Department of Management Science and Statistics

Mission Statement

The mission of the Department of Management Science and Statistics is to offer both undergraduate and graduate educational programs that are of high quality and meet the changing needs of the global community; to provide a supportive learning environment for students; to foster the success of our students in their professional careers; and to create an academic environment that stresses excellence in teaching, intellectual contributions, and service. The Department contributes to the missions of the College and the University through research and education in the quantitative sciences. Theory and analysis are applied to a variety of interdisciplinary problems to discover new approaches for meeting the challenges of decision making in a global arena of expanding technology and information.

Department Information

The disciplines of Management Science and Statistics are integral to modern decision-making processes. These interdisciplinary fields emphasize the use of quantitative methods and computers for analyzing, understanding, visualizing, and interpreting data. Management Science seeks to provide a rational basis for decision analysis across a broad spectrum of business functions such as production/operations, marketing, finance, human resources, project management, logistics, and supply chain management. Statistical methods provide analytical tools for research in high-technology and biomedical industries, insurance, and government agencies. Both disciplines offer the opportunity to pursue advanced graduate studies. The Department of Management Science and Statistics offers a Bachelor of Business Administration (B.B.A.) degree in Management Science, a B.B.A. degree in Actuarial Science, and a Bachelor of Science (B.S.) degree in Statistics and Data Science. The department also offers minors in Actuarial Science, Adaptive Decision Models for Business, Statistics, and Management Science, which are open to all majors in the University. In addition, certificates are offered in Business Analytics, and Operations and Supply Chain Management.

- B.B.A. degree in Actuarial Science (p. 1)
- B.B.A. degree in Management Science (p. 3)
- B.S. degree in Statistics and Data Science (p. 6)

Bachelor of Business Administration Degree in Actuarial Science

Actuarial Science is a discipline that uses mathematics and statistical models to assess and manage risk and to solve emerging financial and social problems. Graduates’ unique blend of analytical and business skills are especially valuable in the insurance and financial services industry. They apply their skills to calculations in life, health, social, and casualty insurance, annuities and pensions. Traditionallly, they have been involved in developing probability tables for natural disasters, unemployment, etc. There is an increasing need for trained actuaries in the insurance industry. The Bachelor of Business Administration (B.B.A.) in Actuarial Science provides students the opportunity to acquire the quantitative and business skills to prepare them for a career as an actuary. The minimum number of semester credit hours for the B.B.A. degree in Actuarial Science is 120, at least 39 of which must be at the upper-division level.

All candidates seeking this degree must fulfill the Core Curriculum requirements, the Common Body of Knowledge (CBK) requirements, and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.B.A. degree in Actuarial Science must fulfill University Core Curriculum requirements. The two courses listed below satisfy both degree requirements and Core Curriculum requirements.

MAT 1214 should be used to satisfy the core requirement in Mathematics (020). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

All degrees in the College of Business require 120 hours. If students elect to take a course that satisfies both a Core and COB requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (http://catalog.uta.edu/undergraduate/bachelorsdegreeeregulations/ degreerequirements/corecurriculumcomponentarearequirements)

- First Year Experience Requirement 3
- Communication 6
- Mathematics 3
- Life and Physical Sciences 6
- Language, Philosophy and Culture 3
- Creative Arts 3
- American History 6
- Government-Political Science 6
- Social and Behavioral Sciences 3
- Component Area Option 3
- Total Credit Hours 42

Common Body of Knowledge (CBK)

All students seeking a B.B.A. degree in the College of Business must complete the following Common Body of Knowledge (CBK) courses in addition to the Core Curriculum.

- ACC 2013 Principles of Accounting I 3
- ACC 2033 Principles of Accounting II 3
- COM 1053 Business and Professional Speech 3
- or COM 1063 Digital Business Communication 3
- ECO 2013 Introductory Macroeconomics 3
- ECO 2023 Introductory Microeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement) 3
- FIN 3013 Principles of Business Finance 3
- GBA 2013 Legal, Social and Ethical Issues in Business 3
- IS 1403 Business Information Systems Fluency 3
- or IS 1413 Excel for Business Information Systems 3
- IS 3003 Principles of Information Systems for Management 3
- MAT 1133 Calculus for Business (satisfies Mathematics Core Curriculum requirement, Actuarial Science majors must take MAT 1214 in lieu of MAT 1133) 3

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MGT 3003 Business Communication and Professional Development 3
MGT 3013 Introduction to Organization Theory, Behavior, and Management 3
MGT 4893 Management Strategy (taken in semester of graduation) 3
MKT 3013 Principles of Marketing 3
MS 1023 Business Statistics with Computer Applications I (Actuarial Science majors must take STA 3003 in lieu of MS 1023) 3
MS 3043 Business Statistics with Computer Applications II (Actuarial Science majors must take STA 3513 in lieu of MS 3043) 3
MS 3053 Management Science and Operations Technology 3

Note: Students majoring in Accounting, Actuarial Science, Economics, Finance, Management Science, and Statistics and Data Science are strongly encouraged to select IS 1413 Excel for Business Information Systems.

In addition to the Core Curriculum requirements and requirements from the College of Business Common Body of Knowledge (CBK), all candidates for the degree must complete the following degree requirements.

Degree Requirements

A. Major Requirements 20
MAT 1224 Calculus II
MAT 2214 Calculus III
STA 3523 Mathematical Statistics
STA 4133 Introduction to Programming and Data Management in SAS
STA 4713 Applied Regression Analysis
STA 4753 Time-Series Analysis

B. Support Work in Major 12
Select four courses from the following:
FIN 4523 Introduction to Risk Management
FIN 4813 Property-Liability Insurance Finance
FIN 4823 Life and Health Insurance Finance
MS 3073 Business Analytics
STA 4233 Introduction to Programming and Data Management in R
STA 4643 Introduction to Stochastic Processes
STA 4933 Internship in Statistics
STA 4963 Actuarial Science Examination Preparation

Total Credit Hours 32

Recommended Four-Year Academic Plan

First Year

Fall
Credit Hours
AIS 1203 Academic Inquiry and Scholarship (core) 3
IS 1403 or IS 1413 Business Information Systems Fluency (CBK) 3
MAT 1214 Calculus I (core and CBK) 4
WRC 1013 Freshman Composition I (Q) (core) 3
American History (core) 3

Spring
Credit Hours
COM 1053 or COM 1063 Business and Professional Speech (CBK) or Digital Business Communication 3
ECO 2023 Introductory Microeconomics (core and CBK) 3
MAT 1224 Calculus II (major) 4
STA 3003 Applied Statistics (CBK) 3
WRC 1023 Freshman Composition II (Q) (core) 3

Second Year

Fall
Credit Hours
ACC 2013 Principles of Accounting I (CBK) 3
ECO 2013 Introductory Macroeconomics (CBK) 3
MAT 2214 Calculus III (major) 4
STA 3513 Probability and Statistics (CBK) 3
Language, Philosophy & Culture (core) 3

Spring
Credit Hours
ACC 2033 Principles of Accounting II (CBK) 3
FIN 3013 Principles of Business Finance (CBK) 3
STA 3523 Mathematical Statistics (major) 3
American History (core) 3
Life & Physical Sciences (core) 3

Third Year

Fall
Credit Hours
MGT 3003 Business Communication and Professional Development (CBK) 3
MS 3053 Management Science and Operations Technology (CBK) 3
STA 4133 Introduction to Programming and Data Management in SAS (major) 3
STA 4713 Applied Regression Analysis (major) 3

Students may choose to take courses during Summer terms to reduce course loads during long semesters.

