

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2015	
Course Name	Engineering Statistics	
Course Code	ENGTECH 3ES3	
Date(s) and Time(s) of lectures	C01: Monday 3:30-5:30 C02: Wednesday 8:30-10:30 <i>T01: Wednesday 2:30-3:30</i> <i>T03: Wednesday 3:30-4:30</i> <i>T02: Friday 11:30-12:30</i>	
Program Name	Process Automation Technology and Biotechnology	
Calendar Description	An introductory statistics course covering the following topics with engineering applications: organization and description of data, probability and distributions, confidence intervals and hypothesis testing and bivariate data analysis using regression.	
Instructor(s)	Karen Lawrence, MSc Tom Sutton, B. Sc., B. Eng., M. Eng., P. Eng., FCIC	Email: lawrek@mcmaster.ca Office: ETB/204 Office Hours: By appointment only Email: tsutton@mcmaster.ca Office: ETB/209 Office Hours: By appointment only

2. COURSE SPECIFICS

Course Description	The course introduces statistical methods for estimation, inference (hypothesis testing) and regression analysis. The course integrates the concepts and theorems of probability, probability distributions and their mathematical functions, random variables (both continuous and discrete), random sampling and the distinctive nature of samples drawn from populations. The emphasis is on practical decision making.		
Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	25
	L	Laboratory, workshop or fieldwork	
	T	Tutorial	11
	DE	Distance education	
	Total Hours		36
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	10: 0133956490	"Stats: Data and Models" 4 ^e	De Veaux et al, 2016 Pearson
	10: 032119991X	Stand alone MyStatLab + eBook	De Veaux et al, 2016 Pearson
	Other Supplies		Source
	<ul style="list-style-type: none"> • Minitab® Statistical Software • Quality Trainer® • Scientific calculator w/ stat functions (Casio) 	Download (Avenue) Registration (Avenue) Bookstore	
Prerequisite(s)	ENG TECH 1MT3 and registration in Level III of Biotechnology or Process Automation Technology		

Antirequisite(s)	ENG TECH 3ES3 or ENG TECH 3STS
Course Specific Policies	The textbook is bundled with <i>MyStatLab</i> © which is an online homework component. Assignments are required preparation for any tests and exams. Minitab® tutorials/quizzes are an integral part of the course and part of the evaluation. Late submissions are not accepted unless prior permission has been granted.
Departmental Policies	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <p>In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of “out-of-class” work for every scheduled hour in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>
3. SUB TOPIC(S)	
Week 1	<p>Introduction, Organizing and presenting data</p> <ul style="list-style-type: none"> Identify context of a data set (population, sample) Define a variable and its ability to measure a characteristic Distinguish between quantitative and categorical variables
Week 2	<p>Describing and Comparing Distributions</p> <ul style="list-style-type: none"> Select and construct appropriate visual representations of variables Describe distributional characteristics of variables Calculate appropriate measures of centre and spread and assess for outliers Compare two or more distributions numerically and graphically
Week 3	<p>Normal distribution</p> <ul style="list-style-type: none"> Identify a distribution as a Normal probability model Apply Normal probabilities to decision making Construct and interpret Normal Probability plots Transform random variables when required. Minitab Quiz
Week 4	<p>Correlation and regression</p> <ul style="list-style-type: none"> Identify characteristics of a linear relationship with a single independent variable. Calculate appropriate measures to describe a linear relationship Interpret all measures of a linear relationship Predict a value of the dependent value Evaluate the appropriateness and effectiveness of a linear model <p>Minitab Quiz</p>
Week 5	<p>Probability</p> <ul style="list-style-type: none"> Utilize the Basic concepts of probability concepts in problem solving Apply theories of probabilities (ie Law of Large Numbers) Calculate the expectation of a function of several random variables

