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 degree in Management Science, a Bachelor of Business Administration degree in Actuarial Science, and a Bachelor of Science degree in Statistics. 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.

Department Honors
The Department of Management Science and Statistics offers the opportunity for certain of its outstanding students to achieve the designation of Honors in Major and provides the opportunity for advanced study under close faculty supervision.

Selection for Honors designation is based on the student’s academic performance and recommendation by the Department Undergraduate Program Committee (UPC) in consultation with the faculty of the student’s major discipline. To be eligible for the designation, students must have a minimum overall grade point average of 3.0 at UTSA and a minimum grade point average of 3.5 in their major at UTSA. To enroll in honors thesis courses and to graduate with the honors designation, these minimum grade point averages must be maintained. Students applying for Honors in Major are expected to enroll in the appropriate honors thesis course during their final two semesters. The completed honors thesis must be approved by the supervising faculty sponsor from the student’s discipline and the UPC. Students interested in this program should contact the Department of Management Science and Statistics office for additional information. Department honors can be attained independent of, or in addition to, University Honors. In order to have departmental honors noted on the transcript, students must submit a letter of request for departmental honors to the Department Chair by Census Date of their last semester.

- Bachelor of Business Administration Degree in Actuarial Science (p. 1)
- Bachelor of Business Administration Degree in Management Science (p. 3)
- Bachelor of Science Degree in Statistics (p. 5)

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. Traditionally, 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 requirements, and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)
Students seeking the Bachelor of Business Administration degree in Actuarial Science must fulfill University Core Curriculum requirements. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for the degree. For a complete listing of courses that satisfy the Core Curriculum requirements, see below.

MAT 1214 should be used to satisfy the core requirement in Mathematics. ECO 2013 should be used to satisfy the core requirement in Social and Behavioral Sciences.

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/bachelorsdegeregulations/degreerequirements/corecurriculumcomponentarearequirements)

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
BLW 3013 Business Law 3
COM 1053 Business and Professional Speech 3
ECO 2013 Introductory Macroeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement) 3
ECO 2023 Introductory Microeconomics 3
FIN 3014 Principles of Business Finance 4
GBA 2013 Social and Ethical Issues in Business 3
IS 1403 Business Information Systems Fluency 3
IS 3003 Principles of Information Systems for Management 3
MAT 1033 Algebra with Calculus for Business (Satisfies Mathematics Core Curriculum requirement. Actuarial Science majors must take MAT 1214 in lieu of MAT 1033.) 3
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 3023 in lieu of MS 1023) 3
MS 3043 Business Statistics with Computer Applications II (Actuarial Science majors must take STA 3003 in lieu of MS 3043) 3
MS 3053 Management Science and Operations Technology 3

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. Required Mathematics and Statistics courses
MAT 1224 Calculus II 4
MAT 2214 Calculus III 4
STA 3513 Probability and Statistics 3
STA 3523 Mathematical Statistics 3
STA 4713 Applied Regression Analysis 3
STA 4753 Time-Series Analysis 3

B. Additional Courses
Select two courses from the following: 6
FIN 4523 Introduction to Risk Management
FIN 4813 Property-Liability Insurance Finance
FIN 4823 Life and Health Insurance Finance
MS 3073 Business Analytics
STA 3023 Statistical Mathematics
STA 4133 Introduction to Programming and Data Management in SAS
STA 4643 Introduction to Stochastic Processes
STA 4933 Internship in Statistics

C. Examination Preparation
STA 4961 Actuarial Science Examination Preparation (to be taken two semesters) 2

Total Credit Hours 28

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

Recommended Four-Year Academic Plan

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

Spring
COM 1053 Business and Professional Speech (CBK) 3
WRC 1023 Freshman Composition II (Q) (core) 3
ECO 2013 Introductory Macroeconomics 1, 2 3
STA 3023 Statistical Mathematics (CBK) 3
MAT 1224 Calculus II (major) 4

Second Year
Fall
ACC 2013 Principles of Accounting I 3
ECO 2023 Introductory Microeconomics 1 3
MAT 2214 Calculus III (major) 4
STA 3003 Applied Statistics (CBK) 3
Language, Philosophy & Culture (core) 3
Evaluated for Admission to the College of Business

Spring
ACC 2033 Principles of Accounting II 3
FIN 3014 Principles of Business Finance (CBK) 4
STA 3513 Probability and Statistics (major) 3
American History (core) 3
Life & Physical Sciences (core) 3

Third Year
Fall
MGT 3003 Business Communication and Professional Development (CBK) 3
MS 3053 Management Science and Operations Technology (CBK) 3
prepare students for careers in manufacturing, materials management, service operations, procurement, third party logistics, transportation processes, and management consulting. Since management science 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 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 Bachelor of Business Administration degree in Management Science must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree. For a complete listing of courses that satisfy the Core Curriculum requirements, see below.

