

# ACTUARIAL SCIENCE

Actuaries have a deep understanding of finance, business, mathematics, and statistics. With this knowledge, they help businesses measure and manage risk, develop new products, and make strategic value-enhancing decisions. In high demand, actuaries work for and with businesses engaged in many different types of activities, including life-, health-, and property-casualty insurance, banking, investments, financial services, government, energy, e-commerce, marketing, 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 business 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 background and training needed for certification as an actuary (via the 5 preliminary exams of the profession). The major is an excellent opportunity for individuals who want to use advanced technical and analytical skills to solve important business problems.

## 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.

## Undergraduate Major in Actuarial Science

**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.

Students are limited to three business majors/degrees within the Ivy College of Business, or a total of three business majors/minors within the college. This limit is on business majors/degrees/minors only, and does not apply to multiple majors/degrees/minors taken outside the Ivy College of Business.

For more information on the undergraduate major in Actuarial Science, please visit: <https://ivybusiness.iastate.edu/undergraduate/majors-minors/actuarial-science/>

## Curriculum:

While the General Education Requirements for Actuarial Science majors remains the same as all other Business majors, there are specific changes in the following areas that must be completed in order to receive a Bachelor's degree in Actuarial Science:

**Pre-Professional Program – Foundation: (21)**

BUSAD 102	Business Learning Team Orientation or BUSAD 103 Orientation	1
BUSAD 203	Professional Development in Business	1
COM S 113	Introduction to Spreadsheets and Databases	3
MATH 165	Calculus I	4
ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
STAT 226	Introduction to Business Statistics I	3
ACCT 284	Financial Accounting	3

**Supporting Courses: (23)**

ACCT 215	Legal Environment of Business	3
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: (27)**

ACCT 285	Managerial Accounting #	3
ENTSP 310	Entrepreneurship and Innovation	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
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# With the exception of ACCT 285, Pre-Business students cannot take Professional Program courses.

**Major – 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.**

NOTE: Actuarial Science majors must take STAT 326 Introduction to Business Statistics II as part of the supporting courses.

Actuarial Science, B.S.

*Sample 4-Year Plan (Your plan may differ)*

**Freshman**

Fall	Credits Spring	Credits
BUSAD 102 or 103	1 ACCT 284*	3
ECON 101*	3 ECON 102*	3
COM S 113	3 MATH 166	4
ENGL 150	3 STAT 226	3
MATH 165	4 BUSAD 203	1
PHIL 230	3 HUM/SOC SCI	3
	<b>17</b>	<b>17</b>

**Sophomore**

Fall	Credits Spring	Credits
ACCT 285	3 Business Core Course	3
STAT 326	3 FIN 320	3
MATH 265	4 STAT 341	4
MATH 240	3 ENGL 250	3
FIN 301*	3 Global/International Perspective@	3
(Students should take FM exam during winter break)	LIB 160	1

(Students should take P exam summer after sophomore year)

<b>Junior</b>		
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>
FIN 424	3 FIN 464	3
ACSCI 401	3 ACSCI 402	3
SP CM 212	3 STAT 342*	4
Business Core Course	3 Business Core Course	3
MATH 207	3 US Diversity <sup>#</sup>	3
Natural Science	3 (Students should take IFM (or STAM) exam summer after junior year)	
<b>18</b>		<b>16</b>
<b>Senior</b>		
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>
MATH 441	3 MATH 442	3
Business Core Courses	9 Global/International Perspective <sup>@</sup>	3
ENGL 302	3 ACCT 215	3
(Students should take STAM (or IFM) exam during winter break)	MGMT 478**	3
	HUM/SOC SCI	3
	(Students should take LTAM exam)	
<b>15</b>		<b>15</b>

**Total Credits: 131**

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

@ Courses in these requirements may also be used as Global Perspective.

# US Diversity courses may be used to satisfy HUM/SOC SCI.

\* Validation of Educational Experience courses

\*\* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

FM = Financial Mathematics exam

P = Probability exam

IFM = Investments & Financial Markets exam

STAM = Short-Term Actuarial Mathematics exam

LTAM = Long-Term Actuarial Mathematics exam

Students must be admitted to the professional program in business to major in actuarial science. The requirements to enter the professional program are:

1. Completion of at least 30 credits, all Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses. Early admission is allowed for Honors-eligible students. (See your advisor for specific information.)

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses from a four-year institution.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).

5. 131 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.

6. A grade of C or better in ENGL 250 required, and also in one other required ENGL course.

7. A grade of C- or better in MATH 166 and MATH 265 required.

8. All 300-level and higher business credits must be earned at a four-year college.

9. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

## Undergraduate Certificate

**For the undergraduate certificate in actuarial science.**

### Purpose

The College of Liberal Arts and Sciences offers a certificate in Actuarial Science. The certificate 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

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.

*Prereq: STAT 341*

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.

*Prereq: ACSCI 401*

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.