

# ACTUARIAL SCIENCES

---

**John Symms**

Associate Professor of Mathematics

Broadly speaking, actuaries are professionals who analyze financial risks of future events. Trained in mathematics, statistics, economics and finance, actuaries quantify these risks by building and evaluating mathematical models. Such analyses are essential for the success of businesses in areas such as insurance, investment, and employee benefits. The Carroll University Actuarial Sciences Major gives students a broad and in-depth background in these core disciplines in preparation for entry into the actuarial sciences profession.

Carroll University has internship programs with Northwestern Mutual and the Assurant insurance companies. Each year, representatives from Northwestern Mutual and Assurant select interns from among Carroll University Actuarial Science majors for full-time (or part-time) paid internships. Selected student interns receive an authentic experience in the actuary profession while earning Carroll University credit. The full-time internships also include 100 hours of paid study time for the intern's next actuarial sciences exam.

## **Learning Outcomes for Actuarial Science**

Students majoring in actuarial science are expected to:

1. Develop an understanding of the actuarial profession, what actuaries do, and how they do it.
2. Develop a knowledge base and proficiency in the core subjects needed for entry into the profession.
3. Develop an appreciation for the linkages between these core subjects.
4. Develop the critical and analytical thinking skills necessary for success in the profession.
5. Develop the communication skills that are essential in the business environment.
6. Develop the learning skills necessary for continued success in the profession.

## **Actuarial Sciences Major (76 credits)**

**Bachelor of Science**

### **Required Major Courses**

Accounting 205, Financial Accounting  
Accounting 206, Managerial Accounting  
Actuarial Science 301, Financial Mathematics  
Actuarial Science 302, Probability  
Actuarial Science 401, Financial Economics

## ACTUARIAL SCIENCE

---

Actuarial Science 402, Life Contingencies  
Business 101, Introduction to Business  
Business 304, Principles of Finance  
Economics 124, Principles of Economics I - Microeconomics  
Economics 212, Applied Statistics for Business  
Economics 225, Principles of Economics II - Macroeconomics  
Mathematics 112, Introduction to Statistics  
Mathematics 160, 161, 207, Calculus I, II and III  
Mathematics 208, Linear Algebra

### **Required Support Courses: (Required for all majors)**

Computer Science 107, Problem Solving Using Information Technology  
Computer Science 110, Problem Solving through Programming  
Computer Science 211, Database, Web Creation and Networks

### **301. Financial Mathematics**

**4 credits**

Workshop-style course that develops fundamental concepts of financial mathematics and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flows. Additionally, the course provides an introduction to financial instruments, including derivatives, and the concept of no-arbitrage as it relates to financial mathematics. (*Sp, even years*) Prerequisite: MAT 161.

### **302. Probability**

**4 credits**

This course develops fundamental probability tools for quantitatively assessing risk. Topics include general probability, univariate probability distributions (including binomial, negative binomial, geometric, hypergeometric, Poisson, uniform, exponential, gamma, and normal), and multivariate probability distributions (including the bivariate normal). Application of these tools to problems encountered in actuarial science is emphasized. (*Sp, odd years*) Prerequisite: MAT 207. May not be taken for credit by those who have taken MAT 312.

### **313. Time Series and Forecasting**

**2 credits**

Workshop-style course that develops fundamental concepts and skills in time series/forecasting. Topics include linear time series models; moving average; ARIMA models; estimation, data analysis and forecasting with time series models; Forecast errors and confidence intervals. This course meets VEE requirements for Time Series/Forecasting. Offered when there is sufficient student demand (at least seven students take the course) and when sufficient time is provided to secure staffing. Prerequisites: MAT 208, ECO 212, and ECO 225.

### **380/480. Internship in Actuarial Science**

**4-16 credits**

Professional work experience in the actuarial sciences under the supervision of faculty and professional actuaries. Course requirements will depend on the type of internship. S/U graded. (*Fa, Wn, Sp, Su*) Prerequisites: Junior or senior standing and approval of instructor are required prior to registration.

**401. Financial Economics**

**4 credits**

Workshop-style course that develops the theoretical basis of certain financial-economic models and the application of those models to insurance and other financial risks. Topics include interest rate models, rational valuation of derivatives securities, simulation, and risk management techniques. (*Fall, even years*) Prerequisite: ASC 301.

**402. Life Contingencies**

**4 credits**

Workshop-style course that develops theoretical basis of life contingencies and the application of those models to insurance and other financial risks. Topics include survival models, Markov Chain models, life insurances and annuities, and Poisson processes. (*Fall, odd years*) Prerequisite: ASC 302.