MAT 1033 should be used to satisfy the core requirement in Mathematics. ECO 2013 should be used to satisfy the core requirement in Social and Behavioral Sciences.

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

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

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.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 2013</td>
<td>Principles of Accounting I</td>
<td>3</td>
</tr>
<tr>
<td>ACC 2033</td>
<td>Principles of Accounting II</td>
<td>3</td>
</tr>
<tr>
<td>BLW 3013</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>COM 1053</td>
<td>Business and Professional Speech</td>
<td>3</td>
</tr>
<tr>
<td>ECO 2013</td>
<td>Introductory Macroeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement)</td>
<td>3</td>
</tr>
<tr>
<td>ECO 2023</td>
<td>Introductory Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>FIN 3014</td>
<td>Principles of Business Finance</td>
<td>3</td>
</tr>
<tr>
<td>GBA 2013</td>
<td>Social and Ethical Issues in Business</td>
<td>3</td>
</tr>
<tr>
<td>IS 1403</td>
<td>Business Information Systems Fluency</td>
<td>3</td>
</tr>
<tr>
<td>IS 3003</td>
<td>Principles of Information Systems for Management</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1033</td>
<td>Algebra with Calculus for Business (Satisfies Mathematics Core Curriculum requirement. Actuarial Science majors must take MAT 1214 in lieu of MAT 1033.)</td>
<td>3</td>
</tr>
<tr>
<td>MGT 3003</td>
<td>Business Communication and Professional Development</td>
<td>3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Component Area Option (core)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government-Political Science (core)</td>
<td>3</td>
</tr>
</tbody>
</table>

Fourth Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>GBA 2013</td>
<td>Social and Ethical Issues in Business (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>STA 4753</td>
<td>Time-Series Analysis (major)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>STA 4961</td>
<td>Actuarial Science Examination Preparation (support work)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Component Area Option (core)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Government-Political Science (core)</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>BLW 3013</td>
<td>Business Law (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MGT 4893</td>
<td>Management Strategy (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>STA 4961</td>
<td>Actuarial Science Examination Preparation (support work)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Creative Arts (core)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life &amp; Physical Sciences (core)</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Total Credit Hours: 120.0

1. ECO 2013 and ECO 2023 may be taken in either sequence.
2. College of Business students should take MAT 1214 and ECO 2013 satisfy both Core and COB requirements.
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.

### 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 1033**
Algebra with Calculus for Business

### Degree Requirements

#### A. Required Management Science courses

<table>
<thead>
<tr>
<th>Course</th>
<th>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. Business upper-division electives

Select 5 of the following: 15

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECN 3123</td>
<td>Introduction to Econometrics and Business Forecasting</td>
<td></td>
</tr>
<tr>
<td>FIN 4523</td>
<td>Introduction to Risk Management</td>
<td></td>
</tr>
<tr>
<td>FIN 4873</td>
<td>Computer Modeling of Financial Applications</td>
<td></td>
</tr>
<tr>
<td>MKT 3083</td>
<td>Marketing Research</td>
<td></td>
</tr>
<tr>
<td>MS 3063</td>
<td>Decision Support Systems</td>
<td></td>
</tr>
<tr>
<td>MS 3073</td>
<td>Business Analytics</td>
<td></td>
</tr>
<tr>
<td>MS 3131</td>
<td>Business Applications of Statistics</td>
<td></td>
</tr>
<tr>
<td>MS 3413</td>
<td>Purchasing and Inventory Management</td>
<td></td>
</tr>
<tr>
<td>MS 4313</td>
<td>Six Sigma and Lean Operations</td>
<td></td>
</tr>
<tr>
<td>MS 4323</td>
<td>Simulation Applications in Business</td>
<td></td>
</tr>
<tr>
<td>MS 4353</td>
<td>Service Operations Management</td>
<td></td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</td>
<td></td>
</tr>
<tr>
<td>MS 4383</td>
<td>Applied Forecasting in Operations</td>
<td></td>
</tr>
<tr>
<td>MS 4543</td>
<td>Supply Chain Management</td>
<td></td>
</tr>
<tr>
<td>MS 4913</td>
<td>Independent Study in Management Science</td>
<td></td>
</tr>
<tr>
<td>MS 4933</td>
<td>Internship in Management Science</td>
<td></td>
</tr>
<tr>
<td>MS 4953</td>
<td>Special Studies in Management Science</td>
<td></td>
</tr>
<tr>
<td>STA 3003</td>
<td>Applied Statistics</td>
<td></td>
</tr>
<tr>
<td>STA 3313</td>
<td>Experiments and Sampling</td>
<td></td>
</tr>
<tr>
<td>STA 4133</td>
<td>Introduction to Programming and Data Management in SAS</td>
<td></td>
</tr>
<tr>
<td>STA 4753</td>
<td>Time-Series Analysis</td>
<td></td>
</tr>
<tr>
<td>STA 4803</td>
<td>Statistical Quality Control</td>
<td></td>
</tr>
</tbody>
</table>

