Department of Electrical & Electronic Engineering
College of Engineering & Computer Science

ENGR 120: Probability and Random Signals
Fall 2022 Semester Syllabus

# Part 1: Course Information

## Instructor Information

**Instructor:** Prof. ECS Academic Council
**Office:** Riverside Hall, Room 2014
**Office Hours:** TBD
**Office Telephone:** (916) 278-6366
**E-mail:** instructor\_email@csus.edu

## Course Description

Probability and random signals and their application in engineering systems. Topics include the random sample space model, concept of axiomatic probability, conditional probability, discrete and continuous random variables, probability density and distribution functions, functions and statistics of random variables, random vectors multivariate distributions, and correlation and covariance of random vectors. Applications include estimation, risk, signal detection, random signals and noise in linear systems, reliability, and estimation.

### Prerequisite

* EEE 180, may be taken concurrently.

### GE Area if Applicable

* NA.

## Textbook & Course Materials

### Required Text

* C. Therrien and M. Tummala, “Probability and Random Processes for Electrical and Computer Engineers”, CRC Press, 2nd Edition, 2011. Available at CSUS book store. E-book also available in CSUS library.

### Recommended Texts & Other Readings

* P. Z. Peebles, “Probability, Random Variables, and Random Signal Principles”, McGraw-Hill, 4th Edition, 2001.
* D. P. Bertsekas, J. Tsitsiklis, “Introduction to *Probability*”, Athena Scientific, 2nd Edition, 2008.
* M. Carlton and J. Devore, “Probability with Applications in Engineering, Science and Technology”, Springer, 2nd Edition, 2017.
* Leon-Garcia, “*Probability and Random Processes for EE*”, Addison Wesley, 2nd Edition, 1994.

## Course Requirements

* Access to Canvas
* MATLAB will be required for computer assignments. Contact [ECS helpdesk](https://www.csus.edu/college/engineering-computer-science/computing-services/ecs-help-desk.html) for campus-wide software license.

## Course Structure

This course will be delivered entirely face-to-face at the class location and time listed above. All lecture material and assignments will be uploaded to the course management system Canvas. You will use your Saclink account to login to the course from your [My Sac State](https://my.csus.edu/) account and click on the Canvas button or login directly through the [Canvas Login Page](https://csus.instructure.com/).

## Canvas Access

To access this course on Canvas you will need access to the Internet and a supported Web browser (Chrome, Firefox, Safari). To ensure that you are using a supported browser and have required plug-ins, please visit the “[Which browsers does Canvas support](https://community.canvaslms.com/docs/DOC-10720-which-browsers-does-canvas-support)” website.

## Technical Assistance

If you need technical assistance at any time during the course or to report a problem with Canvas you can:

* [Submit a Ticket](https://csus.service-now.com/service/?id=help) to Report a Problem to the Information Resources and Technology Support Team
* Call the Canvas Support line at Sac State: M-F 8a.m. – 5p.m. (916) 278-2450.
* [Schedule a Consultation](https://www.csus.edu/information-resources-technology/get-support-consultation/consultation.html) to get assistance with Canvas and other Academic technologies
* Visit the [Canvas Instructor Video Guides](https://community.canvaslms.com/community/answers/guides/video-guide#jive_content_id_Instructors)
* Visit the [Canvas Student Video Guides](https://community.canvaslms.com/community/answers/guides/video-guide#jive_content_id_Students)
* Visit the Canvas [Student Web Tutorials](https://community.canvaslms.com/docs/DOC-10701)
* Visit the [Canvas Instructor Web Tutorials](https://community.canvaslms.com/docs/DOC-10460)

**Important Note:** This syllabus, along with course assignments and due dates, are subject to change. It is the student’s responsibility to check Canvas for corrections or updates to the syllabus. Any changes will be clearly noted in course announcement or through Canvas email.

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# Part 2: Course Objectives

After successfully completing the course, the students will be able to

* Apply basic concepts of probabilities.
* Explain the use of random variables in solving engineering problems.
* Explain the basic concepts of random processes.
* Describe the basic concepts of system analysis using random inputs.

