Special & Advanced Mathematics Courses for Fall 2023

Note: ***It is recommended that both MATH 290 and 300 be taken by the end of the second year to permit the widest possible selection of courses in the third and fourth years.***

Visit http://math.lafayette.edu/ for updates on these and other courses anticipated for next academic year.

264 - Differential Equations ***(Abedin)***
An introductory course in ordinary differential equations including techniques of elementary linear algebra. Emphasis is on first-order equations, higher-order linear equations, and systems of equations. Topics include qualitative analysis of differential equations, analytical and numerical solutions, Laplace transforms, existence and uniqueness of solutions, and elemental models in science and engineering. ***Prerequisite: MATH 263***

272 - Linear Algebra with Applications ***(Zhou)***
An introductory course in linear algebra emphasizing applications to fields such as economics, natural sciences, computer science, statistics, and engineering. The course covers solutions of systems of equations, matrix algebra, vector spaces, linear transformations, determinants, eigenvalues, and eigenvectors. ***Corequisite: MATH 263 or permission of instructor***

287 – Introduction to Data Modeling (Xu)
This course will examine advanced methods for analyzing data. Topics will include experimental design concepts, one- and two-way ANOVA (and interaction), multiple regression and ANCOVA, analysis of categorical outcomes (including logistic regression), and power. Time permitting, additional topics may be covered. The course emphasizes the correct application and interpretation of these methods, including assessment of underlying assumptions. Applications will require use of statistical software (presumably R), which is left to the discretion of the instructor. ***Prerequisite: MATH 186 or 286 or 336 or PSYC 120***

290 - Transition to Theoretical Math ***(Zulli)***
An introduction to the concepts and techniques that permeate advanced mathematics. Topics include set theory, propositional logic, proof techniques, relations, and functions. Special emphasis on developing students' facility for reading and writing mathematical proofs. Examples and additional topics are included from various branches of mathematics, at the discretion of the instructor. ***Corequisite: MATH 263 or permission of instructor***

301 - Case Studies in Mathematical Modeling ***(Storey)***
A course which engages students in the creation of mathematical models to answer questions about a variety of phenomena. Students work in small teams on a sequence of projects which require the formulation, analysis, and critical evaluation of a mathematical model and conclude with the submission of a written report by each student. ***Prerequisite: MATH 272 or 300 and 282***

325 - Combinatorics ***(Grodzicki)***
An introduction to the techniques and theory of enumeration of finite sets. Topics include combinations, permutations, generating functions, recurrence relations, the inclusion-exclusion principle, block designs, and graph theory. ***Prerequisite: MATH 263, or permission of instructor; reading and writing proofs will be a significant part of the course, so MATH 290 could be useful, though it is not a prerequisite***

335 - Probability ***(Fisher/Gaugler)***
A development of basic probability theory including the axioms, random variables, expected value, the law of large numbers, and the central limit theorem. Additional topics include distribution functions and generating functions. ***Prerequisite: MATH 263***

336 - Mathematical Statistics ***(Liebner)***
A mathematical development of fundamental results and techniques in statistics. Topics include estimation, sampling distributions, hypothesis testing, correlation and regression. ***Prerequisite: MATH 335***

338 - Advanced Regression Analysis ***(Gaugler)***
Topics include simple linear regression, multiple linear regression, and nonlinear regression. More specifically, the course covers applications of least squared techniques, inference, diagnostics such as residual analysis and the associated remedial measures, and the use of ANOVA in regression. The course uses a matrix-based approach. In addition, this course shows how regression is used in many other fields through practical application of the techniques covered in this class in real-world scenarios. ***Prerequisite: MATH 336 and one of MATH 272 or 300***

343 - Advanced Multivariable Calculus ***(Corvino)***
A continuation of multivariable calculus from Mathematics 263, using concepts from linear algebra. Topics include the derivative as a linear transformation, the Chain Rule, the Inverse and Implicit Function Theorems, the Change of Variables Theorem, and the integral theorems of Green, Gauss and Stokes; additional topics may include differential forms and series of functions. ***Prerequisite: MATH 263, and MATH 272 or MATH 300***

351 - Abstract Algebra I ***(Dougherty)***
An introduction to some of the fundamental ideas and structures of abstract algebra. Homomorphisms and isomorphisms, substructures and quotient structures are discussed for algebraic objects such as fields, vector spaces, rings, and groups. Other topics may include factorization in rings, and finite group theory. ***Prerequisite: MATH 290***

357 - Real Analysis II (*Abedin)*
An introduction to metric spaces and measure theory. Topics covered include metric space topology, compactness and completeness, uniform convergence of functions; basic measure theory, construction of Lebesgue measure on the real line, and the definition and basic convergence properties of the Lebesgue integral. ***Prerequisite: MATH 356***

383 – Numerical Analysis for Math Modeling ***(Lewis)***
A course in the study of numerical algorithms for approximating solutions to math models without explicit analytic solutions. The course will be application-driven, with numerical techniques developed in response to problems that arise when analyzing models from physics, biology, engineering, and other fields. Topics will include interpolation and curve fitting, numerical differentiation and integration, Runge-Kutta and other numerical methods for solving ODEs, and eigenvalue algorithms. Emphasis will be placed on implementing algorithms via computer programming. ***Prerequisite: MATH 263 and a course containing exposure to ordinary differential equations (MATH 264, 282, or 310), or permission of instructor***

Special Topics Courses anticipated for Spring 2024 :

- **Special Topics in Algebra** ***(prerequisite Math 351)***
- **Special Topics in Applied Mathematics** ***(prerequisite Math 282 or permission of instructor)***

Anticipated Courses for Spring 2024 :

- **182 Discrete Mathematics**
- **264 Differential Equations**
- **272 Linear Algebra with Applications**
- **282 Techniques of Mathematical Modeling**
- **286 Probability & Mathematical Statistics**
- **290 Transition to Theoretical Mathematics**
- **300 Vector Spaces**
- **306 Operations Research**
- **310 Ordinary Differential Equations**
- **335 Probability**
- **336 Mathematical Statistics**
- **337 Introduction to Stochastic Processes**
- **356 Introduction to Real Analysis**
- **400 Senior Seminar**