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.

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

Select 5 semester credit hours of lower-division or upper-division business or non-business electives 5

### Total Credit Hours

29

### 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>Term</th>
<th>Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>AIS 1203 Academic Inquiry and Scholarship (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>IS 1403 Business Information Systems (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MAT 1033 Algebra with Calculus for Business (core and CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>WRC 1013 Freshman Composition I (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>American History (core)</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>COM 1053 Business and Professional Speech (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ECO 2013 Introductory Macroeconomics (core and CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MS 1023 Business Statistics with Computer Applications I (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>WRC 1023 Freshman Composition II (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>American History (core)</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Second Year

<table>
<thead>
<tr>
<th>Term</th>
<th>Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>ECO 2023 Introductory Microeconomics (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ACC 2013 Principles of Accounting I (CBK)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MS 3043 Business Statistics with Computer Applications II (CBK)</td>
<td>3</td>
</tr>
</tbody>
</table>
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 degree in Statistics 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 is 120, at least 39 of which must be at the upper-division level.

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

Students seeking the Bachelor of Science degree in Statistics must fulfill University Core Curriculum requirements. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree. For a complete listing of courses that satisfy the Core Curriculum requirements, see below.

MAT 1214 should be used to satisfy the core requirement in Mathematics. ECO 2013 should be used to satisfy the core requirement in Social and Behavioral Sciences.

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/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements)

### Degree Requirements

#### A. Required courses in the computational and mathematical sciences

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 1214</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MAT 1224</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MAT 2214</td>
<td>Calculus III</td>
<td>4</td>
</tr>
</tbody>
</table>

#### B. Courses required for the major

1. Required Statistic courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA 3003</td>
<td>Applied Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STA 3013</td>
<td>Multivariate Analysis for the Life and Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>STA 3023</td>
<td>Statistical Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>STA 3313</td>
<td>Experiments and Sampling</td>
<td>3</td>
</tr>
<tr>
<td>STA 3513</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STA 3523</td>
<td>Mathematical Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STA 4133</td>
<td>Introduction to Programming and Data Management in SAS</td>
<td>3</td>
</tr>
<tr>
<td>STA 4233</td>
<td>Statistical Applications Using SAS Software</td>
<td>3</td>
</tr>
<tr>
<td>STA 4713</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STA 4723</td>
<td>Introduction to the Design of Experiments</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Select four of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3073</td>
<td>Business Analytics</td>
<td>3</td>
</tr>
</tbody>
</table>

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1. ECO 2013 and ECO 2023 may be taken in either sequence.

2. College of Business students should take MAT 1033 and ECO 2013 satisfy both Core Curriculum and CBK requirements.

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### Bachelor of Science Degree in Statistics

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.
MS 4363 Quality Management and Control
STA 3813 Discrete Data Analysis
STA 4143 Data Mining
STA 4643 Introduction to Stochastic Processes
STA 4753 Time-Series Analysis
STA 4903 Applied Survival Analysis
STA 4933 Internship in Statistics

C. Electives in disciplines where statistics is actively applied and practiced.

Nine 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.

