**Course Title:** Advanced Research Design & Applied Statistics in Technology

**Course Number:** COT 711

**Prerequisites:** COT 710; competence with Excel; basic statistics

**Credit Hours:** 3 credit hours

**Contact Hours:** 3 hours per week

**Instructor:** Dr. Robert Chapman

**Office Hours:** TBA

**Office:** Sill 118

**Phone(s):**
- (734) 487-2040 at EMU
- (734) 426-3365 (home phone, preferred)

**e-mail:** chaphook@aol.com

**Texts:**
2) R. E. Chapman, COT 711 coursepack

**Software:**
1) Statgraphics 5.1
2) Winzip or equivalent
3) Microsoft Office

**Required Equipment:** Pentium computer using Windows 98/XP

**Course Description:**

This course extends the topics considered in COT 710. COT 711 contains much of the material covered in the EMU/MSQM courses, QUAL 651 & 652. It also contains topics specific to COT Ph.D. students (e.g., design types such as Quasi-experimentation, research critique, writing a brief project). The main statistical course topics are: ANOVA; multiple regression applications; response optimization; modeling large (happenstance) data sets; logistic regression; time series analysis; regression model validation; contingency table analysis; canonical correlation; discriminant analysis; analysis of collinear data problems; cluster analysis; and nonlinear regression analysis. Data sets are included to facilitate all analyses.

**Course Objectives:**

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1 QUAL 548 or equivalent. Also see the Myers reference listed in the course schedule.

2 Coursepack content is under development. Material will be sent as e-mail attachments each week.

3 Statgraphics 5.1 will be installed on selected COT computers. You can obtain Statgraphics 5.1 from me for $75. You can also obtain the latest Statgraphics version (Centurion) from: Cathy Higgins, cathy@statgraphics.com http://www.statgraphics.com/pricing.htm

4 Windows Vista is not yet supported by EMU. My hope, however, is that you will not have problems with this operating system if you use it.
The course objectives are listed below:

1. Upon course completion, each student should understand—and be able to use—a variety of advanced statistical data analysis methods.
2. Be able to critique scientific/technical articles from the literature.
3. Be able to write a brief, complete research project.

**Required Activities:**

1. **Problem sets** - Problems and associated data sets are included in the course material. Some—*but not all*—answers are also given. You are expected to complete as many of these exercises as possible to understand the techniques and how they are applied. The exercises are for your benefit as reinforcement for the concepts covered in class. My experience has been that those students who do well on the problem sets usually do well on the exams. Problem sets will *not* be turned in and will *not* be graded.
2. **Exams** - There are two exams (midterm & final) as shown on the class schedule. Both exams will be done groupwise in groups of, say, 3-4 students, using problems/data sets taken from the course material. I will randomly assign students to each group and give each group several problems from they will choose one as their exam (applies to both midterm and final). The exams have two purposes: 1) to demonstrate your competence using advanced statistical methods; and 2) to serve as a written project exercise similar to what will be required when you write your thesis. The exam answers will be presented in class in PowerPoint format. I also require a written exam report from each group. Each written report should contain (~10-15 pages) using APA format that follows the guidelines below:

   • Exams (written project submissions) should include the following items:
     ◊ cover page
     ◊ abstract (1 page)
     ◊ table of contents (1 page)
     ◊ introduction
     ◊ methodology
     ◊ data analysis
     ◊ conclusions
     ◊ references (1 page)

3. **Research critique** - These—as with exams—are to be done groupwise. Each group will find a well-written article in a (hopefully) common area of interest. Send copies to all class members as e-mail attachments. The goal for each group is to critique the chosen article based on why/how the statistical techniques discussed in the course were employed. Each group will present their critiques to the class in PowerPoint format as shown on the class schedule.

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5 You can also use a data set taken from the literature if you discuss this with me beforehand.
6 Group assignments may change based on student preferences.
7 I will initially use the same grouping as for exams. This could change, however, if we find that certain students group differently with respect to research interests.
Grading:
- Scores in the 90’s will count as A’s (A to A’).
- Scores in the 80’s will count as B’s (B’ to B’).
- Students in graduate courses are not supposed to score less than a B’. If you find yourself in this position, see me at the earliest possible time.

Course grade - The total course grade is made up of three parts as follows:
- Midterm exam = 45%
- Final exam = 45%
- Research critique = 10%

General Policies:

1. Texts - Since this is a graduate level course, I will draw from a variety of texts and articles. The ones listed on the course schedule have proved useful in my professional work. But due to the costs involved, I can’t expect you to buy all of them. Check the Halle Library for availability, or—if not available there—contact Halle for possible inter-library loans.

2. Computer software - We will use Statgraphics software for problem-solving and data analysis. Statgraphics is available for student purchase at a fraction of the cost of an original program. You are expected to demonstrate your competency in those aspects of Statgraphics illustrated in the course.

3. Incomplete (“I” grade) - This will be given only in accordance with Eastern Michigan University’s guidelines.

4. Course difficulty - Students who do not feel prepared for this course or those experiencing difficulty with the material should contact me as soon as possible.

5. Feedback - I encourage voluntary, critical feedback at any and all times about this course. My preference is that it to be face-to-face. But if this is not acceptable, I will accept it on an anonymous basis.

6. Anyone requiring accommodations due to a disability that would affect course performance should discuss the situation with me. For assistance, you may also contact the EMU Office of Students with Disabilities, 210 Goodison Hall, phone: (734) 487-2470.

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8 You can also use SPSS or Minitab. However, I offer no support for these programs in the course.
Basic statistics prerequisites

I will assume that students have studied—and are reasonably familiar with—the following topics from a basic statistics course. Please review these topics as needed.

• Frequency tables & frequency distributions
• Creating a histogram (e.g., in Excel, Statgraphics, etc.)
• Other graphical presentation formats
• Measures of central tendency & dispersion
• Mean, median & mode for normally distributed data
• Asymmetrical (skewed) distributions & Pearson’s index
• z-scores
• Quartiles
• Binomial distribution
• Poisson distribution
• normal distribution
• t-distribution
• $\chi^2$ distribution
• Hypothesis testing
• Comparison of means
• Comparison of variances of two populations (or samples)
• Categorical variables: nominal & ordinal
• Paired-sample sign test
• Nonparametric Mann-Whitney U test for two samples