new courses entitled *Introduction to Analysis I*, Math 355, and *Introduction to Analysis II*, Math 455. The four digit numbers will be 3550 and 4550, respectively. Each course will be a three credit hour course. Math 350 will be deleted from the catalog. Math 355 will replace Math 350 as a required course for mathematics majors.

Rationale. The courses will expand on the topics now covered in Math 350, Fundamental Concepts in Analysis, and are consistent with the offerings at many other institutions, including UTK and Georgia Tech. The purpose is to give mathematics majors a deeper understanding of the topics covered in these courses. This is important for all our majors but essential for those who wish to pursue graduate study in mathematics because an introduction to analysis is an admission requirement for most graduate departments, including the newly approved master's program at UTC. Math 355 will be required for mathematics majors and, after approval of a separate proposal from the Teacher Preparation Academy, majors in Secondary Mathematics. All these students will be strongly encouraged to take Math 455 as an elective. We have decided not to require Math 455 in order to continue to allow our students some flexibility in their scheduling and in their choice of upper-level courses. Math 355 will cover the topics in calculus which offer the most challenges to future teachers, specifically, limits and continuity. Others who might take the course include mathematics minors and those students who seek a deeper understanding of the foundations of the calculus.

The current description of Math 350 is given here along with the proposed catalog descriptions of the new courses. We have added Math 245 as a prerequisite to Math 355 because it is a required sophomore level analysis course which would increase the students' understanding in Math 355. In the catalog, all references to Math 350 and will be replaced by Math 355; in particular, Math 355 will become the prerequisite for Math 450. Also, Math 455 will be added to the second list of approved courses for the BA. A sample syllabus for each course is attached.

This proposal will require no new resources. The required course Math 355 is replacing the required course Math 350 which is taught every fall. In the spring, Math 455 will be offered concurrently with Math 555 which is part of the core of the graduate program approved last year.

Impact on other departments. TPA will have to replace Math 350 with Math 355 in its required list of Mathematics courses in the Secondary Mathematics major. Environmental Sciences will need to do the same in the Mathematics concentration of the Environmental Sciences major.

Catalog descriptions

Current catalog description (this course will be removed from the catalog):

Math 350 Fundamental Concepts in Analysis (3) Classical treatment of the basic concepts of calculus: limits, continuity, differentiation, Riemann integration, sequences and series of numbers and functions. *Prerequisites: Mathematics 255 and 300 with minimum grades of C.*

Proposed catalog descriptions:

Math 355 Introduction to Analysis I (3) Theoretical investigation of real sequences, functions, limits, and continuity. *Prerequisites: Math 245, 255, and 300 with minimum grades of C.*

Math 455 Introduction to Analysis II (3) Rigorous development of the derivative, the definite integral, sequences and series of functions, and improper integrals. *Prerequisites: Math 355 with minimum grade of C.*

Additional Catalog Copy (Deletions are struck-through, additions are bold face. General Education Course requirements are omitted to save space. The format followed is that of the online catalog.)

450 Modern Analysis (3) Differentiation; inverse and implicit function theorems; functions of bounded variation. Integration and measure; integration on manifolds; Stokes' and Green's Theorems; other selected topics. On demand. Prerequisite: Mathematics ~~355~~ ~~350~~ with a minimum grade of C.

Applied Mathematics (B.S.)

Major and Related Courses

- Computer Science 150, English 278, and one course from Theatre and Speech 109, 209 or University Honors 214
- Mathematics 151#/152, 161/162, 212, 245, 255, 300, ~~355~~ ~~350~~
- NOTE: Mathematics sequence may begin with 144 and/or 145 rather than 151/152 depending on preparation.

One of the following concentrations:

2065 - General Mathematics

Mathematics 321 or 412; either Mathematics 307 plus 12 additional hours in Mathematics at the 300-400 level OR Mathematics 407 and 408 plus 9 additional hour in Mathematics at the 300-400 level excluding Mathematics 307. **Mathematics 455 is strongly recommended, particularly for those students who are seeking teacher certification in mathematics and students who are planning graduate study.**

In addition, the student must choose an established minor or design a program of study approved by the Mathematics Department Curriculum Committee consisting of 18 hours of courses in other disciplines, including at least 8 hours at the 300-400 level. A minimum grade point average of 2.0 must be achieved in these courses. Completion of a second major will satisfy this requirement.

2068 - Actuarial Science

- Mathematics 407, 408, 412, 465; one of 414, 420 or 424; plus 9 additional hours in Mathematics at the 300-400 level excluding Mathematics 307; Accounting 201, 202; Economics 101, 102, 324, 325; Finance 302, 337. Strongly recommended electives include Mathematics 401, 420, **455** and Economics 460.
- 2.0 average in all mathematics courses and also in all 300-400 level mathematics courses.
- Minimum of 39 hours of 300 and 400 level courses.
- Electives to complete 120 hours.
- See additional requirements.

1570 - Mathematics (B.A.)