1. Specialization in Actuarial Science
   ACC 2013 Principles of Accounting I
   ECO 2013 Introductory Macroeconomics
   ECO 2023 Introductory Microeconomics
   FIN 3014 Principles of Business Finance
   or FIN 4873 Computer Modeling of Financial Applications
   STA 4961 Actuarial Science Examination Preparation (to be taken two semesters)

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 Diversity in a Pluralistic Society
   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
   or MAT 4313 Applied Combinatorics

6. Specialization in Psychology
   PSY 1013 Introduction to Psychology
   PSY 2503 Developmental Psychology
   PSY 3403 Experimental Psychology
   PSY 3413 Experimental Psychology Laboratory
   Two additional psychology courses at the 3000 or 4000 level.

7. Specialization in Social Sciences
   SOC 1013 Introduction to Sociology
   SOC 3223 Population Dynamics and Demographic Techniques
   SOC 3323 Introduction to Social Research
   SOC 3373 Qualitative Research Methods
   SOC 3393 Quantitative Research Methods
   One additional sociology course at the 3000 or 4000 level.

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

Course Sequence Guide for B.S. Degree in Statistics

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
Fall
AIS 1203 Academic Inquiry and Scholarship (core) 3
MAT 1214 Calculus I (core and major) 1 4
STA 3003 Applied Statistics (major) 2 3
STA 3023 Statistical Mathematics (major) 3
WRC 1013 Freshman Composition I (Q) (core) 3

Spring
STA 3513 Probability and Statistics (major) 3
WRC 1023 Freshman Composition II (Q) (core) 3
MAT 1224 Calculus II (major) 4
American History (core) 3
Life & Physical Sciences (core) 3

Second Year
Fall
ECO 2013 Introductory Macroeconomics (core) 3

1. May be taken to satisfy a Mathematics requirement.
2. Must be taken to satisfy a Mathematics requirement.
MAT 2214  Calculus III (major)  4
STA 3313  Experiments and Sampling (major)  3
STA 3523  Mathematical Statistics (major)  3
STA 4133  Introduction to Programming and Data Management in SAS (major)  3

DECLARE MAJOR

Spring
STA 3013  Multivariate Analysis for the Life and Social Sciences (major)  3
STA 4233  Statistical Applications Using SAS Software (major)  3
American History (core)  3
Government-Political Science (core)  3
Life & Physical Sciences (core)  3

Third Year

Fall
STA 4713  Applied Regression Analysis (major)  3
STA 4753  Time-Series Analysis (major)  3
Course option in specialization track  3
Course option in specialization track  3
Language, Philosophy & Culture (core)  3

Spring
STA 4723  Introduction to the Design of Experiments (major)  3
Business or non-business elective (support work)  3
Course option in specialization track (support work)  3
Course option in major  3
Government-Political Science (core)  3

Fourth Year

Fall
Course option in major  3
Course option in major  3
Course option in specialization track (support work)  3
Course option in specialization track (support work)  3
Course option in specialization track (support work)  3

Spring
Business or non-business elective (support work)  3
Course option in major  3
Creative Arts (core)  3
Component Area Option (core)  3

Total Credit Hours:  120.0

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 other required courses.

• Minor in Actuarial Science (p. 7)
• Minor in Adaptive Decision Models for Business (p. 7)
• Minor in Statistics (p. 8)
• Minor in Management Science (p. 8)

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
ECO 2013  Introductory Macroeconomics  3
ECO 2023  Introductory Microeconomics  3

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

Total Credit Hours  18

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
Select one of the following:  3
CS 3333  Mathematical Foundations of Computer Science
ME 3113  Measurements and Instrumentation
MS 3053  Management Science and Operations Technology

B. Additional courses
ACC 2013  Principles of Accounting I  3
FIN 3003  Survey of Finance  3
or FIN 3014  Principles of Business Finance

C. Models
Select 6 semester credit hours of the following:  6
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  Applied Forecasting in Operations
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
MS 4543  Supply Chain Management

D. Upper-division electives
Select 3 semester credit hours of upper-division electives in disciplines where quantitative methods are actively applied and practiced. These courses should be approved by the designated management science faculty member.

Total Credit Hours 18

To declare a minor in Adaptive Decision Models for Business and seek approval of substitutions for course requirements, students must consult with their academic advisor or the designated management science faculty member.

