

# ACTUARIAL SCIENCE

Actuaries measure and manage risk, and have a deep understanding of mathematics, statistics and business. With this knowledge, they help businesses grow and provide value to their customers, help leaders make strategic decisions, and help consumers prepare for their future. In demand, actuaries work for and with businesses with a financial focus – such as life, health, and property-casualty insurance, along with banking, investments, government, energy, e-commerce, marketing, employee benefits, product development, enterprise risk management, predictive analytics, and consulting.

Students studying actuarial science will acquire the knowledge base and skills in finance, mathematics, and statistics needed to pass the preliminary actuarial exams offered by the Society of Actuaries and Casualty Society of America, while acquiring essential skills to be successful in the field.

## Undergraduate Major:

**The Department of Finance in the Ivy College of Business** offers a major in actuarial science. Students will complete the business general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the bachelor of science (B.S.) degree, and 29 additional credits in the major.

The actuarial science major, intended for students with strong quantitative backgrounds and interest in business, has the goal of educating students in business and risk management, while providing the technical and analytical skills needed to enable them for certification as an actuary (via the 5 preliminary exams of the profession). The major is an excellent opportunity for individuals who want to help businesses grow and provide value to their customers, help leaders make strategic decisions, and help consumers prepare for their future.

## Certificate:

The certificate in actuarial science is available from the **College of Liberal Arts and Sciences** for non-actuarial science majors at Iowa State. The certificate requires 23 credits from a designated list of courses, of which 9 credits must stand-alone. There are 9 prerequisite courses required for the certificate's required courses.

The certificate in actuarial science is intended for students studying mathematics, statistics, or other STEM disciplines at Iowa State (or who hold a baccalaureate degree from an accredited institution) who wish to prepare for a career in the field while obtaining the advanced technical and analytical skills in their chosen major. Students completing the certificate will have sufficient background to pass the first 4 preliminary exams of the profession, along with applying actuarial mathematics to

problems in finance, investments, and risk analysis for a broad range of businesses and consumers.

## For undergraduate curriculum in business, major in actuarial science.

The Department of Finance offers a major in actuarial science. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the bachelor of science (B.S.) degree, and 29 additional credits in the major.

Actuaries measure and manage risk and work for and with businesses with a financial focus, such as finance and insurance. The actuarial science program provides a background in probability, statistics, finance, and actuarial mathematics to enable students to pass the 5 preliminary exams offered by the Society of Actuaries and Casualty Society of America. After completion of this program, students will acquire the business-related skills needed to be a successful actuary. These include the ability to: understand how a business is organized and functions; communicate effectively in written, oral, visual, and electronic modes; work in teams; make ethical choices; use quantitative and analytical methods to address unstructured business problems; think critically; understand financial statements; and understand markets and investments.

Areas of study in the field of actuarial science include interest theory, theory of probability, financial futures and options, loss models, credibility theory, and mathematics of life contingencies.

The instructional objective of the Actuarial Science program is to provide a well-rounded professional business education in actuarial science. Such a program will provide the student with:

1. a mastery of actuarial concepts and methods of analysis
2. a basic understanding of insurance operations in a global setting and of the role of financial institutions in the economy
3. an ability to effectively communicate and work with others as an actuary
4. an ability to demonstrate leadership capabilities in actuarial, financial analysis, and portfolio management.

In addition to the specific business requirements, actuarial science majors must also complete:

MATH 240	Mathematics of Investment and Credit	3
STAT 341	Introduction to the Theory of Probability and Statistics I	4
STAT 342	Introduction to the Theory of Probability and Statistics II	4
FIN 424	Financial Futures and Options	3
ACSCI 401	Loss Models I	3

ACSCI 402	Credibility Theory	3
FIN 464	Risk Management Derivatives	3
MATH 441	Life Contingencies I	3
MATH 442	Life Contingencies II	3
Total Credits		29

**Curriculum:****International Perspective: (3)** (May count toward Global Perspective)

Select from University approved list <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current>

**U.S. Diversity: (3)** (May also be used to fulfill another area requirement)

Select from University approved list <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses>

**Communications: (13)**

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 302	Business Communication	3
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1

