Course Description: Covers the same topics as QMM 240 and QMM 241 combined. Intended for motivated students with good writing and analytical skills. *Satisfies the university general education requirement in the knowledge applications integration area. Prerequisite for knowledge applications: completion of the general education requirement in the formal reasoning knowledge foundation area.*

Course Prerequisites: MTH 122 or MTH 154 and MIS 100 (or MIS 200 or CSE 125 or CSE 130) with a minimum grade of 2.0 in each course and sophomore status.

General Education Learning Outcomes—Knowledge Applications Area:

- The student will demonstrate:
  - how knowledge in a field outside of the student’s major can be evaluated and applied to solve problems across a range of applications
  - knowledge of the personal, professional, ethical and societal implications of these applications.

Cross-Cutting Capacity: Critical Thinking.

Course Goals and Objectives: This is one of a number of courses that satisfy the knowledge applications general education learning outcomes (a requirement within Oakland University’s general education curriculum). QMM 250 seeks to help the student:

- Understand the roles and limitations of statistics in addressing decision problems faced by individuals, firms, organizations, and public agencies, and the contexts in which such problems arise.
- Organize, summarize, compare, and analyze univariate data.
- Recognize and apply common probability distributions (e.g., binomial, normal) to business situations.
- Create and interpret confidence intervals for the mean and proportion and estimate sample sizes for given precision.
- Perform hypothesis tests for the mean and proportion and recognize situations in which they would be appropriate.
- Understand Type I error, power, and the role of *p*-values in hypothesis tests.
- Recognize data that requires analysis of variance, use computer tools to calculate and interpret ANOVA results, and understand the assumptions underlying ANOVA.
• Recognize situations where non-parametric tests are pertinent and perform a few common tests using the computer.

• Use regression terminology correctly, analyze bivariate data (scatter plots, correlation, simple regression), and know the assumptions of least-squares regression.

• Fit trends and make forecasts from time series data using appropriate computer tools.

• Estimate a multiple regression, perform significance tests, and interpret the results. Understand the importance of data conditioning, know when a model may be overfitted and why that can be a problem, and perform diagnostic tests for model adequacy (multicollinearity, residual tests, leverage).

• Interpret common process control charts and apply simple pattern recognition rules to detect out-of-control processes.

• Use computers confidently and write effective technical reports.

**Homework:** I will assign homework problems on a regular basis. These assignments will not be graded and are strictly for the student’s edification. They should be regarded as prototypes of the questions and problems that will be posed on the exams. I cannot emphasize enough the importance of working the homework problems on a timely basis. Such extra effort will surely bear fruit with respect to your performance on the exams.

**Problem Sets:** Three graded problem sets will be assigned during the term. The problem sets will account for 10% of your course grade.

**Computer Assignments:** There will be four computer projects assigned during the term. The four assignments will account for 15% of the student's grade.

**Examinations:** There will be three examinations during the term. They will take place on the following dates:

- Exam I: Wednesday, February 10
- Exam II: Wednesday, March 24
- Exam III: Monday, April 26 (9:00-11:00 a.m.)

Each exam will cover approximately 1/3 of the course. The last exam is not comprehensive.

**Make-Up Exams:** Make-up exams will only be given at my discretion. Work related reasons for missing exams are generally not acceptable. Should I decide to let you take a make-up exam, you will be allowed to do so at a mutually convenient time during finals week.

**Academic Conduct Policy:** Students are advised to familiarize themselves with the Oakland University Academic Conduct Policy articulated on pp. 77-78 of the Undergraduate Catalog (http://www2.oakland.edu/catalog/undergrad/2009_2010_undergrad_catalog.pdf). I have a zero tolerance policy for cheating. Cheating is easily detectable. If you give the appearance of cheating, then I will immediately refer your case to the Office of the Dean of
Students. If your exam answers are copied by another student, then I will assume that you are complicit in the academic misconduct and such cases will also be submitted to the Dean of Students. (To prevent your answers from being copied by another student, simply protect your work.) Penalties for cheating at Oakland are excessive and usually result in a 0.0 for the course and suspension or expulsion.

**Class Assessment and Assignment Weights:**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Dates</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Exam I</td>
<td>February 10</td>
<td>25%</td>
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<tr>
<td>Exam II</td>
<td>March 24</td>
<td>25%</td>
</tr>
<tr>
<td>Exam III</td>
<td>April 26</td>
<td>25%</td>
</tr>
<tr>
<td>Problem Sets</td>
<td>As assigned</td>
<td>10%</td>
</tr>
<tr>
<td>Computer Assignments</td>
<td>As assigned</td>
<td>15%</td>
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</tbody>
</table>


**COURSE OUTLINE**

I will cover topics in the following order:

I. Descriptive Statistics: Types of data, graphical techniques for data, measures of central location, measures of dispersion, data exploration.
   

II. Probability: Probability theory, rules of probability, probability trees, Bayes' law.
   
   Read Ch. 5.

III. Random Variables and Discrete Probability Distributions: Random variables, expected value, variance, the Binomial distribution.
   

IV. Continuous Probability Distributions: Uniform distribution, normal distribution, standard normal distribution, normal probabilities.
   
   Read pp. 261-280.
V. Sampling Distributions: Central Limit Theorem, sampling distribution of $\bar{x}$, properties of estimators.

Read pp. 303-314.

VI. Estimation: Point versus interval estimators, estimating the mean, estimating the population proportion, estimating the difference between two means, estimating the difference between two proportions, estimating the variance, selecting the sample size.

Read pp. 315-345.

VII. Hypothesis Testing: Basic ideas, testing the mean, one-tail and two-tail tests, p-values, t-tests, inference about a population proportion, inference about a population variance.

Read Ch. 9

VIII. Comparing Two Populations: Comparing two means, comparing two variances.

Read pp. 403-425.

IX. Analysis of Variance: One way ANOVA, ANOVA models, randomized blocks, two factor ANOVA.

Read pp. 449-480.

X. Correlation and Linear Regression Analysis: Correlation, bivariate regression, inference, $R^2$, prediction.

Read pp. 499-538, 543-547.

XI. Multiple Regression: The multiple regression equation, inference, qualitative independent variables, non-linear regressors, interaction among regressors.

Read pp. 561-584.

XII. Time Series Analysis: Trend, cyclic, and seasonal variation; trend forecasting; moving averages, exponential smoothing, seasonality.

Read pp. 609-641.


Read pp. 661-676, 683-687.
XIV. Nonparametric Methods: Runs test, Wilcoxon signed-rank test, Mann-Whitney test, Kruskal-Wallis test, Spearman Rank Correlation test.

Read Chapter 16.

XV. Statistical Quality Control: Control charts, process capability; out-of-control processes, attribute charts.

Read Chapter 17.