

ESC 310 ENGINEERING STATISTICS & PROBABILITY

Section 1 - SPRING SEMESTER 2021

- COURSE OBJECTIVE:** The objective of this course is to introduce engineering students to basic statistical concepts and methods used in the analysis of data and in decision making based on statistical evidence.
- COURSE DESCRIPTION:** Probability and Statistical concepts and definitions, discrete and continuous random variables and probability distributions; point estimates, confidence intervals statistical inference, hypothesis testing, least squares curve fitting as applied to engineering problems and experimental data. Covers statistical material in the body of knowledge required for the FET Eng. Licensing exam.
- DESIGN CONTENT:** Students will be required to design various statistical tests, gather appropriate data, analyze, and express results.
- COURSE REQUIREMENTS:** MTH 182: Calculus II, MTT 300: Applied Mathematics. Familiarity with Microsoft Excel spreadsheets.

TEXT: BOTH First: Engineering Statistics, 5th Edition, Hard Copy Book by Douglas C. Montgomery and George C. Runger Wiley Press ISBN: 9780470631478 and **Secondly Wiley Plus Student Package by Douglas C. Montgomery and George C. Runger Wiley Press ISBN 9780470919149**

INSTRUCTOR: Elie Barbari- Mechanical Engineering department-Industrial and Manufacturing Engineering

OFFICE HOURS: **T-Th 10:00AM- 11:15 AM Eastern Time USA -Zoom Meeting to ask Questions and Learn the concepts, theories well and their applications in solving engineering statistics problems and make decisions.**

COURSE GRADE:	Homework	15%	A >=92%	C+ >= 75%
	3 Tests (20% each)	60%	A- >= 90%	C >= 70%
	Comprehensive	25%	B+>= 87%	D >=60%
	_____	_____	B >= 83%	F < 60%
	Total	100%	B- >= 80%	

Home Work Policy: Homework assignments **are due on T-Th at 10:00 am.** Late submittal of homework or assignments will be penalized by 20% deduction per day. The Homework assignment will have 2 parts: Part 1 of the homework assignments will be completed on **Wiley Plus WEB SITE** accessed by using the Wiley Plus Code and it is the student responsibility to complete them on or before the due date. Part 2 is to have the **HANDWRITTEN** answers to the

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same questions solved in part 1 but showing all steps, calculations, equations, tables and graphs/plots to be submitted on **Blackboard** on or before the due date. **Hence it is advisable to Listen to all Power Points Lectures, read the examples in the book, attend all Zoom meetings in order to be able to complete the Homework assignments CORRECTLY.**

Attendance & Late Policy: Attendance of the Zoom Meetings is mandatory and highly recommended. Make-up Tests can be arranged if the student has a proper reason for missing the test and has notified the instructor before the test is given in the class. **Proper reasons include Medical Excuse with a doctor notice or an Immediate Family member Funeral. You need to contact me in person in case these reasons are warranted. You can call at 216-687-2567 and leave a message with the Mechanical Dept. Secretary. Also you can e-mail me at e.barbari@csuohio.edu with ESC 310 and kindly include your Name in the Subject/Title of your e-mail in order to receive a response from me by return e-mail.**

The four tests are OPEN BOOK will cover computations, theories and ideas covered in class. You will be allowed to use the Charts at the end of the book, and a calculator during the tests. The exams will have the same format as the Homework assignment with 2 Parts. **Also, old Tests with solutions, Pages from the Solution Manual, a second Laptop, or I-Phone or I-Pad are not allowed to be used during the online exams.** As part of the University's ongoing efforts to prevent cheating, and based on evidence of increased use of headphones and ear piece devices to permit cheating on exams, all students are required to display their ears for the duration of any exam. This policy may require students to tuck long hair behind ears or pull it into a ponytail or hair clip; remove hoods, caps or hats, or pull hats and caps up above ears; pull back headbands, beanies, hijabs, bandanas or other head coverings to display the student's ears. Any student not complying with this policy will, after a warning, be issued a zero on the exam. Students with concerns about their compliance with this policy must speak to me before the final.