Major and Related Courses

- Computer Science 150, English 278, and one course from Theatre and Speech 109, 209, or University Honors 214

- Mathematics 151#/152, 161/162, 212, 245, 255, 300, 321, **355 350**
NOTE: Mathematics sequence may begin with 144 and/or 145 rather than 151/152 depending on preparation.
- Mathematics 307# or 408#
- Five additional courses at the 300-400 level (excluding 303) including:
 - At least one course from 403, 407, 414, 440, 445, 460, 465, 470
 - At least one course from 408, 410, 412, 422, 424, 428, 450, **455**, 454, 466
 - Physics 230/280#, 231/281#
- Decisions concerning the most appropriate 300-400 level courses for each student should be made in consultation with mathematics advisers, particularly for those students who are seeking teacher certification in mathematics and students who are planning graduate study.
Mathematics 455 is strongly recommended.
- 2.0 average in all mathematics courses and also in all 300, 400-level mathematics courses
- Minimum of 39 hours of 300 and 400 level courses
- Electives to complete 120 hours

*Also satisfies requirement in the major.

#Also satisfies general education requirement.

Sample Syllabus for Math 355

Course:	Math 355
Title:	Introduction to Analysis I
Credit:	3 hours
Faculty:	Faculty name; office phone, email address, and office hours
Prerequisites:	Math 245, 255, and 300 with minimum grades of C.
Course Description:	Theoretical investigation of real sequences, functions, limits, and continuity.
Course Objectives:	The purpose of the course is to give students a deeper understanding of the topics covered Calculus I and Calculus II and to prepare the student for future study of analysis.
Attendance Policy:	Specify the attendance policy.
Make-up Policy:	State the policy for make-up exams, projects, papers, etc.
Evaluation (Sample):	Eight assignments (10 points each) Three regular exams (100 points each) Comprehensive final exam (120 points) At the end of the course all the scores will be added together and grades will be determined by the following scale: $90\% \leq A \leq 100\%$, $80\% \leq B < 90\%$, $70\% \leq C < 80\%$, $60\% \leq D < 70\%$, $F < 60\%$.
Textbook (Sample):	Edward D. Gaughan, <i>Introduction to Analysis</i> , Fifth Edition, American Mathematical Society, 2009.
Topics:	The following topics will be covered. <ul style="list-style-type: none">• Preliminaries: Sets; Relations and Functions; Mathematical Induction and Recursion, Equivalent and Countable Sets.• Sequences: Sequences and Convergence; Cauchy Sequences; Arithmetic Operations on Sequences; Subsequences and Monotone Sequences.• Limits of Functions: Definition of the Limit of a Function; Limits of Functions and Sequences; Algebra of Limits; Limits of Monotone Functions.• Continuity: Continuity of a Function at a Point; Algebra of Continuous Functions; Uniform Continuity: Open Closed, and Compact Sets; Properties of Continuous Functions.
ADA Statement:	Insert the current ADA Statement.

Sample Syllabus for Math 455

Course:	Math 455
Title:	Introduction to Analysis II
Credit:	3 hours
Faculty:	Faculty name; office phone, email address, and office hours
Prerequisites:	Math 355 with a minimum grade of C
Course Description:	Rigorous development of the derivative, the definite integral, sequences and series of functions, and improper integrals.
Course Objectives:	The purpose of the course is to give students a deeper understanding of the topics covered Calculus I and Calculus II and to prepare the student for future study of analysis.
Attendance Policy:	Specify the attendance policy.
Make-up Policy:	State the policy for make-up exams, projects, papers, etc.
Evaluation (Sample):	Eight assignments (10 points each) Three regular exams (100 points each) Comprehensive final exam (120 points) At the end of the course all the scores will be added together and grades will be determined by the following scale: $90\% \leq A \leq 100\%$, $80\% \leq B < 90\%$, $70\% \leq C < 80\%$, $60\% \leq D < 70\%$, $F < 60\%$.
Textbook (Sample):	Edward D. Gaughan, <i>Introduction to Analysis</i> , Fifth Edition, American Mathematical Society, 2009.
Topics:	The following topics will be covered. <ul style="list-style-type: none">• Differentiation: The Derivative of a Function; The Algebra of Derivatives; Rolle's Theorem and the Mean-Value Theorem; L'Hospital's Rule and the Inverse-Functions Theorem.• The Riemann Integral: The Riemann Integral; Classes of Integrable Functions; Riemann Sums; The Fundamental Theorem of Integral Calculus; algebra of Integrable Functions; Derivatives of Integrals; Mean-Value and Change-of-Variable Theorems.• Infinite Series: Convergence of Infinite Series; Absolute Convergence and the Comparison Test; Ratio and Root Tests; Conditional Convergence; Power Series; Taylor Series.• Sequences and Series of Functions: Pointwise and Uniform Convergence; Consequences of Uniform Convergence; Uniform Convergence of Power Series.
ADA Statement:	Insert the current ADA Statement.