Course Sequence Guide for B.B.A. Degree in Actuarial Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations.

2 | 09/07/18
majors study a wide variety of topics dealing with daily activities and problems faced by managers in today’s ever-changing world, many career tracks are available to them. The minimum number of semester credit hours required for the Bachelor of Business Administration (B.B.A.) in Management Science is 120, at least 39 of which must be at the upper-division level.

All candidates seeking this degree must fulfill the Core Curriculum requirements, the Common Body of Knowledge (CBK) requirements, and the degree requirements, which are listed below.

**Core Curriculum Requirements (42 semester credit hours)**

Students seeking the B.B.A. degree in Management Science must fulfill University Core Curriculum Requirements in the same manner as other students.

MAT 1053 and MAT 1133 should be used to satisfy the core requirement in Mathematics (020) and the core requirement in the Component Area Option (090). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

MAT 1133 and ECO 2023 may be used to satisfy both Core Curriculum requirements and Common Body of Knowledge (CBK) requirements.

All degrees in the College of Business require 120 hours. If students elect to take a course that satisfies both a Core and COB requirement, students may need to take an additional course to meet the 120 hours.

**Core Curriculum Component Area Requirements**

Students seeking the B.B.A. degree in Management Science must complete the following Common Body of Knowledge (CBK) courses in addition to the Core Curriculum.

- ACC 2013: Principles of Accounting I (3)
- ACC 2033: Principles of Accounting II (3)
- COM 1053: Business and Professional Speech (3)
- ECO 2013: Introductory Macroeconomics (3)
- ECO 2023: Introductory Microeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement) (3)
- FIN 3013: Principles of Business Finance (3)
- GBA 2013: Legal, Social and Ethical Issues in Business (3)

1. College of Business students should take MAT 1214 and ECO 2023 to satisfy both Core Curriculum and CBK requirements.

**Bachelor of Business Administration Degree in Management Science**

Solving problems and making decisions are integral parts of every organization’s daily operations. The discipline of Management Science focuses on the development and application of scientific and mathematical modeling to aid organizations in making these decisions. Students will have the opportunity to develop and apply analytical models and to acquire essential computer skills necessary in the increasingly technical business environments. Many organizations hire management science majors for managerial positions because of their computing skills and problem-solving abilities. These skills are essential in business environments that are seeking increased efficiency and productivity. The focus of this degree is on applications and appropriate software with a view toward how a manager can effectively apply quantitative models to improve the decision-making process.

The diverse courses offered provide students with an opportunity to specialize in professional fields such as operations and logistics. Thus, students have the option of emphasizing operations and logistics or using their breadth of marketable skills and abilities to solve problems in a variety of organizations and functional areas. The degree is designed to prepare students for careers in manufacturing, materials management, service operations, procurement, third party logistics, transportation processes, and management consulting. Since management science
Department of Management Science and Statistics

Degree Requirements (without track)

A. Major Requirements
- MS 3403 Logistics Management
- MS 4333 Project Management
- MS 4343 Production/Operations Management

Total Credit Hours 9

B. Support Work in Major
- Select five courses from the following:
  - FIN 4523 Introduction to Risk Management
  - FIN 4873 Computer Modeling of Financial Applications
  - MKT 3083 Marketing Research
  - MS 3063 Decision Support Systems
  - MS 3073 Business Analytics
  - MS 3313 Business Applications of Statistics
  - MS 3413 Purchasing and Inventory Management
  - MS 4313 Six Sigma and Lean Operations
  - MS 4323 Simulation Applications in Business

Total Credit Hours 15

Gateway Course

Students pursuing the B.B.A. degree in Management Science must successfully complete the following Gateway Course with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete this course within two attempts, including dropping the course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

MAT 1133 Calculus for Business

Total Credit Hours 3

Note: Students majoring in Accounting, Actuarial Science, Economics, Finance, Management Science, and Statistics and Data Science are strongly encouraged to select IS 1413 Excel for Business Information Systems.

In addition to the Core Curriculum requirements and requirements from the College of Business Common Body of Knowledge (CBK), all candidates for the degree must complete the following degree requirements.

Course Sequence Guide for B.B.A. Degree in Management Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

For options in designing and selecting career tracks and/or certificates, contact the chair of the Management Science and Statistics department or department designee.

Recommended Four-Year Academic Plan

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS 1203 (core)</td>
<td>3</td>
</tr>
<tr>
<td>IS 1403 (or IS 1413)</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1053</td>
<td>3</td>
</tr>
<tr>
<td>WRC 1013 (core)</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total Credit Hours  | 33 |

1 To substitute another course for one of the above electives, a student should submit a petition to their academic advisor and receive approval from the chair of the Management Science and Statistics department or department designee before registering for the course.
American History (core) 3

Spring
COM 1053 or COM 1063 Business and Professional Speech (CBK) 3
or Digital Business Communication
ECO 2023 Introductory Microeconomics (core and CBK) 3
MAT 1133 Calculus for Business (core and CBK) 3
WRC 1023 Freshman Composition II (Q) (core) 3
American History (core) 3

Second Year
Fall
ACC 2013 Principles of Accounting I (CBK) 3
ECO 2013 Introductory Macroeconomics (CBK) 3
MS 1023 Business Statistics with Computer Applications I (CBK) 3
Government-Political Science (core) 3
Life & Physical Sciences (core) 3

Credit Hours 15

Spring
ACC 2033 Principles of Accounting II (CBK) 3
MS 3043 Business Statistics with Computer Applications II (CBK) 3
GBA 2013 Legal, Social and Ethical Issues in Business (CBK) 3
Government-Political Science (core) 3
Language, Philosophy & Culture (core) 3

Credit Hours 15

Third Year
Fall
MGT 3003 Business Communication and Professional Development (CBK) 3
MS 3053 Management Science and Operations Technology (CBK) 3
MGT 3013 Introduction to Organization Theory, Behavior, and Management (CBK) 3
MS 4343 Production/Operations Management (major) 3
Upper-division Business elective (major) 3

