

## Probability and Statistical Methods for Engineering

### ENGR-210

CG Section 8WK 07/01/2018 to 12/31/2199 Modified 04/08/2022

### Course Description

Introduction to applied probability and the principles and methodologies of statistical inference. Topics include methods of data analysis, point and interval estimation; test of hypotheses, correlation, regression and an introduction to analysis of variance methods.

#### Requisites

For information regarding prerequisites for this course, please refer to the [Academic Course Catalog \(https://catalog.liberty.edu/\)](https://catalog.liberty.edu/).

### Rationale

The engineering degree programs are designed to develop Christ-centered men and women with the values, knowledge, and skills essential to positively influence engineering-related industries in the current and evolving economy. The programs prepare graduates for the thoughtful integration of work and life and to view the engineering profession as a lifelong commitment to serving others. Within a few years of graduating, engineering graduates will be able to advance in an engineering career or graduate studies, be recognized as a creative thinkers exhibiting an aptitude for continuous learning, and display professional ethics and behavior consistent with foundational Christian principles. To that end, the objective of this course is to study applied probability, along with descriptive and inferential statistics. Topics include applied probability, statistical inference including point and interval estimation, tests of hypotheses, correlation, regression and analysis of variance methods.

### Course Learning Outcomes

Upon completion of this course the student will be able to (SO 1, 3, 5, 6, 7):

- A. Calculate and use descriptive statistics to represent data (SO 6).
- B. Identify, formulate and solve problems applying principles in probability and using various probability distributions (SO 1, 6).
- C. Compute the expected value of a probability distribution and function and use in decision-making (SO 6).
- D. Calculate confidence intervals for a population mean, proportion, and standard deviation (SO 6).
- E. Use hypothesis testing to analyze and interpret data, and draw conclusions (SO 1, 6).
- F. Use regression analysis and curve-fitting to determine the correlation between sets of data (SO 1, 6).
- G. Use Analysis of Variance (ANOVA) to compare different treatments or populations (SO 1, 6).
- H. Research and synthesize biblical principles relevant to mathematics and / or statistics (SO: 3, 7).
- I. Participate in teams to apply statistical principles to various projects and produce appropriate reports (SO 3, 5, 6).

#### Relation to Student Outcomes

Student Outcome	Level	Demonstrate Proficiency

1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	E	Exams, homework, projects, quizzes
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	N	
3	an ability to communicate effectively with a range of audiences	R	Projects, discussion boards
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	N	
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	R	Projects
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	E	Homework, quizzes, exams, projects, discussion boards
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	I	Project, quizzes, discussion boards
N = none; I=introduced; R=reinforced; E=emphasized			

## Course Resources

Click on the following link to view the required resource(s) for the term in which you are registered: [Liberty University Online Bookstore \(https://bncvirtual.com/liberty\)](https://bncvirtual.com/liberty)

**Additional Materials for Learning**

- A. Computer with basic audio/video output equipment
- B. Internet access (broadband recommended)
- C. Canvas [recommended browsers \(https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66\)](https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66)
- D. Microsoft Office

## ☰ Course Assignments

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### Textbook Readings and Lecture Presentations

#### Course Requirements Checklist

After reading the Course Syllabus and [Student Expectations \(https://www.liberty.edu/institutional-effectiveness/student-expectations/\)](https://www.liberty.edu/institutional-effectiveness/student-expectations/), the student will complete the related checklist found in the Course Overview.

#### Discussions (2)

Discussion boards are collaborative learning experiences. Therefore, there will be 2 discussion boards (@ 20 pts = 40 pts) to apply concepts learned in class, and learn from and encourage other students in the course.

#### Homework Assignments (8)

There will be approximately 200 homework problems: some from the textbook, and most from the online homework problems (worth 200 pts) on WebAssign accessed through Canvas to complete for the textbook sections covered. The purpose of the homework is to reinforce material covered and expand the student's knowledge of problem solving with problems that are too complicated to put on exams or quizzes. The student must not get behind!

#### Project Assignments (4)

There will be three graded team projects and a team *paper* during the semester that will reinforce the class learning and provide the student with challenging ways to apply probability and statistical principles (4 @ 50 pts = 200 pts). The paper will include integration of biblical worldview to the maximum extent possible. Team members must be *proactive* – those not contributing will earn a zero.

#### Review Quizzes (8)

There will be 8 periodic quizzes (@ 20 pts / each = 160 points) for the sections of the assigned text covered and based on the homework problems. The purpose of the quizzes is to reinforce the learning process, validate the student's comprehension of the material in a timed environment, and prepare the student for future tests on this material (e.g., Fundamentals of Engineering Exam). Quizzes are *not* meant to help the student prepare for cumulative quizzes.