Minor in Statistics

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

A. Sequence options

Select two courses from one of the following four options: 6

1. Option 1
   - STA 1403 Probability and Statistics for the Biosciences
   - STA 3003 Applied Statistics

2. Option 2
   - STA 2303 Probability and Statistics for Engineers
   - STA 3513 Probability and Statistics
   - STA 3533 Probability and Random Processes

3. Option 3
   - MS 1023 Business Statistics with Computer Applications I
   - MS 3043 Business Statistics with Computer Applications II

4. Option 4
   - STA 3003 Applied Statistics
   - Select one of the following:
     - STA 2303 Probability and Statistics for Engineers
     - STA 3513 Probability and Statistics
     - STA 3533 Probability and Random Processes

B. Select four of the following courses 12

- MS 3073 Business Analytics
- STA 3013 Multivariate Analysis for the Life and Social Sciences
- STA 3023 Statistical Mathematics
- STA 3313 Experiments and Sampling
- STA 3433 Applied Nonparametric Statistics
- STA 3613 Discrete Data Analysis
- STA 4113 Introduction to Programming and Data Management in SAS
- STA 4114 Data Mining
- STA 4233 Statistical Applications Using SAS Software
- STA 4713 Applied Regression Analysis
- STA 4723 Introduction to the Design of Experiments
- STA 4753 Time-Series Analysis
- STA 4803 Statistical Quality Control
- or MS 4363 Quality Management and Control

Total Credit Hours 18

To declare a Minor in Statistics, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor or the designated Statistics faculty member.

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</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3053</td>
<td>Management Science and Operations Technology</td>
<td>3</td>
</tr>
<tr>
<td>MS 4343</td>
<td>Production/Operations Management</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Select four of the following courses 12

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<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 3313</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>
</tr>
<tr>
<td>MS 4353</td>
<td>Service Operations Management</td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</td>
</tr>
<tr>
<td>MS 4383</td>
<td>Applied Forecasting in Operations</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>
</tr>
<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 4775</td>
<td>Time-Series Analysis</td>
</tr>
<tr>
<td>STA 4803</td>
<td>Statistical Quality Control</td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</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 (p. 8)
- Certificate in Operations and Supply Chain Management (p. 9)

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
To earn an Operations and Supply Chain Management Certificate, cutting edge techniques and best practices to leverage their operations organizations. Moreover, this certificate program will help students learn about the myriad of complex problems facing production issues, challenges, problems, and decision tools that relate to the internal and external flow of materials and requisite knowledge. Production/Operations Management, logistics management, and procurement topics are included to resolve the 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 a Business Analytics certificate, students must earn 15 semester credit hours as follows:

A. Required courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3073</td>
<td>Business Analytics</td>
<td>3</td>
</tr>
<tr>
<td>STA 4133</td>
<td>Introduction to Programming and Data</td>
<td>3</td>
</tr>
<tr>
<td>STA 4233</td>
<td>Statistical Applications Using SAS Software</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>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>STA 4143</td>
<td>Data Mining</td>
<td>3</td>
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</table>

C. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3313</td>
<td>Business Applications of Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STA 3013</td>
<td>Multivariate Analysis for the Life and Social Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credit Hours: 15**

This certificate is open only to College of Business students. 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. 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 help them understand a myriad of issues, challenges, problems, and decision tools that relate to the internal and external flow of materials and requisite knowledge. Production/Operations Management, logistics management, and procurement topics are included to resolve the 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>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 4543</td>
<td>Supply Chain Management</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 4343</td>
<td>Production/Operations Management</td>
<td>3</td>
</tr>
<tr>
<td>MS 4353</td>
<td>Service Operations Management</td>
<td>3</td>
</tr>
</tbody>
</table>

C. Select one of the following

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MS 4313</td>
<td>Six Sigma and Lean Operations</td>
<td>3</td>
</tr>
<tr>
<td>MS 4363</td>
<td>Quality Management and Control</td>
<td>3</td>
</tr>
</tbody>
</table>

D. Select one of the following

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3413</td>
<td>Purchasing and Inventory Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**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 and MAT 1033, 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.

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

Prerequisites: A grade of “C-” or better in MAT 1033, IS 1403, 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.

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

Prerequisites: A grade of “C-” or better in MAT 1033, IS 1403, 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, multi-criteria 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.

**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.
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.

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.

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.

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.

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.

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.

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.

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.

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.)

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.

MS 4383. Applied Forecasting in Operations. (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).

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.
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.

MS 4933. Internship in Management Science. (0-0) 3 Credit Hours.
Prerequisites for business majors: Permission in writing from the instructor, the Department Chair, and the Dean of the College of Business; and a 2.5 grade UTSA point average. 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. May be repeated for credit, but not more than 6 semester credit hours will apply to a bachelor’s degree.