**Humanities & Social Sciences: (9)**

Select from College approved list <https://www.business.iastate.edu/undergraduate/majors-minors/>

**Global Perspectives: (6)** (May count 3 credits of International Perspective here)**Natural Science: (3)**

Select from College approved list <https://www.business.iastate.edu/undergraduate/majors-minors/>

**Pre-Professional Program – Foundation: (23)**

BUSAD 102	Business Learning Team Orientation	1
	or BUSAD 103 Orientation	
COM S 113	Introduction to Spreadsheets and Databases	3
MATH 165	Calculus I	4
ECON 101	Principles of Microeconomics	3
BUSAD 250	Introduction to Business	3
ECON 102	Principles of Macroeconomics	3
STAT 226	Introduction to Business Statistics I	3
ACCT 284	Financial Accounting	3

**Supporting Courses: (24)**

ACCT 215	Legal Environment of Business	3
BUSAD 203	Business Careers and Employment Preparation	1
FIN 320	Investments	3
MATH 166	Calculus II	4
MATH 207	Matrices and Linear Algebra	3
MATH 265	Calculus III	4
PHIL 230	Moral Theory and Practice	3
STAT 326	Introduction to Business Statistics II	3

**Professional Program – Business Core: (24)**

ACCT 285	Managerial Accounting #	3
FIN 301	Principles of Finance	3
MGMT 371	Organizational Behavior	3
MGMT 372	Responsible Management and Leadership in Business	3
MIS 301	Management Information Systems	3
MKT 340	Principles of Marketing	3
SCM 301	Supply Chain Management	3
Above courses are prerequisites and must be taken prior to:		
MGMT 478	Strategic Management	3

**Professional Program – Actuarial Science: (29)\*\***

MATH 240	Mathematics of Investment and Credit	3
STAT 341	Introduction to the Theory of Probability and Statistics I	4
STAT 342	Introduction to the Theory of Probability and Statistics II	4
FIN 424	Financial Futures and Options	3
ACSCI 401	Loss Models I	3
ACSCI 402	Credibility Theory	3
FIN 464	Risk Management Derivatives	3
MATH 441	Life Contingencies I	3
MATH 442	Life Contingencies II	3

\*\*Part of the IFM actuarial exam includes material covered in **FIN 310 Corporate Finance**. Thus, FIN 310 remains *highly recommended as an elective*, and should be taken sooner rather than later.

**Pre-Business students must apply for admission to the Professional Program.**

**Requirements:** Completion of at least 30 credits; all Foundation courses; all ENGL 99 and 101 courses (if required), and ENGL 150; ISU Cumulative

or Foundation GPA of 2.50. Early admission is allowed for Honors-eligible students. (See your adviser for specific information.)

**Notes pertaining to the Curriculum:**

No courses required for the AcSci major/Business degree may be taken Pass/Not Pass (only non-business free electives may be P/NP).

Courses are monitored for prerequisite requirements. All prerequisites will be enforced.

# With the exception of ACCT 285, Pre-Business students cannot take Professional Program courses.

Actuarial Science, B.S.

**Freshman**

Fall	Credits Spring	Credits
BUSAD 102	1 ACCT 284*	3
or BUSAD 103	ECON 102*	3
ECON 101*	3 MATH 166	4
COM S 113	3 BUSAD 250	3
ENGL 150	3 STAT 226	3
MATH 165	4 (Apply to Professional Program)	
PHIL 230	3	
	17	16

**Sophomore**

Fall	Credits Spring	Credits
ACCT 285	3 Business Core	3
BUSAD 203	1 FIN 320	3
STAT 326	3 STAT 341	4
MATH 265	4 ENGL 250	3
MATH 240	3 Global/International Perspective	3
FIN 301*	3 LIB 160	1
(Students should take FM exam during winter break)	(Students should take P exam summer after sophomore year)	
	17	17

**Junior**

Fall	Credits Spring	Credits
FIN 424	3 FIN 464	3
ACSCI 401	3 ACSCI 402	3
SP CM 212	3 STAT 342*	4
Business Core	3 Business Core	3

