# AYDIN ADNAN MENDERES UNIVERSITY
# COURSE INFORMATION FORM

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|---|---|---|---|---|---|---|---|---|---|
| Course Title | Random Variables & Stochastic Process | | | | | | | | |
| Course Code | EEE531 | | Couse Level | Second Cycle (Master's Degree) | | | | | |
| ECTS Credit | 8 | Workload | 200 *(Hours)* | Theory | 3 | Practice | 0 | Laboratory | 0 |
| Objectives of the Course | The main objective of this course is to understand the mathematical theory and to gain experience about the application areas of random variables and random processes. | | | | | | | | |
| Course Content | Review of probability theory: Conditional probability and independence, random variables, probability distribution and density, function of random variables, expectation and conditional expectation with their properties. Random processes: Continuous and discrete-time random processes, correlation function and power spectrum, Gaussian and Poisson processes, continuity of random processes, stationarity and wide-sense stationarity, white noise, ergodicity. | | | | | | | | |
| Work Placement | N/A | | | | | | | | |
| Planned Learning Activities and Teaching Methods | Explanation (Presentation), Discussion, Case Study, Individual Study, Problem Solving | | | | | | | | |
| Name of Lecturer(s) | | | | | | | | | |

| Assessment Methods and Criteria | | |
|---|---|---|
| Method | Quantity | Percentage (%) |
| Midterm Examination | 1 | 30 |
| Final Examination | 1 | 40 |
| Assignment | 6 | 30 |

| Recommended or Required Reading | |
|---|---|
| 1 | Probability, Random Variables and Stochastic Processes, by Athanasios Papoulis and S. Unnikrishna Pillai, 4th Edition, McGraw Hill 2002 |
| 2 | Probability, Statistics and Random Processes for Electrical Engineering, by Alberto Leon-Garcia, 3rd Edition, Pearson, 2008. |
| 3 | Introduction to Probability and Random Processes, by Jorge I. Aunon and V. Chandrasekar, McGraw Hill, 1997 |

| Week | Weekly Detailed Course Contents | |
|---|---|---|
| 1 | Theoretical | Basic Concepts of Probability: Axiomatic definition, use of set concepts, conditional and joint probability. |
| 2 | Theoretical | Basic Concepts of Probability: Independence, Bayes Rule, Total Probability. |
| 3 | Theoretical | Random Variables: Basic concepts, The random variable concept, Distribution function, Density function. |
| 4 | Theoretical | Random Variables: The Gaussian random variable, other distribution and density examples, Conditional distribution and density functions |
| 5 | Theoretical | Operation on One Random Variable: Expectation, Functions of a Random Variable. |
| 6 | Theoretical | Operation on One Random Variable: Transformations of a random variable, Computer generation of one random variable. |
| 7 | Theoretical | Multiple Random Variables |
| 8 | Intermediate Exam | Midterm |
| 9 | Theoretical | Operations on Multiple Random Variables |
| 10 | Theoretical | Vector Random Variables |
| 11 | Theoretical | Operations on Vector Random Variables |
| 12 | Theoretical | Random Processes: The random process concept, Stationarity and independence, Correlation functions. |
| 13 | Theoretical | Random Processes: Measurement of correlation functions, Gaussian random processes, Poisson random process |
| 14 | Theoretical | Spectral Characteristics of Random Processes |
| 15 | Theoretical | Spectral Characteristics of Random Processes |
| 16 | Final Exam | Final Exam |

| Workload Calculation | | | | |
|---|---|---|---|---|
| Activity | Quantity | Preparation | Duration | Total Workload |
| Lecture - Theory | 14 | 3 | 3 | 84 |
| Assignment | 6 | 3 | 3 | 36 |
| Individual Work | 14 | 4 | 0 | 56 |
| Midterm Examination | 1 | 9 | 3 | 12 |
| Final Examination | 1 | 9 | 3 | 12 |
| | | | Total Workload (Hours) | 200 |
| | | | [Total Workload (Hours) / 25*] = **ECTS** | 8 |
| **25 hour workload is accepted as 1 ECTS* | | | | |

| Learning Outcomes | |
|---|---|
| 1 | To identify and formulate the fundamental probability density and distribution functions, as well as functions of random variables. |
| 2 | To explain the concepts of expectation and conditional expectation, and describe their properties. |
| 3 | To understand and analyse continuous and discrete-time random processes |
| 4 | To explain the concepts of stationarity and wide-sense stationarity, and appreciate their significance |
| 5 | To employ the theory of stochastic processes to analyse linear systems |
| 6 | Apply the above knowledge to solve basic problems in filtering, prediction and smoothing |

| **Programme Outcomes** *(Electrical and Electronics Engineering Master)* | |
|---|---|
| 1 | Developing and intensifying knowledge that requires expertise in the area of Electrical-Electronics Engineering, and gaining the skills necessary to analyze and solve problems using this knowledge |
| 2 | Grasping the inter-disciplinary interaction related to Electrical-Electronics Engineering, interpreting and forming new types of knowledge by combining the knowledge from Electrical-Electronics Engineering and the knowledge from various other disciplines |
| 3 | Developing new approaches to solve the complex problems arising in Electrical-Electronics Engineering, coming up with solutions while taking responsibility and carrying out a specific study independently |
| 4 | Assessing the knowledge and skill gained in the area of Electrical-Electronics Engineering with a critical view |
| 5 | Transferring the current developments and one’s own work in Electrical-Electronics Engineering, to other groups in written, oral and visual forms |
| 6 | The ability to control the collecting, interpreting, practicing and announcing processes of the Electrical-Electronics Engineering related to data taking into consideration scientific, cultural and ethical values and the ability to teach these values to others |
| 7 | Developing application plans concerning the subjects related to Electrical-Electronics Engineering and the ability to evaluate the end results of these plans within the frame of quality processes |

**Contribution of Learning Outcomes to Programme Outcomes** *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

| | L1 | L2 | L3 | L4 | L5 | L6 |
|---|---|---|---|---|---|---|
| P1 | 4 | 4 | 4 | 4 | 4 | 4 |
| P2 | 4 | 4 | 4 | 4 | 4 | 4 |
| P3 | 4 | 4 | 4 | 4 | 4 | 4 |
| P4 | 4 | 4 | 4 | 4 | 4 | 4 |
| P5 | 4 | 4 | 4 | 4 | 4 | 4 |
| P6 | 4 | 4 | 4 | 4 | 4 | 4 |
| P7 | 4 | 4 | 4 | 4 | 4 | 4 |