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.

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.

Statistics (STA) Courses

STA 1043. Introduction to Quantitative Reasoning. (3-0) 3 Credit Hours. (TCCN = MATH 1442)
Prerequisite: Satisfactory performance on placement examination. Intended primarily for liberal arts majors, this course provides an overview of statistical methods useful for judgment and decision making under conditions of uncertainty. The emphasis of the course will be on using quantitative reasoning to gain insight and draw conclusions from observations. The common pitfalls of statistical studies and common myths about the fallacies of inference will be discussed. Topics may include data analysis, inference, correlation, and regression. (Formerly titled “Introduction to Statistical Reasoning.”).

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.

STA 1403. Probability and Statistics for the Biosciences. (3-0) 3 Credit Hours. (TCCN = MATH 2342)
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, covariation 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.).

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.

STA 3003. Applied Statistics. (3-0) 3 Credit Hours.
Prerequisite: Completion of or concurrent enrollment in MAT 1033, MAT 1093, MAT 1214, STA 3023, 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 inferences 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.

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.

STA 3023. Statistical Mathematics. (3-0) 3 Credit Hours.
Prerequisite: MAT 1093 or an equivalent course or satisfactory performance on a placement examination. 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, eigenvalues and eigenvectors.

STA 3313. Experiments and Sampling. (3-0) 3 Credit Hours.
Prerequisite: One of the following: MS 1023, STA 1043, 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.

STA 3433. Applied Nonparametric Statistics. (3-0) 3 Credit Hours.
Prerequisite: One of the following: MS 3313, STA 2303, STA 3003, or STA 3513. Tests of location, goodness-of-fit tests, rank tests, tests based on nominal and ordinal data for both related and independent samples, and measures of association.
STA 3513. Probability and Statistics. (3-0) 3 Credit Hours.
Prerequisites: STA 3003 and one of the following: STA 3023 or MAT 1224. Axiomatic probability; random variables; discrete and continuous distributions; bivariate and multivariate distributions and their applications; mixture distributions; moments and generating functions, bivariate transformations.

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.

STA 3533. Probability and Random Processes. (3-0) 3 Credit Hours.
Prerequisite: EGR 2323. Probability, random variables, distribution and density functions, limit theorems, random processes, correlation functions, power spectra, and response of linear systems to random inputs.

STA 3813. Discrete Data Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 3003 or STA 3513. Introduction to methods for analyzing discrete (categorical) data. Course emphasizes the uses and interpretations of the methods rather than the underlying theory. Topics include Two-way and Three-Way Contingency Tables, Partial Association, Cochran-Mantel-Haenszel Method, Generalized Linear models, Model Inference and Model Checking, Logistic Regression, Loglinear Models, and Models for Matched Pairs.

STA 4133. Introduction to Programming and Data Management in SAS. (3-0) 3 Credit Hours.
This course introduces essential programming concepts using SAS Enterprise Guide software, 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, and conducting basic statistical analyses. This course also demonstrates how to write, generate, and modify SAS code within SAS Enterprise Guide.

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.

STA 4233. Statistical Applications Using SAS Software. (3-0) 3 Credit Hours.
Prerequisites: STA 4133 or approval of instructor; and one of the following: MS 3313, STA 3003, STA 3513, or STA 3523. Analysis of datasets using the statistical software package SAS. Methods for analyzing continuous and categorical data will be introduced, using procedures from Base SAS, SAS/GRAPH and SAS/STAT software. Techniques for efficient programming will be stressed. Examples will be drawn from regression analysis, analysis of variance, categorical analysis, multivariate methods, simulation, and resampling.

STA 4643. Introduction to Stochastic Processes. (3-0) 3 Credit Hours.
Prerequisite: STA 3513. Probability models, Poisson processes, finite Markov chains, including transition probabilities, classification of states, limit theorems, queuing theory, and birth and death processes.

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.

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.

STA 4753. Time-Series Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 3513 or STA 3533, 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.

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 MAT 4803. Credit cannot be earned for both STA 4803 and MAT 4803.)

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.

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.

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.

STA 4933. Internship in Statistics. (0-0) 3 Credit Hours.
Prerequisites: Permission in writing from the instructor, the Department Chair, and the Dean of the College of Business; and a 2.5 UTSA grade point average. 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. May be repeated for credit, but not more than 6 semester credit hours will apply to a bachelor's degree.
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.

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.

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.