# HASAN KALYONCU UNIVERSITY
## Faculty of Engineering
## Course Description Form

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| **COURSE:** Signals and Systems | | | | |
| **CODE: EE331** | **SEMESTER:** FALL | | | |
| **LANGUAGE:** ENGLISH | **TYPE:** COMPULSORY | | | |
| **PRE-REQUISITES:** MATH251, MATH252<br>**CO-REQUISITES:** | **THEORY** | **PRACTICAL** | **CREDIT** | **ECTS** |
| **WEEKLY HOURS:** | 3 | 0 | 3 | 4 |

**CONTENT OF THE COURSE:**
Classification of signals, basic signals, classification and properties of systems, time domain characterization of Linear Time Invariant (LTI) systems, Continuous-Time and Discrete-Time Fourier Series, Continuous-Time and Discrete-Time Fourier Transforms, frequency domain characterization of Linear Time Invariant (LTI) systems, Sampling. Laplace and z-transforms and their applications.

**OBJECTIVE OF THE COURSE:**
1. To provide information on the classification of continuous-time and discrete-time signals and systems,
2. To provide information on the analysis of continuous-time and discrete-time linear systems.

| **WEEKLY SCHEDULE** | |
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| **Week** | **Topics** |
| 1 | Continuous- and Discrete-Time Signals; Signal Energy and Power; Time Shift, Reflection, Time Scaling; Even and Odd Signals; Unit Impulse and Unit Step; |
| 2 | Continuous- and Discrete-Time Systems; Interconnections of Systems; Systems and Memory; Invertibility, Causality, (BIBO) Stability, Time Invariance, Linearity |
| 3 | Real Exponential Signals; Differences between Continuous- and Discrete-Time cases; Complex Exponential Signals; Definitions and Units: (Fundamental) Period and Frequency, in Discrete- and Continuous-Time; (Time) Periodicity in Continuous-Time Signals; (Time and Frequency) Periodicity in Discrete-Time Signals; |
| 4 | Linear Time-Invariant Systems: convultion, properties of LTI systems, Unit impuls, systems described by differential and difference equations, and block diagrams. |
| 5 | Continuous-Time Fourier Series and LTI Systems; Frequency Response of ContinuousTime LTI Systems; LTI Systems described by Constant Coefficient Differential Equations; RC Filters; Continuous-Time Highpass, Lowpass etc Filters |
| 6 | Discrete-Time Fourier Series and LTI Systems; Frequency Response of Discrete-Time LTI Systems; LTI Systems described by Constant Coefficient Difference Equations; Recursive and Nonrecursive Filters; Discrete-Time Highpass, Lowpass etc Filters; |
| 7 | Midterm I |
| 8 | Continuous-Time Fourier Transform and LTI Systems described by Constant Coefficient |

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| | Differential Equations; |
| 9 | Discrete-Time Fourier Transform and LTI Systems described by Constant Coefficient Difference Equations; |
| 10 | Magnitude-Phase Representation, Magnitude-Phase Representation of the Fourier Transform vs. Bode Plots; Ideal vs. Nonideal Filters;<br>First- and Second-Order Continuous- and Discrete-Time System: Unit impulse Response; Unit Step Response; Frequency Response and Bode Plots; |
| 11 | Representation of Continuous (and discrete)-Time Signals by its Samples; Sampling Theorem; ImpulseTrain Sampling of Continuous-Time Signals; Zero-Order Hold; Interpolation and Reconstruction of Signals from its Samples; |
| 12 | Introduction to the Laplace Transform |
| 13 | Introduction to the z-Transform |
| 14 | Block Diagram Representation using the z-Transforms; and filter design. |

**TEXTBOOK:** Signals and systems, Alan V. Oppenheim, Alan S. Willsky, Syed H. Nawab, Englewood (Textbook) Cliffs, N.J. Prentice-Hall, 2nd edition, 2014.
**REFERENCE BOOKS:** Simon Haykin, Barry van Veen, Signals and Systems, John Wiley and Sons, 2002.

| **EVALUATION SYSTEM:** | | |
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| **IN-TERM STUDIES** | **QUANTITY** | **PERCENTAGE (%)** |
| Midterm Exam | 2 | 30 |
| Homework | 3 | 15 |
| Laboratory works | | |
| Quiz | 3 | 5 |
| Final Exam | 1 | 50 |
| **TOTAL** | **9** | **100** |
| CONTRIBUTION OF INTERM STUDIES TO OVERALL GRADE | 8 | 50 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 50 |
| **TOTAL** | **9** | **100** |

| **COURSE CATEGORY:** | **PERCENTAGE (%)** |
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| Mathematics and Basic Sciences | 50 |
| Engineering | 30 |
| Engineering Design | 20 |
| Social Sciences | 0 |

| TABLE OF ECTS / WORKLOAD: | | | |
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| **Activities** | **QUANTITY** | **Duration (Hour)** | **Total Workload** |
| Course Duration | 13 | 3 | 39 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Laboratory works | | | |
| Mid-term | 2 | 2 | 4 |
| Final examination | 1 | 2 | 2 |
| Homework | 3 | 3 | 9 |
| Quiz | 3 | 1 | 3 |
| **Total Work Load** | | | **115** |
| **Total Work Load / 30** | | | **3.83** |
| **ECTS Credit of the Course** | | | **4** |

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
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| **LO1** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| **LO2** | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 | 0 | 2 |
| **LO3** | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 1 |
| **LO4** | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| | PO: Program Outcomes \| LO: Learning Outcomes<br>Values: 0: None \| 1: Low \| 2: Medium \| 3: High | | | | | | | | | | |

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| **INSTRUCTOR(S):** | Asst. Prof. Dr. Abdul Hafiz ABDULHAFIZ |
| **FORM PREPARATION DATE:** | 22/05/2019 |

| **LEARNING OUTCOMES OF THE COURSE:** | **PROGRAM OUTCOMES:** |
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| **LO1:** Classify continuous-time signals and systems,<br>**LO2:** Analyze continuous-time and discrete-time signals and systems in time-domain,<br>**LO3:** Analyze continuous-time and discrete-time signals and systems in frequency-domain,<br>**LO4:** Analyze continuous-time and discrete-time signals and systems in transform-domain. | **PO1:** Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.<br>**PO2:** Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.<br>**PO3:** Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.<br>**PO4:** Ability to devise, select, and use modern techniques and tools needed for analyzing and solving |

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| | complex problems encountered in engineering practice; ability to employ information technologies effectively.<br>**PO5:** Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.<br>**PO6:** Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.<br>**PO7:** Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.<br>**PO8:** Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.<br>**PO9:** Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.<br>**PO10:** Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.<br>**PO11:** Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions. |