**Course Number**: MAT 126  
**Course Title**: Elementary Statistics II  
**Credits**: 3

<table>
<thead>
<tr>
<th>Hours:</th>
<th>Co- or Pre-requisite</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture/Lab/Other</td>
<td></td>
<td>Semester &amp; Year</td>
</tr>
<tr>
<td>3 Lecture</td>
<td>MAT 125 Elementary Statistics I</td>
<td>Spring 2022</td>
</tr>
</tbody>
</table>

**Catalog description:**
This course is designed to follow Elementary Statistics I. Topics covered include: random sampling procedures, experimental and observational studies, confidence intervals and hypothesis testing on two populations and two proportions, F and Chi-Square distributions, One-Way and Two-Way ANOVA, linear regression analysis and basic nonparametric tests. Statistical software will be used.

**General Education Category:**  
**Goal 2: Mathematics**

**Course coordinator:**  
Charlene Sharkey, 609-570-3892, sharkeyc@mccc.edu

**Required texts & Other materials:**
No Book Required – Materials will be supplied through Blackboard.  
Minitab – Free trial available or on some MCCC computers  
Calculator - TI 30 Multi-view, TI 34 Multi-view, TI 36 Pro, or other TI statistical/graphing calculator (Please ask prior to purchasing a new one if you do not have one on the list.)

**Course Student Learning Outcomes (SLO):**

**Upon successful completion of this course, the student will be able to:**

1. Analyze a study to determine whether the study is descriptive or inferential and either observational or experimental and identify various aspects of an experimental design. [Supports ILG # 2, 11]  
2. Explain what is meant by a representative sample, determine the sampling procedure in which a sample was taken and take a random sample using different sampling procedures. [Supports ILG #2, 11]  
3. Construct and interpret confidence intervals and perform hypothesis tests for differences between two means and two proportions by hand and using Minitab. [Supports ILG # 2, 4, 11]  
4. Compare means of 3 or more populations using the methods of analysis of variance (ANOVA) and conduct a two-way ANOVA test using a statistical software package to determine the effect of two nominal predictor variables on a continuous outcome variable. [Supports ILG #2, 4, 11]  
5. Perform a chi-square goodness-of-fit test to make inferences about the distribution of a variable and a chi-square independence test to decide whether an association exists between two variables of a population, given bivariate data for a sample of a population. [Supports ILG #2, 4, 11]  
6. Construct and interpret confidence intervals and perform hypothesis tests for the population slope of the least-squares regression line and construct confidence intervals for the mean response and prediction intervals. [Supports ILG #2, 4, 11]  
7. Perform nonparametric tests when testing the population median or distributions that are non-normal or unknown and conduct runs for randomness. [Supports ILG #2, 4, 11]
Course-specific Institutional Learning Goals (ILG):

**Institutional Learning Goal 2. Mathematics.** Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

**Institutional Learning Goal 4. Technology.** Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

**Institutional Learning Goal 11. Critical Thinking:** Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Units of study in detail – Unit Student Learning Outcomes:

**Unit I**

**Data Collection** [Supports Course SLO # 1, 2]

**Learning Objectives**

The student will be able to:

- Explain the difference between an observational study (association) and designed experiment (causation).
- Classify a statistical study as either descriptive or inferential study.
- Explain what is meant by a representative sample.
- Describe simple random sampling, systematic random sampling, cluster sampling and stratified sampling.
- Determine the sampling procedure (simple random sampling, systematic random sampling, cluster sampling and stratified sampling) in which a sample was taken.
- Take a random sample using different sampling procedures.
- State the three basic principles (control, randomization, and replication) of experimental design.
- Identify the response variable, experimental units, the factor, levels of the factor, treatments, blocks (if applicable), and randomization of the experimental units to each treatment for an experimental design.
- Determine whether an experimental design is a completely randomized design, a randomized block design or a matched pair design.

**Unit II**

**Confidence Intervals and hypothesis testing for two population means and two population proportions** [Supports Course SLOs # 3]

**Learning Objectives**

The student will be able to:

- Construct and interpret a confidence interval and perform a hypothesis test based on independent simple random samples to compare the means of two populations when the population standard deviations are unknown, but assumed to be equal; by hand and using a statistical software package.
- Construct and interpret a confidence interval and perform a hypothesis test based on independent simple random samples to compare the means of two populations when the population standard deviations are unknown, but are not assumed to be equal; both by hand and using a statistical software package.
- Construct and interpret a confidence interval and perform a hypothesis test based on a simple random paired sample to compare the means of two populations; by hand and using a statistical software package.
Perform a hypothesis test based on a simple random paired sample to compare the means of two populations, when the paired-difference variable has a symmetric distribution; by hand and using a statistical software package.

Decide which procedure should be used to perform a hypothesis test to compare the means of two populations.

Construct and interpret a confidence interval and perform a hypothesis test based on large and independent samples to compare two population proportions by hand and using a statistical software package.

Unit III  
One-way Analysis of Variance and Two-way Analysis of Variance  
[Supports Course SLOs # 4]

**Learning Objectives**  
*The student will be able to…*

- Explain the basic properties of an F-distribution.
- Calculate the F-statistic by hand and using a statistical software package.
- Explain the essential ideas behind a one-way analysis of variance.
- State and check the assumptions for a one-way ANOVA.
- Perform and interpret a one-way ANOVA test by hand and using a statistical software package.
- Perform and interpret a two-way ANOVA test using a statistical software package.

Unit IV  
Chi Square Tests  
[Supports Course SLOs #5]

**Learning Objectives**  
*The student will be able to…*

- Use the Chi-Square table.
- Explain the reasoning behind the chi-square goodness-of-fit test.
- Perform a chi-square goodness-of-fit test; by hand and using a statistical software package.
- Decide whether an association exists between two variables of a population, given bivariate data for the entire population, by hand and using a statistical software package.
- Explain the reasoning behind the chi-square independence test.
- Perform a chi-square independence test to decide whether an association exists between two variables of a population, given bivariate data for a sample of the population; by hand and using a statistical software package.

Unit VI  
Inference in Linear Models  
[Supports Course SLOs #6]

**Learning Objectives**  
*The student will be able to …*

- Explain the assumptions for a linear model
- Check the assumptions of a linear model
- Construct a confidence interval for the population slope of the least-squares regression line by hand and using Minitab
- Perform a hypothesis test for the slope of the least-squares regression line
Construct and interpret a confidence interval for the mean response, given a particular x-value of the independent variable by hand and using a statistical software package.

Construct and interpret a prediction interval for an individual response, given a particular x-value of the independent variable.

**Unit VI  Nonparametric Statistics  [Supports Course SLOs #7]**

**Learning Objectives**

*The student will be able to ...*

- Explain what a nonparametric test is.
- Perform the sign test to test a population median by hand and using a statistical software package.
- Perform the paired-sample sign test to test the difference between two population medians (dependent samples) by hand and using a statistical software package.
- Perform the Wilcoxon signed-rank test and the Wilcoxon rank sum test to test the difference between two population distributions by hand and using a statistical software package.
- Perform the Kruskal-Wallis test to determine whether three or more samples were selected from populations having the same distribution by hand and using a statistical software package.
- Perform the Spearman rank correlation coefficient to determine whether the correlation between two variables is significant.
- Perform the runs test to determine whether a data set is random.

**Evaluation of student learning:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests (3)</td>
<td>60%</td>
</tr>
<tr>
<td>Projects (2)</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20%</td>
</tr>
</tbody>
</table>