Credit Hours 15

Spring
FIN 3013 Principles of Business Finance (CBK) 3
IS 3003 Principles of Information Systems for Management (CBK) 3
MS 3403 Logistics Management (major) 3
MS 4333 Project Management (major) 3
Upper-division Business elective (major) 3

Credit Hours 15

Fourth Year
Fall
MKT 3013 Principles of Marketing (CBK) 3
Upper division business elective, Business Competency course, or free elective (support work) 3
Upper-division business elective (major) 3
Creative Arts (core) 3

Credit Hours 15

Spring
MGT 4893 Management Strategy (CBK) 3
Upper-division business elective (major) 3
Upper-division business elective, Business Competency course, or free elective (support work) 3
Upper-division business elective, Business Competency course, or free elective (support work) 3
Life & Physical Sciences (core) 3

Credit Hours 15

Total Credit Hours 120

1 College of Business students should take MAT 1133 and ECO 2023 to satisfy both Core Curriculum and CBK requirements.

Degree Requirements for Business Analytics (BSA) Track

A. Major Requirements 9
MS 3403 Logistics Management
MS 4333 Project Management
MS 4343 Production/Operations Management

B. Support Work in Major 15
Select five courses from the following:
MS 4313 Six Sigma and Lean Operations
MS 4323 Simulation Applications in Business
MS 4383 Predictive Operational Analytics
MS 4913 Independent Study in Management Science
MS 4933 Internship in Management Science
MS 4953 Special Studies in Management Science
STA 3333 Introduction to Data Science and Analytics
STA 4133 Introduction to Programming and Data Management in SAS
STA 4143 Data Mining
STA 4233 Introduction to Programming and Data Management in R
STA 4753 Time-Series Analysis

C. Additional Support Work 9
MS 3063 Decision Support Systems
MS 3073 Business Analytics
MS 3313 Business Applications of Statistics

Total Credit Hours 33
Degree Requirements for Operations and Supply Chain Management (OSCM) Track

A. Major Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3403</td>
<td>Logistics Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4333</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4343</td>
<td>Production/Operations Management</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Support Work in Major

Select five courses from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3063</td>
<td>Decision Support Systems</td>
<td>3</td>
</tr>
<tr>
<td>MS 3313</td>
<td>Business Applications of Statistics</td>
<td>3</td>
</tr>
<tr>
<td>MS 3413</td>
<td>Purchasing and Inventory Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4313</td>
<td>Six Sigma and Lean Operations</td>
<td>3</td>
</tr>
<tr>
<td>MS 4323</td>
<td>Simulation Applications in Business</td>
<td>3</td>
</tr>
<tr>
<td>MS 4353</td>
<td>Service Operations Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</td>
<td>3</td>
</tr>
<tr>
<td>MS 4383</td>
<td>Predictive Operational Analytics</td>
<td>3</td>
</tr>
<tr>
<td>MS 4443</td>
<td>Supply Chain Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4913</td>
<td>Independent Study in Management Science</td>
<td>3</td>
</tr>
<tr>
<td>MS 4933</td>
<td>Internship in Management Science</td>
<td>3</td>
</tr>
<tr>
<td>MS 4953</td>
<td>Special Studies in Management Science</td>
<td>3</td>
</tr>
<tr>
<td>STA 4753</td>
<td>Time-Series Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

C. Additional Support Work

Select 9 semester credit hours of upper-division coursework

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Completing 9 semester credit hours of upper division business electives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 2</td>
<td>Completing a business competency (9 semester credit hours in a competency).</td>
</tr>
<tr>
<td>Option 3</td>
<td>Completing 9 semester credit hours of free electives.</td>
</tr>
</tbody>
</table>

Total Credit Hours: 33

Bachelor of Science Degree in Statistics and Data Science

Statistics is a science that deals with principles and procedures for obtaining and processing information in order to make decisions in the face of uncertainty. In particular, it deals with collection, organization, analysis, and interpretation of numerical information to answer questions in almost every aspect of modern-day life. Statistical methods are used to address complex questions common in business, government, and science. Employers such as research divisions in pharmaceutical companies, clinical research units at medical centers, quality control or reliability departments in manufacturing companies, corporate planning and financial analysis units, and government agencies require persons with advanced quantitative skills.

The Bachelor of Science (B.S.) degree in Statistics and Data Science provides students with access to such skills preparing them for careers as statistical analysts or for further graduate academic training. The minimum number of semester credit hours required for the Bachelor of Science degree in Statistics and Data Science is 120, at least 39 of which must be at the upper-division level.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Statistics and Data Science must fulfill University Core Curriculum requirements. The courses listed below satisfy both degree requirements and Core Curriculum requirements.

MAT 1214 should be used to satisfy the core requirement in Mathematics (020). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

All degrees in the College of Business require 120 hours. If students elect to take a course that satisfies both a Core and COB requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (http://catalog.utsa.edu/undergraduate/bachelorsdegree/regulations/degreerequirements/corecurriculumcomponentarearequirements)

<table>
<thead>
<tr>
<th>Component Area</th>
<th>Requirement</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year Experience</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Life and Physical Sciences</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Language, Philosophy and Culture</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Creative Arts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>American History</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Government-Political Science</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Component Area Option</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Total Credit Hours: 42

Degree Requirements

A. Required courses in the computational and mathematical sciences

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 1214</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MAT 1224</td>
<td>Calculus II</td>
</tr>
<tr>
<td>MAT 2214</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MAT 2233</td>
<td>Linear Algebra</td>
</tr>
</tbody>
</table>

B. Courses required for the major

1. Required Statistics courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA 3003</td>
<td>Applied Statistics</td>
</tr>
<tr>
<td>STA 3013</td>
<td>Multivariate Analysis for the Life and Social Sciences</td>
</tr>
<tr>
<td>STA 3313</td>
<td>Experiments and Sampling</td>
</tr>
<tr>
<td>STA 3513</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>STA 3523</td>
<td>Mathematical Statistics</td>
</tr>
<tr>
<td>STA 4133</td>
<td>Introduction to Programming and Data Management in SAS</td>
</tr>
<tr>
<td>STA 4233</td>
<td>Introduction to Programming and Data Management in R</td>
</tr>
<tr>
<td>STA 4713</td>
<td>Applied Regression Analysis</td>
</tr>
<tr>
<td>STA 4723</td>
<td>Introduction to the Design of Experiments</td>
</tr>
</tbody>
</table>