#### Cumulative Quizzes (3)

There will be 2 quizzes (@ 130 pts / each), as well as a final quiz (new material) (140 pts). The purpose of these quizzes is to reinforce the learning process and validate the student's comprehension and retention of the material covered. Solutions, rather than answers, are expected for all problems. An answer is the final answer to the question asked in the problem. By contrast, a solution is more; it also includes the argument/reasoning/work that leads to the answer.

## ✓ Course Grading

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Course Requirements Checklist	10
Discussions (2 at 20 pts ea)	40
Homework Assignments (1 at 29 pts, 2 at 31 pts, 1 at 27 pts, 1 at 37 pts, 1 at 7 pts, 1 at 18 pts, 1 at 20 pts)	200

Project Assignments (3 team projects at 50 pts ea, 1 team paper at 50 pts)	200
Review Quizzes (8 at 20 pts ea)	160
Cumulative Quizzes (2 at 130 pts ea, 1 at 140 pts)	400
<b>Total</b>	<b>1010</b>

## \* Course Policies

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Consistent or improving performance is encouraged. The instructor reserves the right to adjust and curve the final grades based on student effort. Students are expected to be actively engaged in the course by allocating sufficient time to study the course materials, actively participate in the assigned projects, and making positive contributions to the learning environment.

## Policies

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### Late Assignment Policy

Course Assignments, including discussions, exams, and other graded assignments, should be submitted on time.

If the student is unable to complete an assignment on time, then he or she must contact the instructor immediately by email.

Assignments that are submitted after the due date without prior approval from the instructor will receive the following deductions:

1. Late assignments submitted within one week after the due date will receive up to a 10% deduction.
2. Assignments submitted more than one week and less than 2 weeks late will receive up to a 20% deduction.
3. Assignments submitted two weeks late or after the final date of the course will not be accepted outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.
4. Group projects, including group discussion threads and/or replies, and assignments will not be accepted after the due date outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.

### Disability Assistance

Students with a disability and those with medical conditions associated with pregnancy may contact Liberty University's Online Office of Disability Accommodation Support (ODAS) at [LUOODAS@liberty.edu](mailto:LUOODAS@liberty.edu) for accommodations. Such accommodations require appropriate documentation of your condition. For more information about ODAS and the accommodations process, including how to request an accommodation, please visit <https://www.liberty.edu/online/online-disability-accommodation-support/> (<https://www.liberty.edu/online/online-disability-accommodation-support/>). Requests for accommodations not related to disabilities or pregnancy must be directed to the Registrar's Office, which generally handles medical needs support.

If you have a complaint related to disability discrimination or an accommodation that was not provided, you may contact ODAS or the Office of Equity and Compliance by phone at (434) 592-4999 or by email at [equityandcompliance@liberty.edu](mailto:equityandcompliance@liberty.edu). Click to see a full copy of Liberty's [Discrimination, Harassment, and Sexual Misconduct Policy](https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf) ([https://www.liberty.edu/media/1226/Liberty\\_University\\_Discrimination\\_Harassment\\_and\\_Sexual\\_Misconduct\\_Policy.pdf](https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf)) or the [Student Disability Grievance Policy and Procedures](http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf) ([http://www.liberty.edu/media/8021/Disability\\_Grievance\\_Procedures.pdf](http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf)).

### Course Attendance

In an effort to comply with U.S. Department of Education policies, attendance is measured by physical class attendance or any submission of a required assignment within the enrollment dates of the course (such as examinations, written papers or projects, any discussion posts, etc.) or initiating any communication with one's professor regarding an academic subject. More information

regarding the [attendance policy \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2Band%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2Band%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0) can be found in the [Academic Course Catalogs \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0). Regular attendance in online courses is expected throughout the length of the term. Students who do not attend within the first week of a sub-term by submitting a required academic assignment (such as the Course Requirements Checklist, an examination, written paper or project, discussion post, or other academic activity) will be dropped from the course. Students who wish to re-engage in the course are encouraged to contact Academic Advising to discuss their enrollment options. Students who begin an online course, but at some point in the semester cease attending, and do not provide official notification to withdraw, will be assigned a grade of "FN" ([Failure for Non-Attendance \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FUnofficial%2BWithdrawals&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=MoMvZdPfza69InuhVHMHAVgu59ZP0Fw45xJTU9PIBrU%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FUnofficial%2BWithdrawals&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=MoMvZdPfza69InuhVHMHAVgu59ZP0Fw45xJTU9PIBrU%3D&reserved=0)). Students wishing to withdraw from courses after the official start date should familiarize themselves with the [withdrawal policy](#).