You will meet the objectives listed above through a combination of the following activities in this course:

* Biweekly course assignments
* Quizzes
* Two computer assignments
* Three Examinations

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# Part 3: Topic Outline/Schedule

**Important Note:** Refer to the course calendar for specific meeting dates and times. Activity and assignment details will be explained in detail within each week's corresponding module. If you have any questions, please contact your instructor.

|  |  |  |
| --- | --- | --- |
| **Week** | **Topics** | **Reading Assignment (chapter/section)** |
| 1 | **Probability**IntroductionSet definitions and set operationsAxioms of probability | 1.1-1.22.12.2.1 |
| 2 | Conditional probability, independent events, Bayes law  | 2.2.2-2.4 |
| 3 | **Random Variables**Discrete random variables, PMFSome common discrete distributionsContinuous random variables | 3.13.23.3.1 |
| 4 | CDF, PDFSome important random variables | 3.3.2-3.3.43.4 |
| 5 | **Exam I**Mixed random variablesTransformation of random variables | 3.53.6 |
| 6 | Transformation of random variables (continued) Conditional distribution and density functions | 3.63.7 |
| 7 | ExpectationMomentsMoment generating functions | 4.14.24.3 |
| 8 | **Multiple random variables**Pairs of random variablesProperties of joint distribution and joint density | 5.1.15.1.2-5.2 |
| 9 | Joint, conditional expectation/momentSum of random variables | 5.3-5.45.5 |
| 10 | Markov, Chebyshev inequalities Law of large numbers, central limit theorem | 6.16.2 |
| 11 | **Exam II**Estimation, sample mean, variance | 6.3 |
| 12 | **Random Processes –Temporal Characteristics**Concept of a random process Stationarity and independence | 8.18.2 |
| 13 | First and second moments of a random process, cross correlation | Chapter 9 |
| 14 | **Random Signals in the Frequency Domain**Power spectral density, properties and applications | Chapter 10 |
| 15 | Other topics in probability/review |  |
| 16 | **Finals Week** |  |

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# Part 4: Grading Policy

## Graded Course Activities

Visit the **Assignments** link in Canvas for details about each assignment listed below. Click on **Quizzes** to access quizzes and exams.

| **Points**  | **Description** |
| --- | --- |
| 20 | Assignments and quizzes.  |
| 20 | Exam I |
| 25 | Exam II |
| 35 | Final Exam (comprehensive) |
| 100 | Total Points Possible |

### Late Work Policy

Be sure to pay close attention to deadlines—there will be no make up assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

### Viewing Grades in Canvas

Points you receive for graded activities will be posted to the Canvas Grade Book. From a computer or mobile device, select the Grades option from course navigation to view your grades.

Your instructor will update the online grades each time a grading session has been complete—typically 3 days following the completion of an activity. You will see a visual indication of new grades posted on your Canvas home page under Recent Feedback and/or next to the Grades link on course menu.

## Letter Grade Assignment

Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

| **Letter Grade** | **Percentage** | **Performance** |
| --- | --- | --- |
| A | 93-100% | Excellent Work |
| A- | 90-92% | Nearly Excellent Work |
| B+ | 87-89% | Very Good Work |
| B | 83-86% | Good Work |
| B- | 80-82% | Mostly Good Work |
| C+ | 77-79% | Above Average Work |
| C | 73-76% | Average Work |
| C- | 70-72% | Mostly Average Work |
| D+ | 67-69% | Below Average Work |
| D | 60-66% | Poor Work |
| F | 0-59% | Failing Work |

\*Note to the instructor: Exact grade cutoffs may be determined by the instructor – the above is for reference/layout only.

**Important note:** For more information about grading at Sac State, visit the [academic policies and grading section](http://aaweb.csus.edu/catalog/current/First%20100%20Pages/academicpolicies.html#Grading) of the university catalog.

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# Part 5: Course Policies

## Participation

Students are expected to participate in all course activities as listed on the course calendar.

## Build Rapport

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that we can help you find a solution.