2. Select four of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3073</td>
<td>Business Analytics</td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</td>
</tr>
<tr>
<td>STA 4143</td>
<td>Data Mining</td>
</tr>
<tr>
<td>STA 4643</td>
<td>Introduction to Stochastic Processes</td>
</tr>
</tbody>
</table>
### C. Electives in disciplines where statistics is actively applied and practiced

1. **Specialization in Actuarial Science:**
   - ACC 2013 Principles of Accounting I
   - ECO 2013 Introductory Macroeconomics
   - ECO 2023 Introductory Microeconomics
   - FIN 3013 Principles of Business Finance
   - FIN 3023 Intermediate Corporate Finance
   - or FIN 4873 Computer Modeling of Financial Applications
   - STA 4963 Actuarial Science Examination Preparation

2. **Specialization in Biology:**
   - BIO 2313 Genetics
   - BIO 3283 Principles of Ecology
   - BIO 3323 Evolution
   - BIO 3333 Plants and Society
   - BIO 3433 Neurobiology
   - BIO 4033 Conservation Biology

3. **Specialization in Business:**
   - ECO 3123 Introduction to Econometrics and Business Forecasting
   - MKT 3083 Marketing Research
   - MS 3063 Decision Support Systems
   - MS 4313 Six Sigma and Lean Operations
   - MS 4343 Production/Operations Management
   - MS 4363 Quality Management and Control

4. **Specialization in Education:**
   - BBL 3403 Cultural and Linguistic Equity for Schooling
   - EDP 3203 Learning and Development in the Secondary School Adolescent
   - EDU 2103 Social Foundations for Education in a Diverse U.S. Society
   - ESL 3023 Second Language Teaching and Learning in EC–6
   - IDS 2013 Introduction to Learning and Teaching in a Culturally Diverse Society
   - SPE 3603 Introduction to Special Education

5. **Specialization in Mathematics:**
   - MAT 2233 Linear Algebra
   - MAT 3213 Foundations of Analysis
   - MAT 3223 Complex Variables
   - MAT 3613 Differential Equations I
   - MAT 3633 Numerical Analysis
   - MAT 4213 Real Analysis I

6. **Specialization in Psychology:**
   - PSY 1013 Introduction to Psychology
   - PSY 2503 Developmental Psychology
   - PSY 3403 Experimental Psychology
   - PSY 3413 Experimental Projects and Laboratory

Two additional psychology courses at the 3000 or 4000 level

7. **Specialization in Social Sciences:**
   - SOC 1013 Introduction to Sociology

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### D. Lower-division or upper-division business or non-business electives

Select 6 semester credit hours of lower-division or upper-division business or non-business electives.

**Total Credit Hours**: 78

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1. Nine (9) semester credit hours must be upper division. The department has given pre-approval to the following plans of study for specializations in actuarial science, biology, business, education, mathematics, psychology, and social sciences. Other specialization plans and the relevant courses may be submitted for approval to the designated statistics faculty member.

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### Course Sequence Guide for B.S. Degree in Statistics and Data Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

#### Recommended Four-Year Academic Plan

##### First Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>AIS 1203</td>
<td>Academic Inquiry and Scholarship (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MAT 1214</td>
<td>Calculus I (core and major)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>WRC 1013</td>
<td>Freshman Composition I (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>American History (core)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life &amp; Physical Sciences (core)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td>MAT 1224</td>
<td>Calculus II (major)</td>
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<tr>
<td></td>
<td>STA 3003</td>
<td>Applied Statistics (major)</td>
<td>3</td>
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<tr>
<td></td>
<td>WRC 1023</td>
<td>Freshman Composition II (Q) (core)</td>
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<tr>
<td></td>
<td>American History (core)</td>
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<tr>
<td></td>
<td>Life &amp; Physical Sciences (core)</td>
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</table>

**Credit Hours**: 16

##### Second Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>MAT 2214</td>
<td>Calculus III (major)</td>
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<td></td>
<td>STA 3313</td>
<td>Experiments and Sampling (major)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>STA 3513</td>
<td>Probability and Statistics (major)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Creative Arts (core)</td>
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</table>

**Credit Hours**: 16
<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>Government-Political Science (core)</td>
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<tr>
<td>Spring</td>
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<tr>
<td>ECO 2023 Introductory Microeconomics (core)</td>
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<tr>
<td>MAT 2233 Linear Algebra (major)</td>
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<tr>
<td>STA 3013 Multivariate Analysis for the Life and Social Sciences (major)</td>
<td>3</td>
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<tr>
<td>STA 3523 Mathematical Statistics (major)</td>
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<tr>
<td>Government-Political Science (core)</td>
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<td>Third Year</td>
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<tr>
<td>Fall</td>
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<tr>
<td>STA 4133 Introduction to Programming and Data Management in SAS</td>
<td>3</td>
</tr>
<tr>
<td>Course option in major</td>
<td>3</td>
</tr>
<tr>
<td>Course option in specialization track (support work)</td>
<td>3</td>
</tr>
<tr>
<td>Course option in specialization track (support work)</td>
<td>3</td>
</tr>
<tr>
<td>Language, Philosophy &amp; Culture (core)</td>
<td>3</td>
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<tr>
<td>Spring</td>
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<tr>
<td>STA 4233 Introduction to Programming and Data Management in R (major)</td>
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</tr>
<tr>
<td>Course option in major</td>
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</tr>
<tr>
<td>Course option in specialization track (support work)</td>
<td>3</td>
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<tr>
<td>Course option in specialization track (support work)</td>
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<td>Component Area Option (core)</td>
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<td>Fourth Year</td>
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<tr>
<td>Fall</td>
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<tr>
<td>STA 4713 Applied Regression Analysis (major)</td>
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<tr>
<td>Course option in major</td>
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</tr>
<tr>
<td>Course option in specialization track (support work)</td>
<td>3</td>
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<tr>
<td>Business or non-business elective (support work)</td>
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<tr>
<td>Free elective</td>
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<tr>
<td>Spring</td>
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<tr>
<td>STA 4723 Introduction to the Design of Experiments (major)</td>
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<tr>
<td>Course option in major</td>
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</tr>
<tr>
<td>Course option in specialization track (support work)</td>
<td>3</td>
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<tr>
<td>Business or non-business elective (support work)</td>
<td>3</td>
</tr>
<tr>
<td>Total Credit Hours</td>
<td>120</td>
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</tbody>
</table>

1. Students must take Math Placement Test to register for MAT 1214. Beginning math course will be determined by Math Placement Test scores.
2. STA 3003 is prerequisite for courses listed under Part B of Degree Requirements.

