

THE UNIVERSITY OF NORTH CAROLINA ASHEVILLE
FACULTY SENATE

Senate Document Number SD3322S
Date of Senate Approval 3/03/2022

Statement of Faculty Senate Action:

APC Document 28 (MATH): Update Prerequisites for MATH 441, CSCI 441 and MATH 452

Effective Date: Fall 2022

1a. Delete: On page 241, the prerequisite for **MATH 441:**

441 Numerical Analysis (CSCI 441) (3)

The theory and methods behind solving mathematical problems numerically. Topics include polynomial approximation, numerical integration, matrix algebra, solutions to systems of non-linear equations and numerical solutions to differential equations. Prerequisites: MATH 192 and 365; or permission of instructor. Odd years Spring.

Add: On page 241, in place of deleted entry:

441 Numerical Analysis (CSCI 441) (3)

The theory and methods behind solving mathematical problems numerically. Topics include polynomial approximation, numerical integration, matrix algebra, solutions to systems of non-linear equations and numerical solutions to differential equations. Prerequisites: MATH 192, 365; CSCI 182 or 183 or 185; or permission of instructor. Odd years Spring.

1b. Delete: On page 110, the prerequisite for **CSCI 441:**

441 Numerical Analysis (MATH 441) (3)

The theory and methods behind solving mathematical problems numerically. Topics include polynomial approximation, numerical integration, matrix algebra, solutions to systems of non-linear equations and numerical solutions to differential equations. Prerequisites: MATH 192 and 365; or permission of instructor. Odd years Spring.

Add: On page 110, in place of deleted entry:

441 Numerical Analysis (MATH 441) (3)

The theory and methods behind solving mathematical problems numerically. Topics include polynomial approximation, numerical integration, matrix algebra, solutions to systems of non-linear equations and numerical solutions to differential equations. Prerequisites: MATH 192, 365; CSCI 182 or 183 or 185; or permission of instructor. Odd years Spring.

2. **Delete:** On page 241, the prerequisite for **MATH 452:**

452 Introduction to Mathematical Models (3)

The development and analysis of mathematical equations based on real world situations. Special emphasis is given to systems of time-dependent equations, their stability analysis, and the assessment of their relevance to the application.

Prerequisite: MATH 394 or permission of instructor. Even years Spring.

Add: On page 241, in place of deleted entry:

452 Introduction to Mathematical Models (3)

The development and analysis of mathematical equations based on real world situations. Special emphasis is given to systems of time-dependent equations, their stability analysis, and the assessment of their relevance to the application.

Prerequisite: MATH 394; CSCI 182 or 183 or 185; or permission of instructor. Even years Spring.

Impact: There will be no impact on resource needs, or on other departments and programs resulting from the additional prerequisite. The impact on students is minimal. The mathematics major currently requires students to take an introductory programming course (CSCI 182 or 183), but adding this prerequisite to MATH 441 and MATH 452 may encourage students to take this requirement early in their undergraduate career. CSCI 185 is also included because the Department of Mathematics and Statistics anticipates adding this course as an option to fulfill the programming requirement for the major. CSCI 185 is an introduction to programming course and should fulfill any requirement that allows CSCI 182 or 183. Moreover, MATH 441 and MATH 452 attract students from other majors, and CSCI 185 provides another way for students to fulfill the programming prerequisite.

MATH 441 and MATH 452 are not required courses for any of the concentrations within the major, and therefore students would be able to take other courses if they do not fulfill the prerequisites for these two particular courses. Students from computer science, physics, and engineering often enroll in MATH 441 or MATH 452, but these students typically have had previous programming experience.

Rationale: Both MATH 441 and MATH 452 require students to implement algorithms in a computational framework. The main goal of MATH 441 is to provide a systematic introduction to numerical methods, as a first step in understanding the mathematics of computation and how it is used in solving real world problems. The course focuses on the construction, analysis and implementation of numerical algorithms, and students implement these algorithms in R or Python.

In MATH 452, students learn to formulate, simulate and analyze mathematical models and apply these tools to understand real world phenomena. Computational software is essential for visualizing data, estimating parameters in models, and simulating models, and it is used heavily throughout the course. At least two weeks of the course are devoted to teaching students basic programming skills.

In recent years, most of the students who enroll in MATH 441 and MATH 452 have taken an introductory programming course. For the small number of students who have not had any programming experience, it is difficult for them to learn basic programming skills in addition to the mathematical content in these two courses. The additional prerequisite will lead to greater student success in these courses, and it will allow instructors to devote more time to the core content of the courses. Moreover, MATH 441 is cross-listed as CSCI 441, and it is expected that a 400-level CSCI course would require at least an introductory programming course.