## Grading Scale

A	B	C	D	F
900-1010	800-899	700-799	600-699	0-599

For courses with a Pass/NP final grade, please refer to the Course Grading section of this syllabus for the assignment requirements and/or point value required to earn a Passing final grade.

## Add/Drop Policy

The full policy statement and procedures are published in the [Policy Directory \(https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes\)](https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes).

## Honor Code

Liberty University comprises a network of students, Alumni, faculty, staff and supporters that together form a Christian community based upon the truth of the Bible. This truth defines our foundational principles, from our Doctrinal Statement to the Code of Honor. These principles irrevocably align Liberty University's operational procedures with the long tradition of university culture, which remains distinctively Christian, designed to preserve and advance truth. Our desire is to create a safe, comfortable environment within our community of learning, and we extend our academic and spiritual resources to all of our students with the goal of fostering academic maturity, spiritual growth and character development.

Communities are predicated on shared values and goals. The Code of Honor, an expression of the values from which our Doctrinal Statement was born, defines the fundamental principles by which our community exists. At the core of this code lie two essential concepts: a belief in the significance of all individuals, and a reliance on the existence of objective truth.

While we acknowledge that some may disagree with various elements of the Code of Honor, we maintain the expectation that our students will commit to respect and uphold the Code while enrolled at Liberty University.

Adherence to the principles and concepts established within facilitates the success of our students and strengthens the Liberty community.

The Code of Honor can be viewed in its entirety at <http://www.liberty.edu/index.cfm?PID=19155> (<http://www.liberty.edu/index.cfm?PID=19155>).

## Schedule

When	Topic	Notes
<b>Course Overview</b>	<b>Student Acknowledgements</b>	Course Requirements Checklist
<b>Module 1: Week 1</b>	Learn	Read: 8 items Watch: 1 item Interact: 2 items
	Apply	Quiz: Descriptive Statistics Written Work Submission: Descriptive Statistics Assignment
<b>Module 2: Week 2</b>	Learn	Read: 9 items Watch: 2 items Interact: 1 item
	Apply	Quiz: Variability & Probability Written Work Submission: Variability and Probability Assignment
<b>Module 3: Week 3</b>	Learn	Read: 6 items Watch: 1 item Interact: 1 item
	Apply	Quiz: Independence and Discrete Random Variables Written Work Submission: Independence and Discrete Random Variables Assignment Quiz: Descriptive Statistics, Probability & Discrete Probability Distributions Written Work Submission: Descriptive Statistics, Probability & Discrete Probability Distributions Assignment
<b>Module 4: Week 4</b>	Learn	Read: 6 items Watch: 1 item Interact: 1 item
	Apply	Discussion: Statistics in the Media Descriptive Statistics Group Assignment Quiz: Discrete and Continuous Probability Distributions Written Work Submission: Discrete and Continuous Probability Distributions Assignment
<b>Module 5: Week 5</b>	Learn	Read: 6 items Watch: 1 item Interact: 1 item
	Apply	Discrete Probability Distributions Group Assignment Christian Perspective of Mathematics Group Paper Assignment Quiz: Continuous Distributions & Central Limit Theorem Written Work Submission: Continuous Distributions & Central Limit Theorem Assignment

When	Topic	Notes
Module 6: Week 6	Learn	Read: 7 items Watch: 1 item Interact: 1 item
	Apply	Quiz: Confidence Intervals Written Work Submission: Confidence Intervals Assignment Quiz: Discrete & Continuous Probability Distributions, CLT & Confidence Intervals Written Work Submission: Discrete & Continuous Probability Distributions, CLT & Confidence Intervals Assignment
Module 7: Week 7	Learn	Read: 8 items Watch: 1 item Explore: 1 item
	Apply	Peer-Review Discussion: Regression Analysis Hypothesis Testing Group Assignment Quiz: Hypothesis Tests & Simple Linear Regression Written Work Submission: Hypothesis Tests & Simple Linear Regression Assignment
Module 8: Week 8	Learn	Read: 8 items Watch: 1 item Interact: 1 item
	Apply	Homework Assignment Quiz: Regression Models & Correlation & ANOVA Written Work Submission: Regression Models & Correlation & ANOVA Assignment Quiz: Confidence Intervals, Hypothesis Tests, Regression, Correlation & ANOVA Written Work Submission: Confidence Intervals, Hypothesis Tests, Regression, Correlation & ANOVA Assignment