- Minor in Management Science (p. 9)
- Minor in Statistics (p. 9)

**Minor in Actuarial Science**

The Minor in Actuarial Science is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

- **A. Required Business courses** 6
  - ECO 2013 Introductory Macroeconomics
  - ECO 2023 Introductory Microeconomics

- **B. Select four of the following courses** 12
  - STA 3513 Probability and Statistics
  - STA 3523 Mathematical Statistics
  - STA 4643 Introduction to Stochastic Processes
  - STA 4713 Applied Regression Analysis
  - STA 4753 Time-Series Analysis
  - STA 4933 Internship in Statistics

To declare a Minor in Actuarial Science, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor.

**Minor in Adaptive Decision Models for Business**

The Minor in Adaptive Decision Models for Business is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

- **A. Course option** 3
  Select one of the following:
  - CS 3333 Mathematical Foundations of Computer Science
  - ME 3113 Measurements and Instrumentation
  - MS 3053 Management Science and Operations Technology

- **B. Additional courses** 6
  - ACC 2013 Principles of Accounting I
  - FIN 3003 Survey of Finance
  - or FIN 3013 Principles of Business Finance

- **C. Models** 6
  Select 6 semester credit hours of the following:
  - Analytical Models
    - MS 3063 Decision Support Systems
    - MS 3073 Business Analytics
    - MS 3313 Business Applications of Statistics
    - MS 4323 Simulation Applications in Business
    - MS 4333 Project Management
    - MS 4383 Predictive Operational Analytics
  - Operational Models
    - MS 3403 Logistics Management
    - MS 3413 Purchasing and Inventory Management
    - MS 4313 Six Sigma and Lean Operations
    - MS 4343 Production/Operations Management
    - MS 4353 Service Operations Management
    - MS 4363 Quality Management and Control
Minor in Management Science

The Minor in Management Science is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

A. Required courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MS 3053</td>
<td>Management Science and Operations Technology</td>
</tr>
<tr>
<td>MS 4343</td>
<td>Production/Operations Management</td>
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B. Select four of the following courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECO 3123</td>
<td>Introduction to Econometrics and Business Forecasting</td>
</tr>
<tr>
<td>FIN 4523</td>
<td>Introduction to Risk Management</td>
</tr>
<tr>
<td>FIN 4873</td>
<td>Computer Modeling of Financial Applications</td>
</tr>
<tr>
<td>MKT 3083</td>
<td>Marketing Research</td>
</tr>
<tr>
<td>MS 3063</td>
<td>Decision Support Systems</td>
</tr>
<tr>
<td>MS 3073</td>
<td>Business Analytics</td>
</tr>
<tr>
<td>MS 3131</td>
<td>Business Applications of Statistics</td>
</tr>
<tr>
<td>MS 3403</td>
<td>Logistics Management</td>
</tr>
<tr>
<td>MS 3413</td>
<td>Purchasing and Inventory Management</td>
</tr>
<tr>
<td>MS 4313</td>
<td>Six Sigma and Lean Operations</td>
</tr>
<tr>
<td>MS 4323</td>
<td>Simulation Applications in Business</td>
</tr>
<tr>
<td>MS 4333</td>
<td>Project Management</td>
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<tr>
<td>MS 4353</td>
<td>Service Operations Management</td>
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<td>MS 4363</td>
<td>Quality Management and Control</td>
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<tr>
<td>MS 4383</td>
<td>Predictive Operational Analytics</td>
</tr>
<tr>
<td>MS 4543</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>MS 4913</td>
<td>Independent Study in Management Science</td>
</tr>
<tr>
<td>MS 4933</td>
<td>Internship in Management Science</td>
</tr>
<tr>
<td>MS 4953</td>
<td>Special Studies in Management Science</td>
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<tr>
<td>STA 3003</td>
<td>Applied Statistics</td>
</tr>
<tr>
<td>STA 3313</td>
<td>Experiments and Sampling</td>
</tr>
<tr>
<td>STA 4133</td>
<td>Introduction to Programming and Data Management in SAS</td>
</tr>
<tr>
<td>STA 4753</td>
<td>Time-Series Analysis</td>
</tr>
</tbody>
</table>

Total Credit Hours 18

To declare a minor in Management Science, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor.

Certificate in Business Analytics

The Business Analytics certificate is designed to prepare business students with a foundational knowledge in analytics. It certifies to employers that students awarded the certificate have completed coursework that will help them understand different forms of analytics (descriptive, predictive, and prescriptive) and the methods used in each. Moreover, this certificate program will help students learn cutting-edge
techniques to sift through large volumes of data and understand how analytics can help improve decisions throughout an organization.

To earn a Business Analytics certificate, students must earn 15 semester credit hours as follows:

A. Required courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3073</td>
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</tr>
<tr>
<td>STA 4133</td>
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</tr>
<tr>
<td>STA 4233</td>
<td>3</td>
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B. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MS 3063</td>
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</tr>
<tr>
<td>STA 4143</td>
<td>3</td>
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C. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3313</td>
<td>3</td>
</tr>
<tr>
<td>STA 3013</td>
<td>3</td>
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</tbody>
</table>

Total Credit Hours 15

To apply for the Business Analytics Certificate, students should consult with Department of Management Science and Statistics for specific information about certificate requirements and consult with their academic advisors to verify that they have met all university requirements as specified in chapter 2 (http://catalog.utsa.edu/undergraduate/certificateprograms) of this catalog. All courses used to satisfy the requirements of this undergraduate certificate program must be college-level courses taken at UTSA.

Certificate in Operations and Supply Chain Management

This certificate is designed to prepare business students with a foundational knowledge in operations and supply chain management (OSCM). It certifies to employers that students awarded the certificate have completed coursework that will help them understand a myriad of complex problems facing organizations. Moreover, this certificate program will help students learn cutting edge techniques and best practices to leverage their operations and supply chain complexities to achieve competitive advantage.

To earn an Operations and Supply Chain Management Certificate (OSCM), students must earn 15 semester credit hours as follows:

A. Required courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MS 3403</td>
<td>3</td>
</tr>
<tr>
<td>MS 4543</td>
<td>3</td>
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</table>

B. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MS 4343</td>
<td>3</td>
</tr>
<tr>
<td>MS 3453</td>
<td>3</td>
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</table>

C. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MS 4313</td>
<td>3</td>
</tr>
<tr>
<td>MS 3463</td>
<td>3</td>
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</tbody>
</table>

D. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3413</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 15

To apply for the Operations and Supply Chain Management Certificate, students should consult with Department of Management Science and Statistics for specific information about certificate requirements and consult with their academic advisors to verify that they have met all university requirements as specified in chapter 2 (http://catalog.utsa.edu/undergraduate/certificateprograms) of this catalog. All courses used to satisfy the requirements of this undergraduate certificate program must be college-level courses taken at UTSA.

Management Science (MS) Courses

MS 1023. Business Statistics with Computer Applications I. (3-0) 3 Credit Hours.