MATH 207	3 US Diversity or Human/Social Science	3
Natural Science	3 (Students should take IFM (or STAM) exam summer after junior year)	
	18	16

**Senior**

Fall	Credits Spring	Credits
MATH 441	3 MATH 442	3
Business Core	3 Global Perspective	3
Business Core	3 ACCT 215	3
ENGL 302	3 MGMT 478	3
Human/Social Science	3 Human/Social Science	3
(Students should take STAM (or IFM) exam during winter break)	(Students should take LTAM exam)	
	15	15

Total Credits: 131

Total Credits = 131 if US Diversity and Human/Social Sciences are dual assigned

\* Validation of Educational Experience courses

P = Probability exam

FM = Financial Mathematics exam

IFM = Investments & Financial Markets exam

STAM Short-Term Actuarial Mathematics exam

LTAM Long-Term Actuarial Mathematics exam

**For the certificate in actuarial science.**

**Purpose**

The certificate in actuarial science provides students with a major in mathematics, statistics, or other STEM disciplines (or who hold a baccalaureate degree from an accredited institution) with the necessary background in mathematics, statistics, and the basic principles of finance for a career in actuarial science while obtaining advanced technical and analytical skills in their chosen major. Students completing the certificate will have the background to pass 4 of the preliminary exams in the profession, will have obtained the specialized knowledge required for success in the field, and will be prepared to work for and with businesses with a financial focus, such as insurance, banking, and investments.

**Learning Outcomes**

After completing the certificate in actuarial science, students will:

- master the quantitative and analytical skills required to obtain an entry-level position in the profession,
- have sufficient background to pass the first 3 or 4 professional exams offered by the professional actuarial organizations,
- apply actuarial mathematics to problems in finance, investment, and risk analysis, and
- demonstrate the ability to communicate the results of quantitative analysis, both in writing and orally.

### Requirements

The certificate in actuarial science requires the completion of 7 courses, totaling 23 credit hours.

These courses are:

FIN 320	Investments	3
FIN 424	Financial Futures and Options	3
MATH 240	Mathematics of Investment and Credit	3
MATH 441	Life Contingencies I	3
MATH 442	Life Contingencies II	3
STAT 341	Introduction to the Theory of Probability and Statistics I *	4
STAT 342	Introduction to the Theory of Probability and Statistics II *	4

*\*Both STAT 341 and STAT 342 are worth 3 credits prior to the 2018-2019 catalog.*

The seven courses in the list above require 9 prerequisite courses. These courses are: ACCT 284, ECON 101, FIN 301, MATH 165, MATH 166, MATH 265, MATH 207 or 317, STAT 226 (or another introductory statistics course: STAT 101, 104, 105, 201, 231, 305, 322 or 330), and STAT 326 (or STAT 301).

In order to be admitted to the certificate program, students must complete ACCT 284, ECON 101, MATH 165, MATH 166, and STAT 226 (or another introductory statistics course) with a cumulative GPA of at least 2.5.

At least 9 credits used for the certificate cannot be used to meet any other department, college or university requirement for the baccalaureate degree except to satisfy the total credit requirement for graduation and to meet credit requirements in courses numbered 300 or above.

Courses for the certificate cannot be taken on a pass/not-pass basis.

A cumulative GPA of at least 2.0 is required in the seven courses for the certificate.

**Courses primarily for undergraduates:**

### ACSCI 401: Loss Models I

(3-0) Cr. 3.

Probability distributions used to model uncertain events in actuarial practice. Aggregate models, evaluating the effect of various coverage modifications such as deductibles and limits. Construction of empirical models, calculations of common risk measures, and calculations of commonly used severity and frequency models. Various methods for estimating distributional parameters and their properties.

### ACSCI 402: Credibility Theory

(3-0) Cr. 3.

Bayesian estimation, including conjugate priors, posterior distributions, and the Poisson-gamma model. Credibility theory, including limited fluctuation credibility, applying Bayesian analysis for both discrete and continuous models, Buhlmann and Buhlmann-Straub models, and their relationship to Bayesian models. Simulating discrete and continuous random variables and the bootstrap method for estimating mean squared error.