Collaboration: Each student must create his/her own unique deliverable solutions to the homework problems. Submitting an assignment containing information copied by any means (visual, cut and paste, etc.) from another student's work, **pirated author's solutions**, or any other source is unacceptable. Enough physical similarity between submitted assignments and any other source to create the suspicion that copying has occurred will result in loss of credit for all involved and possible academic discipline. Please see the following document concerning plagiarism. *Adapted from Course Syllabus CPSC 361: Simulation Hiram College by Professor Dr. Oberta A. Slotterbeck*

Academic misconduct (or plagiarism) is an act in which a student:

- (a) seeks to claim credit for the work or efforts of another without authorization or citation;***
- (b) uses unauthorized materials or fabricated data in any academic exercise;***
- (c) forges or falsifies academic documents or records;***
- (d) intentionally impedes or damages the academic work of others;***
- (e) engages in conduct aimed at making false representation of a student's academic performance;***
- (f) assists other students in any of these acts.***

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Examples of academic misconduct include, but are not limited to: Cheating on an examination; collaborating with others in work to be presented contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above - including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed. Plagiarism is considered a very, very serious crime in the academic world and can result in you failing an assignment, failing a course, or even being dismissed from the college. Note that both the giver and the receiver can be held responsible. Be careful that you do not allow your work to lie around or that you leave files on computers others could access.

The bottom line: Do your own work. If you have any doubts, talk to your instructor -- before you do anything you might regret. A desire to "be a good buddy" could result in serious consequences if plagiarism is detected.

Academic Honesty. "Cheating" means intentionally misrepresenting the source, nature, or other conditions of academic work to receive undeserved credit. Cleveland State University affirms that acts of cheating debase the academic degree awarded, have no place in the University, and are severe offenses to academic goals, objectives and the rights of fellow students. CSU does not tolerate any type of cheating and will take disciplinary action up to and including expulsion.

Outcomes:

0- An ability to demonstrate the principles of engineering science, college level mathematics, and the basic sciences

Upon completion of this course the students should understand and be able to apply the following concepts in their professional practice and personal lives:

- principles of probability and statistics, including hypothesis testing;
- a basis for development, comparison, and selection of the mean, variance of populations and samples;
- graphing methods of data sets, and;
- using normal, binomial and other distributions.

Health and Safety Statement: The COVID-19 pandemic is still present and serious. Before entering class, you should have completed your daily health assessment. While you are in class on campus, you are required to: sit in your designated seat, maintain physical distance, wear your facial covering (e.g., masks or face shields), always cough or sneeze into your elbow or tissue, use the materials provided to clean your desk and chair before and after use, and adhere to other public safety protocols and directives for your specific classroom/lab/studio.

Students who do not follow these health and safety requirements will be instructed to leave class immediately. Students who violate this protocol will need to leave the classroom and MAY be marked absent. Repeated violations of these health-saving protocols may lead to sanctions under the [Student Code of Conduct \(3344-83-04 \[E\] and \[Z\]\)](#) up to and including suspension or expulsion. The CSU community thanks you for your cooperation!

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Tenative topic and test schedule subject to change and possible adjustment during semester

Tuesday	19- JAN	Intro& Chap 1	Tuesday	16-MAR	Chap 4 & Review
Thursday	21- JAN	Chap 1 & 2	Thursday	18-MAR	Test on Chap 4
Tuesday	26- JAN	Chap 2	Tuesday	23-MAR	Chap 5
Thursday	28- JAN	Chap 2	Thursday	25-MAR	Chap 5
Tuesday	2-Feb	Chap 2 & Review	Tuesday	30- MAR	Chap 5
Thursday	4-Feb	Test on Chaps 1 &,2	Thursday	1-APR	Chap 5
Tuesday	9- FEB	Chap 3	Tuesday	6-APR	Chap 5
Thursday	11- FEB	Chap 3	Thursday	8- APR	No class Reading/Study Day
Tuesday	16- FEB	Chap 3	Tuesday	13- APR	Chap 6
Thursday	18- FEB	Chap 3	Thursday	15- APR	Chap 6
Tuesday	23- FEB	Chap 3 & Review	Tuesday	20- APR	Chap 6
Thursday	25- FEB	Test on Chap 3	Thursday	22- APR	Chaps 5 & 7 ANOVA
Tuesday	2- Mar	Chap 4	Tuesday	27- APR	Chap 7 ANOVA
Thursday	4- MAR	Chap 4	Thursday	29-APR	Chap 7 Review for Final Exam
Tuesday	9- MAR	Chap 4	Tuesday	4-May	Final Exam 10:15 am – 12:15 pm
Thursday	11- MAR	Chap 4			