Prerequisites: A grade of “C-” or better in IS 1403 (or IS 1413) and MAT 1053, or equivalents. This is the first course in a sequence of three courses designed to introduce basic statistical and quantitative techniques for business and economics. This course examines analytical skills and statistical concepts important in business-oriented environments. Various statistical techniques will be presented to assist in solving problems encountered by organizations. Topics include, but are not limited to, descriptive statistics, measures of central tendency and dispersion, elementary probability theory, expected value, random variables, discrete and continuous distributions, sampling distributions, point and interval estimation, and hypothesis testing. Electronic spreadsheets will be utilized for analyzing and interpreting data. Generally offered: Fall, Spring, Summer. Course Fees: BISP $10; BTSI $15; LRB1 $15.

MS 3043. Business Statistics with Computer Applications II. (3-0) 3 Credit Hours.

Prerequisites: A grade of “C-” or better in IS 1403 (or IS 1413), MAT 1053, and MS 1023, or equivalents. This course builds on the foundations learned in MS 1023. Statistical concepts include, but are not limited to, hypothesis testing concepts, goodness-of-fit tests, tests of independence, nonparametric tests, decision making under uncertainty, analysis of variance, correlation, linear and multiple regression, and time series. Electronic spreadsheets and statistical software will be utilized in analyzing and interpreting data and for hands-on assessment. Generally offered: Fall, Spring, Summer. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 3053. Management Science and Operations Technology. (3-0) 3 Credit Hours.

Prerequisites: A grade of “C-” or better in IS 1403 (or IS 1413), MAT 1053, MS 1023, and MS 3043, or equivalents. This is an introductory course in management science that emphasizes model building as a foundation for rational decision making and problem solving across disciplines and functional areas. Topics include, but are not limited to, mathematical programming, network models, project management, multicriteria decision making, inventory management, service operations and queuing models, Markov analysis, and simulation. Computer software is used to apply these techniques in the analysis of a wide variety of decision problems. Generally offered: Fall, Spring, Summer. Course Fees: BISP $20; BTSI $15; LRB1 $21.
MS 3063. Decision Support Systems. (3-0) 3 Credit Hours.
This course focuses on applications of decision-support models and computer software to problems in business, government, and other types of organizations with an emphasis on emerging technologies. It emphasizes fundamentals of decision support systems and hands-on experience using computer-based technologies to support organizational decision making. The primary focus is on four essential areas: decision analysis, simulation, project analysis, and mathematical programming. Excel, Microsoft Project, WINQSB, Expert Choice, and Extend are some of the software packages utilized. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 3073. Business Analytics. (3-0) 3 Credit Hours.
This course is designed to provide an introduction to business analytics. It describes and interprets the basic concepts of business analytics, describes basic principles of data mining as a basic tool of business analytics, evaluates the difficulties presented by large databases, and plans, organizes and evaluates methods to prepare raw data. Comparison and contrasts among different business analytics techniques are examined, including different methods of data mining, and provides for interpreting, analyzing and validating results. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 3313. Business Applications of Statistics. (3-0) 3 Credit Hours.
This course emphasizes application of statistics in problem-solving situations involving management, marketing, human resources, finance, and operations management. Useful techniques include analysis of variance, simple and multiple regression, logistic regression, multiple discriminant analysis, factor analysis, cluster analysis, multidimensional scaling, and conjoint analysis. Students use computer software such as SPSS or SAS in their analyses. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 3403. Logistics Management. (3-0) 3 Credit Hours.
This course focuses on analyzing managerial decisions related to the movement and storage of supplies, work-in-process, and finished goods, examining the trade-offs encountered by managers: costs and service levels, level and modes of transportation used, warehousing and control of inventory levels, demand management and forecasting master production scheduling, just-in-time (JIT), materials requirements planning (MRP), MRP II, DRP, materials handling within warehouses, distribution of finished goods to customers, industrial packaging, and importance of logistics to the overall productivity of a firm are investigated. When available, an integrated software approach such as supply chain management (SCM) and enterprise resource planning (ERP) by SAP, Oracle or I2 will be adopted. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 3413. Purchasing and Inventory Management. (3-0) 3 Credit Hours.
This course explores the industrial purchasing cycle for materials acquisition and management. Determination of requirements, supplier qualifications, appraisals, source selection, buying practices, value analysis, policies, ethics, and international purchasing are included in this course. Inventory control concepts, techniques, and strategies for effective integration with basic finance, marketing, and manufacturing objectives are topics covered in this course. Models for dependent and independent demand inventory systems, material requirements planning systems, distribution requirements, planning techniques, and the classical reorder point inventory model are also included. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4313. Six Sigma and Lean Operations. (3-0) 3 Credit Hours.
This course focuses on Six Sigma as a quality improvement methodology structured to reduce failure rates to a negligible level and on lean operations methodology structured to reduce waste. Materials include an overview of lean management philosophy and fundamentals of DMAIC problem-solving methodology. Topics include project criteria and prioritization methods, process capability measures, scorecard development, Six Sigma tools, DOE, and sampling and analyzing process data. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4323. Simulation Applications in Business. (3-0) 3 Credit Hours.
A study of the techniques for modeling and analysis of business processes using computer simulation and animation is the focus of this course. Selected example applications from supply chain management, financial, marketing, and operations functions are included. The computer simulations provide support for the management decision process. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4333. Project Management. (3-0) 3 Credit Hours.
This course provides a practical examination of how projects are managed from start to finish. The emphasis is on planning and control to avoid common pitfalls and manage risk. Planning includes defining objectives, identifying activities, establishing precedence relationships, making time estimates, determining project completion times, and determining resource requirements. CPM/PERT networks are established, and computer software (Microsoft Project, WINQSB, and Excel) is used to monitor and control the project. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4343. Production/Operations Management. (3-0) 3 Credit Hours.
This course focuses on the production and operations management function in business. It includes a review of the methods required for design, operation, and improvements of the systems that create products or services. Traditional topics in manufacturing and service operations are investigated including an introduction to supply chain management concepts. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4353. Service Operations Management. (3-0) 3 Credit Hours.
This course is designed to provide an in-depth examination of operations management practices in service-oriented environments. The subjects introduced include topics from operations management, logistics, marketing, economics, and management demonstrated in a broad spectrum of service organizations. The course looks at strategic concepts in modern service management and presents analytical tools for business decision making. Topics include, but are not limited to, service quality, process design, facility location analysis and site selection, waiting line models, inventory management in services, demand forecasting, workforce scheduling, learning curve models, overbooking, service supply chain, and integrated service operations management. (Same as MKT 4353. Credit cannot be earned for both MS 4353 and MKT 4353.) Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4363. Quality Management and Control. (3-0) 3 Credit Hours.
This course investigates the fundamental nature of quality and its implications for business. Topics include statistical methods for quality improvement in manufacturing and service operations. Emphasis is given to both the technical and managerial issues in understanding and implementing quality as a component for success in today's global business environment. (Same as STA 4803. Credit cannot be earned for both MS 4363 and STA 4803.) Course Fees: BISP $20; BTSI $15; LRB1 $21.
MS 4383. Predictive Operational Analytics. (3-0) 3 Credit Hours.
This course introduces modern and practical methods for operations planning and decision making. Short-term forecasting of demand, personnel requirements, costs and revenues, raw material needs, and desired inventory levels are some of the topics included. Other topics covered include technological and environmental forecasting, decomposition methods, and monitoring (automatic procedures such as tracking signals). (Formerly titled Applied Forecasting in Operations.)
Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4543. Supply Chain Management. (3-0) 3 Credit Hours.
Principles, techniques and practices of corporate supply chain management are covered in this course. The focus is on the strategic coordination and information management that integrates supplier selection, purchasing, transportation, inventory and warehousing, channel planning and configuration, production and distribution from procurement of raw material to customer satisfaction. Business decision models and techniques for facility location, production, inventory, transportation and other operational issues are presented. Currently available software will be surveyed and cases of successful implementations will be analyzed. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4913. Independent Study in Management Science. (0-0) 3 Credit Hours.
Prerequisites for business majors: A 3.0 College of Business grade point average, permission in writing from the instructor, the Department Chair, and the Dean of the College of Business. See academic advisor for required forms and additional requirements. Independent reading, research, discussion, and/or writing under the direction of a faculty member. This course may be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor’s degree. Course Fees: BISP $20; BTSI $15.