## Complete Assignments

**All assignments for this course will be submitted electronically through Canvas unless otherwise instructed.** Assignments must be submitted by the given deadline or special permission must be requested from instructor *before the due date*. Extensions will not be given beyond the next assignment except under extreme circumstances.

All discussion assignments must be completed by the assignment due date and time. Late or missing discussion assignments will affect the student’s grade.

## Understand When You May Drop This Course

It is the student’s responsibility to understand when they need to consider disenrolling from a course. Refer to the Sac State Course Schedule for dates and deadlines for registration. After this period, a serious and compelling reason is required to drop from the course. Serious and compelling reasons includes: (1) documented and significant change in work hours, leaving student unable to attend class, or (2) documented and severe physical/mental illness/injury to the student or student’s family. Students may access necessary forms through OnBase in their Student Center until the census date. After census, drop forms must be initiated by the instructor or an advisor.

### Incomplete Policy

Under emergency/special circumstances, students may petition for an incomplete grade. An incomplete will only be assigned if an average score of 70% or above is obtained in Exams I and II. All incomplete course assignments must be completed within 6 months.

## Inform Your Instructor of Any Accommodations Needed

[Services for Students with Disabilities](https://www.csus.edu/student-affairs/centers-programs/services-students-disabilities/)

Sacramento State is committed to ensuring an accessible learning environment where course or instructional content are usable by all students and faculty. If you believe that you require disability-related academic adjustments for this class, please immediately contact Services for Students with Disabilities (SSWD) to discuss eligibility. A current accommodation letter from SSWD is required before any modifications, above and beyond what is otherwise available for all other students in this class will be provided.

SSWD is located in Lassen Hall 1008 and can be contacted by phone at (916) 278-6955 (Voice) (916) 278-7239 (TDD only) or via email at sswd@csus.edu.

[Student Health and Counseling Services](https://www.csus.edu/student-life/health-counseling/)

Your physical and mental health are important to your success as a college student. Student Health and Counseling Services (SHCS) in The WELL offers medical, counseling, and wellness services to help you get and stay healthy during your time at Sac State. SHCS offers: Primary Care medical services, including sexual and reproductive healthcare, transgender care, and immunizations; urgent care for acute illness, injuries, and urgent counseling needs; pharmacy for prescriptions and over-the-counter products; mental health counseling, including individual sessions, group counseling, support groups, mindfulness training, and peer counseling; athletic training for sports injury rehabilitation; wellness services, including nutrition counseling, peer led health education and wellness workshops, and free safer sex supplies; violence and sexual assault support services. Most services are covered by the Health Services fee and available at
no additional cost.

[Crisis Assistance & Resource Education Support (CARES)](https://www.csus.edu/student-affairs/crisis-assistance-resource-education-support/)
“If you are experiencing challenges with food, housing, financial or other unique circumstances that are impacting your education, help is just a phone call or email away. The CARES office provides case management support for any enrolled student.

## Commit to Integrity

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior in and out of the classroom.

Read more about the [Hornet Honor Code](https://www.csus.edu/diversity-inclusion/_internal/_documents/honor-code1.pdf).

### Sac State's Academic Honesty Policy & Procedures

“The principles of truth and honesty are recognized as fundamental to a community of scholars and teachers. California State University, Sacramento expects that both faculty and students will honor these principles, and in so doing, will protect the integrity of academic work and student grades.”

Read more about Sac State's [Academic Honesty Policy & Procedures](https://www.csus.edu/umanual/student/stu-100.htm)

### Definitions

At Sac State, “**cheating** is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means.”

**“Plagiarism** is a form of cheating. At Sac State, “plagiarism is the use of distinctive ideas or works belonging to another person without providing adequate acknowledgement of that person’s contribution.”

**Source:** Sacramento State University Library

**Important Note:** Any form of academic dishonesty, including cheating and plagiarism, will be reported to the office of student affairs. **Course policies are subject to change.** It is the student’s responsibility to check Canvas for corrections or updates to the syllabus. Any changes will be posted in Canvas.