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Topics Covered

Introduction Chapter 1

- The Engineering Method and Statistical Thinking sec. 1-1
- Making Statistical Inference about a Population sec. 1-1
- Collection of Engineering Data from Retrospective, Observational and Design of Experiment Studies sec. 1-2
- Random Sample, Averages and Variations in Data sec. 1-2
- Mechanistic and Empirical Models sec. 1-3
- Observing Processes over Time sec 1-4

Data Summary and Presentation Chapter 2

- Calculations of the Populations Parameters and Sample Statistics sec. 2-1
- Graphing Methods of data Histogram and Box Plots secs. 2-3, 2-4
- Time Series plots and calculation of the Sample Correlation Coefficient secs. 2-5, 2-6
- Problem Solving

TEST 1 on Chapters 1 & 2

Random Variables and Probability Distributions Chapter 3

- Random Experiment, Discrete and Continuous Variables secs. 3-1, 3-2
- Probability Properties and Differentiation of a Continuous Function secs. 3-3, 3-4
- Standard Normal Distribution, Normal Distribution and Z- Table usage sec. 3-5.1
- Lognormal, Gama and Beta Distributions secs. 3-5.2, 3-5.3, 3-5.5
- Finding if the data is Normally Distributed from Probability Plot sec. 3-6
- Binomial, Exponential, Poisson Distributions secs. 3-5.2, 3-5.5, 3-7, 3-8, 3-9
- Reliability and Independence of more than One Variable in Joint Probability Function secs. 3-11, 3-12.1, 3-12.2
- Central Limit Theorem and Random Sample Statistics sec.3-13
- Problem Solving

TEST 2 on Chapter 3

Hypothesis Testing for One Population Chapter 4

- Statistical Inference and Point Estimation secs. 4-1, 4-2
- Stating the Null and Alternative Hypothesis for One- sided and Two-Sided Tests, Type I, Type II Errors and the Power of the Test, P-Value, Performing the steps of Test to make an Inference about Mean, Variance, Proportion of One Population Parameter secs. 4-3, 4-4, 4-5, 4-6, 4-7
- Utilizing the Z, T, and the Chi-Square Tables to obtain Decisions on different One Population Parameter Test secs. 4-3, 4-4, 4-5, 4-6, 4-7
- Finding the required Sample Size n secs. 4-4, 4-7
- Problem Solving

TEST 3 on Chapter 4

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Hypothesis Testing for Two Population Chapter 5

Statistical Inference about the means sec. 5-1

- Stating the Null and Alternative Hypothesis for One- sided and Two-Sided Tests, Type I, Type II Errors and the Power of the Test, P-Value, Performing the steps of Test to make an Inference about Means, Variances, Proportions of Two Population Parameters secs. 5-2, 5-3, 5-4, 5-5, 5-6
- Utilizing the Z, T, and the F Tables to obtain Decisions on different Test secs. 5-2, 5-3, 5-4, 5-5, 5-6
- Finding the required Sample Size n secs. 5-2, 5-6
- Problem Solving

Multiple and linear Regression Models Chapter 6

- Building Empirical Models for Independent Variable and Dependent Variables sec. 6-1
- Least Square Estimation and Analysis of Simple Linear Regression Model, sec. 6-2
- Obtaining the Estimated Regression Equation, the ANOVA Table for the Simple Linear Regression Model and Test the Significance of the Slope β_1 sec. 6-2
- Calculation of Coefficients of Correlation and Determination of Simple Linear Regression Model and determining the Adequacy of the Model
- Calculating the Confidence and Prediction Intervals sec. 6-2
- Introduction to Multiple Regression Model sec. 6-3
- Problem Solving

Design of Experiments and Factorial Analysis Chapters 5 & 7

- Analysis of Completely Randomized Experiment for Single Factor, Analysis of Completely Randomized Block Experiment for Two Factors, Factorial Experiments Using ANOVA to make an Inference about the Means of more than Two Populations Secs. 5-8, 7-3
- Problem Solving

Final Exam