MS 4933. Internship in Management Science. (0-0) 3 Credit Hours.
Prerequisites: A 2.5 grade UTSA point average and approval in writing from the instructor, the Department Chair, and the Associate/Assistant Dean of Undergraduate Studies in the College of Business. See academic advisor for required forms and additional requirements. Supervised full- or part-time work experience in management science. Offers opportunities for applying management science in private businesses or public agencies. A written report is required. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. Generally offered: Summer. Course Fees: BISP $20; BTSI $15.

MS 4951. Special Studies in Management Science. (1-0) 1 Credit Hour.
Prerequisite: Consent of instructor, Department Chair and Dean. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special studies may be repeated for credit when the topics vary. Course Fees: BISP $20; BTSI $15; LRB1 $21.

MS 4953. Special Studies in Management Science. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor, Department Chair and Dean. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special studies may be repeated for credit when the topics vary. Course Fees: BISP $20; BTSI $15; LRB1 $21.

Statistics (STA) Courses

STA 1053. Basic Statistics. (3-0) 3 Credit Hours. (TCCN = MATH 1342)
Prerequisite: Satisfactory performance on placement examination. Descriptive statistics; histograms; measures of location and dispersion; elementary probability theory; random variables; discrete and continuous distributions; interval estimation and hypothesis testing; simple linear regression and correlation; one-way analysis of variance, and applications of the chi-square distribution. May be applied toward the core curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: BISP $10; BTSI $15; LRB1 $15; LRC1 $12.

STA 1403. Probability and Statistics for the Biosciences. (3-0) 3 Credit Hours.
Prerequisite: A grade of “C-” or better in MAT 1193 or an equivalent. Probability and statistics from a dynamical perspective, using discrete-time dynamical systems and differential equations to model fundamental stochastic processes such as Markov chains and the Poisson processes important in biomedical applications. Specific topics to be covered include probability theory, conditional probability, Markov chains, Poisson processes, random variables, descriptive statistics, covariance and correlations, the binomial distribution, parameter estimation, hypothesis testing and regression. (Formerly STA 1404. Credit cannot be earned for both STA 1403 and STA 1404.) Generally offered: Fall, Spring, Summer. Course Fees: BISP $10; BTSI $15; LRB1 $15.

STA 2303. Applied Probability and Statistics for Engineers. (3-0) 3 Credit Hours.
Prerequisite: MAT 1224. Fundamental concepts of probability and statistics with practical applications to engineering problems. Emphasis on statistical distribution models used in reliability and risk analysis of engineering design; probabilistic reasoning; Bayes' theorem; bivariate and multivariate distributions and their applications. Generally offered: Fall, Spring. Course Fees: BISP $10; BTSI $15; LRB1 $15.

