# UNIVERSITY OF ESWATINI

# FACULTY OF SCIENCE AND ENGINEERING

**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

**Course Outline**

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| **Course Title** | Introduction to Digital Signal Processing (DSP) |
| **Course Code** | EEE446 |
| **Year** | 2019/20 | **Semester** | 1st Semester 2nd Semester  |
| **Credits** | Lecture hours: 3 | Practical hours: 1.5 | Total credit: 3.5 |
| **Course type** | Core Required Elective General Education  |
| **Course Offering** | F-to-F Fully Online Blended Offering  |
| **Prerequisite course(s)** | EEE332: Signals and Systems |
| **Course Instructor(s)** |
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| Name | Office | Phone | E-mail |
| Dr. Mengistu Mulatu | EE1.4 | 70417 | mamulatu@uniswa.sz |

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| **Lecture Times** |
| Refer Moodle course page for specific meeting dates and times |
| **Consultation Times** |
| Office hours are available by appointment. Please email the instructor to schedule a time. |
| **Important Dates** |
| This course begins on **26 October 2020** and ends on **26 February 2021.** |
| **Course description:** |
| Introduction to Digital Signal Processing, Discrete-time signals and systems representation, Review of z-transforms, digital filter structures and design, discrete Fourier transform, fast Fourier transform and its applications, Digital Filtering, Finite Impulse and Infinite Impulse filters design, Digital hardware and DSP applications. |
| **Course Goals and Learning Outcomes** |
| The goals of this course are to provide EEE students with an understanding of discrete-time signals and the analytical tools to analyze and design digital signal processing systems. Upon completion of the course, the students will be able to:* Analyze and exploit signal and systems with digital signal processing techniques.
* Express signal processing systems in mathematical form.
* Analyze signals in terms of their frequency content.
* Write matlab codes describing a signal processing system.
* Design FIR and IIR digital filters to meet arbitrary specifications,
* Develop algorithms to implement digital filters using MATLAB,
* Exploit digital signal processing hardware and applications
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| **Textbook & Course Materials** |
| **Course Textbook*** Alan V. Oppenheim and Ronald W. Schafer, *Discrete-Time Signal Processing* , 2nd (1999) Edition, Prentice Hall, NJ, ISBN 0-13-754920-2 (one copy available in the library)

**Recommended Texts & Other Readings*** Li Tan, Digital Signal Processing: Fundamentals and Applications, 2nd (2013) Edition, Academic Press (Elsevier), ISBN: 978-0-12-415893-1 (free eBook available online)
* J. G. Proakis and D.G. Manolakis , Digital signal Processing: Principles Algorithms and Applications, 3rd or 4th edition, Prentice Hall ISBN: 978- 0133737622 (free eBook available online)
* MIT Open courseware: <https://ocw.mit.edu/resources/res-6-008-digital-signal-processing/>

**Software:** Matlab 2014 or later versions |
| **Course Structure** |
| This course will be delivered entirely **online** through UNESWA’s course learning management system (Moodle). You will use your UNESWA account to login to the course from the Moodle Login Page. In Moodle, you will access online lectures, course materials, and resources.*Since this is an ONLINE course; significant responsibility falls on you, the student, to keep up with the work and not fall behind!*As you can expect, we will use the course web site for all aspects of this course. Students are expected to check the web site regularly for:* General Course Announcements & Assignment Updates
* Quizzes, Assignment Submission and Grades
* Discussion forums
* Course Calendar
* Reference Materials