	<ul style="list-style-type: none"> Calculate joint and conditional distributions for discrete and continuous random variables <p style="text-align: right;">Minitab Quiz</p>	
	<i>Mid-term recess (Monday, October 12 to Saturday, October 17)</i>	
	<p>Probability distributions</p> <ul style="list-style-type: none"> Discriminate between continuous and discrete probability distributions Identify Bernoulli trials Identify a variable as following a Binomial, Geometric, Poisson or Normal probability model Calculate means and standard deviations of probability models Calculate probabilities from a model for decision making <p>Midterm exam (date and time TBD) Minitab Quiz</p>	
Week 7	<p>Sampling distributions</p> <ul style="list-style-type: none"> Demonstrate the basic principles of random sampling and how they are used to obtain a representative sample Describe the sampling distribution of the mean and the proportion. Defend the use of the Central Limit Theorem Solve problems using the sampling distribution of the mean and the proportion. State the assumptions and conditions for the sampling distribution of the mean and the proportion. <p style="text-align: right;">Minitab Quiz</p>	
Week 8	<p>Inferences for proportions</p> <ul style="list-style-type: none"> Construct a confidence interval for a proportion and difference between proportions Interpret a confidence interval. Explain the effect of changing the sample size on the margin of error Calculate the required sample size for a given level of confidence Conduct a hypothesis test for a proportion and difference in two proportions Interpret the p-value in context Generalizes results to target population <p style="text-align: right;">Minitab Quiz</p>	
Week 9/10	<p>Inferences for means</p> <ul style="list-style-type: none"> Check that the assumptions required for t-intervals are met Compute and interpret a t-interval for the population mean and the difference between two means. Calculate the required sample size for a given level of confidence Conduct a hypothesis test for a mean and the difference between two means (pooled t-test, non pooled t-test and a matched pairs t-test) Revise analyses based on assumptions and conditions Generalizes results to target population <p style="text-align: right;">Minitab Quiz</p>	
Week 11	<p>Analysis of Variance (ANOVA) and F- tests</p> <ul style="list-style-type: none"> Perform analysis of variance in one way classifications with fixed effects Define treatment and response Interpret results of an F test Summarize statistics of an F-test in an ANOVA table Investigate significant results with multiple comparisons Qualifies violation of assumptions through residual analysis Generalizes results to target population <p style="text-align: right;">Minitab Quiz</p>	
Week 12	<p>Multiple Regression and Inference</p> <ul style="list-style-type: none"> Perform a hypothesis test on the slope coefficient Interpret the p-value of the t-statistic for the slope Construct and interpret a confidence interval for the slope 	

	<ul style="list-style-type: none"> • Identify and interpret the confidence and the prediction interval for the mean of the predicted y-values based on output. • Examine residuals for violations of assumptions • Perform calculations and make displays required for multiple regression. • Determine significance of overall regression model and individual model coefficients. • Utilise indicator variables for categorical predictors • Utilise an interaction term to adjust for different slopes <p>Minitab Test – last tutorial period of semester Quiz</p>
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Classes end – Tuesday December 8, 2015
Final examination period: Wednesday December 9, 2015 to Tuesday, December 22, 2015
All examinations MUST BE written during the scheduled examination period.

Note that this structure represents a plan and is subject to adjustment term by term. The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING	Weight
Tutorials/Assignments/Quizzes <i>(Weekly)</i>	20%
Midterm test <i>(Week 7)</i>	30%
Minitab Test <i>(Week 12)</i>	10%
Final Examination {comprehensive} <i>(Exam period)</i>	40%
TOTAL	100%

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Differentiate between statistical terms illustrating with examples.
2. Create a computer generated report which summarizes numerical data in a form from which business decisions can be made.
3. Predict future or current values for a variable based on current data, using both manual calculations and computer software.
4. Integrate the use of probabilities into decision making.
5. Integrate sampling distribution techniques into decision making.
6. Use statistical techniques for estimating population means and drawing inferences.
7. Determine if two or more processes or populations are the same with respect to either mean or proportion.

6. POLICIES

Anti-Discrimination

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible. <http://www.mcmaster.ca/policy/General/HR/Anti-Discrimination%20policy.pdf>

Academic Integrity

You are required to exhibit honestly and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the

various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at: <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations.

Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period.

You may submit a maximum of 1 Academic Work Missed requests per term. It is YOUR responsibility to follow up with your Instructor immediately regarding the nature of the accommodation.

If you are absent more than 3 days or exceed 1 request per term you MUST visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation.

This form should be filled out immediately when you are about to return to class after your absence. <http://www.mcmaster.ca/msaf/>

E-Learning Policy

Consistent with the Bachelor of Technology's policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. Avenue can be accessed via <http://avenue.mcmaster.ca>.

Communications

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

Turnitin (Optional)

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin's database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student's work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/turnitin/students/>

Protection of Privacy Act (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades and all other personal information at all times. For example, the submission and return of assignments and posting of grades must be done in a manner that ensures confidentiality.

<http://www.mcmaster.ca/univsec/fippa/fippa.cfm>

Academic Accommodation of Students with Disabilities Policy

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information consult McMaster's policy for Academic Accommodation of Students with Disabilities

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. <http://sas.mcmaster.ca>

Student Code of Conduct

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.

<http://judicialaffairs.mcmaster.ca/pdf/SCC.pdf>