STA 3003. Applied Statistics. (3-0) 3 Credit Hours.
Prerequisite: Completion of or concurrent enrollment in MAT 1093, MAT 1133, MAT 1214, or an equivalent. Introduction to the Scientific Method; principles of sampling and experimentation; scales of measurement, exploratory data analysis; introduction to basic probability; models for discrete and continuous data; simple simulations and inference based on resampling; fundamentals of hypothesis testing and confidence intervals; introduction to analysis of variance and linear regression model. The course will emphasize data analysis and interpretation and effective communication of results through reports or presentations. Generally offered: Fall, Spring, Summer. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 3013. Multivariate Analysis for the Life and Social Sciences. (3-0) 3 Credit Hours.
Prerequisite: STA 3003, STA 3513, or an equivalent. This course emphasizes application of statistics in organizations. Topics include, but are not limited to the multivariate normal distribution, tests on means, discriminant analysis, cluster analysis, principal components, and factor analysis. Use of software packages will be emphasized. Open to students of all disciplines. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.
STA 3023. Mathematics for Statistics. (3-0) 3 Credit Hours.
Prerequisite: MAT 1224 or an equivalent. This course discusses and reviews the classic mathematical methods and techniques to comprehend the advanced statistical concepts. Concepts include sequences, series, convergence, limit, continuity, derivative, optimization, the fundamental theorem of calculus, methods of integration, Taylor expansions, function of several variables, partial derivatives, and multivariate transformations. Other topics include vector and matrix algebra, determinants, inverse matrix, solving linear equations, orthogonality (projections, least-squares, Gram-Schmidt), eigenvalues and eigenvectors (diagonalization, symmetric/positive definite matrices), and singular value decomposition. (Formerly titled Statistical Mathematics.) Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 3313. Experiments and Sampling. (3-0) 3 Credit Hours.
Prerequisite: One of the following: MS 1023, STA 1053, STA 2303, STA 3003, or an equivalent. Research techniques for collecting quantitative data: sample surveys, designed experiments, simulations, and observational studies; development of survey and experimental protocols; measuring and controlling sources of measurement error. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 3333. Introduction to Data Science and Analytics. (3-0) 3 Credit Hours.
Prerequisite: One of the following: MS 1023, STA 1053, STA 1403, STA 2303, or an equivalent. Data science and analytics aim to harness the power of data and statistics for new insights. This course introduces the concepts and principles of data science and analytics through software-aided applications of common statistics-based methods, tools and techniques in various practical case studies. This course also provides students an opportunity to understand the data-driven decision making process, an overview of the data science lifecycle, and the Big Data ecosystem. Topics include popular statistical techniques and algorithms under the current paradigm of analytics (descriptive/diagnostic, predictive/prognostic, and prescriptive/optimization) and machine learning (supervised and unsupervised), applied in a wide variety of fields as demonstrated through case studies. With the application-oriented focus, students will gain hands-on experiences and develop essential skills in discovering, analyzing, visualizing, interpreting data, presenting and communicating results. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 3513. Probability and Statistics. (3-0) 3 Credit Hours.
Prerequisites: STA 3003, and either MAT 1224 or STA 3023. Axiomatic probability; random variables; discrete and continuous distributions; bivariate and multivariate distributions and their applications; mixture distributions; moments and generating functions, bivariate transformations. Generally offered: Fall, Spring, Summer. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 3523. Mathematical Statistics. (3-0) 3 Credit Hours.
Prerequisite: STA 3513 or an equivalent. Sampling distributions and the Central Limit Theorem; order statistics; estimation including method of moments and maximum likelihood; properties of estimators; hypothesis testing including likelihood ratio tests; introduction to ANOVA and regression. Generally offered: Fall, Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4133. Introduction to Programming and Data Management in SAS. (3-0) 3 Credit Hours.
This course introduces essential programming concepts using the statistical software package SAS (Enterprise Guide and Base SAS) with a focus on data management and the preparation of data for statistical analyses. Topics include reading raw data, creating temporary and permanent datasets, manipulating datasets, data prompts, summarizing data, displaying data using tables, charts, and plots. Conducting basic statistical analyses using the SAS Enterprise Guide and the Base SAS procedures are also discussed with the examples selected from regression analysis, analysis of variance, and categorical analysis. This course also demonstrates how to write, generate, and modify SAS code and procedures within the SAS Enterprise Guide and the Base SAS environments. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4143. Data Mining. (3-0) 3 Credit Hours.
Prerequisite: STA 4133 or equivalent. Acquisition, organization, exploration, and interpretation of large data collections. Data cleaning, representation and dimensionality, multivariate visualization, clustering, classification, and association rule development. A variety of commercial and research software packages will be used. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4233. Introduction to Programming and Data Management in R. (3-0) 3 Credit Hours.
This course introduces statistical computing and programming using the R language. Topics include preprocessing/manipulating datasets, summarizing/visualizing data, and conducting basic statistical analyses using R. Other topics include writing R functions, object oriented programming, statistical simulation and resampling, interfacing R with other programming language environments such as SQL, Python, C++, and Hadoop. Techniques for efficient programming will be stressed. The concept of high-performance computing (multi-core/parallel-processing) is also demonstrated. (Formerly titled Statistical Applications Using SAS Software.) Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4643. Introduction to Stochastic Processes. (3-0) 3 Credit Hours.

STA 4713. Applied Regression Analysis. (3-0) 3 Credit Hours.
Prerequisite: MS 3313 or STA 3003. An introduction to regression analysis, with emphasis on practical aspects, fitting a straight line, examination of residuals, matrix treatment of regression analysis, fitting and evaluation of general linear models, and nonlinear regression. Generally offered: Fall. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4723. Introduction to the Design of Experiments. (3-0) 3 Credit Hours.
Prerequisite: MS 3313 or STA 3003. General concepts in the design and analysis of experiments. Emphasis will be placed on both the experimental designs and analysis and tests of the validity of assumptions. Topics covered include completely randomized designs, randomized block designs, complete factorials, fractional factorials, and covariance analysis. The use of computer software packages will be stressed. Course Fees: BISP $20; BTSI $15; LRB1 $21.
STA 4753. Time-Series Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 3513 or an equivalent. Development of descriptive and predictive models for time-series phenomena. A variety of modeling approaches will be discussed: decomposition, moving averages, time-series regression, ARIMA, and forecasting errors and confidence intervals. Generally offered: Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4803. Statistical Quality Control. (3-0) 3 Credit Hours.
Prerequisite: STA 2303, STA 3003, STA 3513, or an equivalent. Statistical methods are introduced in terms of problems that arise in manufacturing and their applications to the control of manufacturing processes. Topics include control charts and acceptance sampling plans. (Same as MS 4363 and MAT 4803. Credit cannot be earned for more than one of the following: STA 4803, MS 4363, or MAT 4803.) Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4903. Applied Survival Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 3523 or an equivalent. Measures of survival, hazard function, mean residual life function, common failure distributions, procedures for selecting an appropriate model, the proportional hazards model. Emphasis on application and data analysis using SAS. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4911. Independent Study. (0-0) 1 Credit Hour.
Prerequisites: A 3.0 College of Business grade point average, permission in writing (form available) from the instructor, the student's advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Course Fees: BISP $20; BTSI $15.

STA 4913. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: A 3.0 College of Business grade point average, permission in writing (form available) from the instructor, the student's advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Course Fees: BISP $20; BTSI $15.

STA 4933. Internship in Statistics. (0-0) 3 Credit Hours.
Prerequisites: A 2.5 grade UTSA point average, and approval in writing from the instructor, the Department Chair, and the Associate/Assistant Dean of Undergraduate Studies in the College of Business. See academic advisor for required forms and additional requirements. Supervised full- or part-time work experience in statistics. Offers opportunities for applying statistics in private businesses or public agencies. A written report is required. May be repeated for credit, but not more than 6 semester credit hours will apply to a bachelor's degree. Course Fees: BISP $20; BTSI $15.

STA 4953. Special Studies in Statistics. (3-0) 3 Credit Hours.
Prerequisites: Consent of instructor, Department Chair and Dean of the College. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4961. Actuarial Science Examination Preparation. (1-0) 1 Credit Hour.
An organized course offering specialized study for Actuarial Science Examinations. Topics covered include General Probability, Random Variables and Probability Distributions, Multivariate Distributions, and Risk Management and Insurance. May be repeated twice for credit. Generally offered: Fall, Spring. Course Fees: BISP $20; BTSI $15; LRB1 $21.

STA 4962. Actuarial Science Examination Preparation. (2-0) 2 Credit Hours.

STA 4963. Actuarial Science Examination Preparation. (3-0) 3 Credit Hours.

STA 4993. Honors Thesis. (0-0) 3 Credit Hours.
Prerequisites: STA 3523 and consent of instructor, Department Chair and Dean of the College. Enrollment limited to students applying for Honors in Management Science and Statistics. Supervised research and preparation of an honors thesis. May be repeated once for credit with advisor's approval. Generally offered: Spring. Course Fees: BISP $20; BTSI $15.