To ensure you receive the maximum credit for your work, follow any guidelines that are provided. |
| **Late Work Policy** |
| Make 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. |
| **Communication Policy**  |
| You are responsible for reading all announcements posted by the instructor. Questions concerning the content of the course, homework, assignment or projects should be directed to the appropriate course discussion forum. This allows your question to be answered by anyone monitoring the discussion forum, and the answer can benefit all readers.The instructor typically will respond to questions within 24 – 48 hrs. Also check your email on the regular basis for any instructor messages. |
| **Time commitment**  |
| To be successful in this course, you will need to commit to at least 8 hrs. of course work per week. |
| **Attendance and participation Policy**  |
| There are no on-campus meetings for this course. You are expected to login to the course at least *three times per week* to ensure you do not miss pertinent postings, messages and announcements. Participation in the course discussion forum is mandatory. |
| **Grading Policy**  |
| The final grade will be based on individual grades received on homework, assignments, quizzes and exams, group assignment and class attendance and participation. The approximate weighting for each area is as follows:* 15% -- Class and Discussion Participation
* 15% -- Homework Assignments
* 20% -- Assignments
* 50% -- Quiz & Tests
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| **Academic Integrity**  |
| UNESWA students are expected to maintain high ethical standards. The consequences of academic integrity, including cheating and plagiarism are very serious. Refer UNESWA’s general regulation (section 011:51 – 011:91) for details. |
| **Required technical skills**  |
| * Ability to utilize Moodle black board.
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| **Technical support**  |
| If technical problem occurs, please direct your question to the student Help Desk at xx@uniswa.sz. |

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| **SCHEDULE OF LESSONS** |
| **Lecture TITLE** | **Lecture Learning OUTCOMES:**

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| **At the end of this lectures, You should be able to:**  |

 | **STUDY****MATERIAL****(Resources)** | **INSTRUCTI ON METHOD** | **STUDENT ACTIVITY** | **ASSESSMENT** | **TECHNOLOGY** |
| **Lecture 1: Introduction** | * Compare and contrast practical analogue processing and DSP systems

•Describe the use of Discrete-time sequences and discrete-time systems* Apply Frequency response

functions of digital system | Lecture 1, Text Book Chapter 2, Online reference s | Independe nt | * Read discrete time(d.t.) signals & systems, and classification of d.t. signals

/systems.* Solve d.t. system response and frequency response problems
* Solve problems using Matlab software.
 | Homework 1 | Moodle, Camtasia, Zoom,Email & whatsapp (for communication) |
| **Lecture 2: Review of the Z- transform** | •Find the relationship between Z transform and the Fourier transform for discrete- time signals* Explore the characteristics and properties of Z transform
* Apply z transform for analyzing LTI systems
 | Lecture 2, Text Book Chapter 3 and recorded video lecture | Independe nt / Collaborati ve learning | -Solve z transform & inverse z transform problems,* Find the LTI system response using z transform.
* Apply z transform properties and solve impulse responses.
* Solve z transform and LTI system response problems using

Matlab software (Lab) | Homework 2 , quiz1,Matlab exercise 1 | Moodle, Camtasia,Email & whatsapp (for communication) |

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| **Lecture 3: Discrete Fourier Transforms (DFT)** | * Explore the relationships between the Z transform, discrete- time Fourier transform (DTFT), discrete Fourier transform (DFT) and fast Fourier transform (FFT)
* Explain the properties of DFT
* Perform discrete-time signal conversion between the time and frequency domains using DFT and its inverse transform.
* Solve problems using DFT and IDFT.
* Compute DFT/IDFT coefficients

using FFT algorithms | Lecture 3,Text Book Chapter 8 | Independe nt and collaborativ e Learning | * Derive DFT from DTFT

-Solve DFT & inverse DFT problems using definitions.* Apply FFT/IFFT algorithms to Solve DFT & inverse DFT problems . Analyze computational complexity.
* Solve the DFT/IDFT problems using Matlab.
 | Homework 3 ,Assignment 1, Group Matlab exercise 2Test 1 (covers Lecture 1-to- 3), | Moodle, Camtasia/ Zoom,Email & whatsapp (for communication) |
| **Lecture 4** |  |  |  |  |  |  |
| **Lecture 5** |  |  |  |  |  |  |
| **Lecture 6** |  |  |  |  |  |  |
| **Lecture 7** |  |  |  |  |  |  |