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| **logoUniversity of Management & Technology**  **School of Science & Technology**  **Department of Electrical Engineering** | | | |
| EE418 DIGITAL SIGNAL PROCESSING | | | |
| **Lecture Schedule** | **Sec A**(Mon/Wed : 13:20-14:40):MAB  **Sec B**(Tue/Thursday:13:20-14:40):MIK  **Sec C**(Mon/Wed:09:20-10:40):MAB  **Sec D**(Fri-Sat:14:40-16:00):JA | **Semester** | Spring 2013 |
| **Pre-requisite** | Calculus  Signal and Systems | **Credit Hours** | 3+1 |
| **Instructor(s)** | Muhammad Ilyas Khan **(MIK)**  Muhammad Asim Butt**(MAB)**  Jameel Ahmad**(JA)** | **Contact** | [ilyas.khan@umt.edu.pk](mailto:ilyas.khan@umt.edu.pk),  [asim.butt@umt.edu.pk](mailto:asim.butt@umt.edu.pk),  [jameel.ahmad@umt.edu.pk](mailto:jameel.ahmad@umt.edu.pk) |
| **Office** | 2nd Floor, South Block,  SST Campus. | **Office Hours** | See office window |
| **Teaching Assistant** | N/A | **Phone** | N/A |
| **Course Description** | This course provides an introduction to the theory and application of DSP with a solid foundation in the basics of DSP related to signal analysis, system analysis and design. The contents of the subject include Sampling, Quantization, Discrete time signals and systems, Z‐transform, Frequency analysis of signals and systems, Discrete Fourier Transform (DFT), Implementation of Discrete Time Systems and Design of Digital Filters. Course will be supplemented through MATLAB’s Digital Signal Processing Toolbox. This course directly contributes to **objectives**a, d, e, and f of the HEC Electrical Engineering Curriculum. | | |
| **Expected Outcomes** | In accordance with HEC curriculum **outcomes** b, d, e and g, students at the end of the course should be able to analyze, design and implement DSP Systems. | | |
| **Textbook(s)** | **Required Textbook:** Discrete‐Time Signal Processing, 2nd/3rdEdition, by Alan V. Oppenheim, Ronald W. Schafer, Published by Pearson Press.  **Reference:** Digital Signal Processing‐Principles, Algorithms and Applications, 4th Edition, by John G. Proakis and Dimitris G. Manolakis, Published by Pearson Press. | | |
| **Grading Policy** | * Assignments 5% ; Quizzes: 10% * Midterm: 30% * Final Exam: 50% | | |

**Course Schedule**

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| **Lecture** | **Topics** | **Textbook**  **Readings** |
| 1-2 | **Introduction to DSP Syllabus, class administration**  **Motivation for DSP.. few real life examples**  Component of a DSPsystem (ADC/DAC, Filters, DSP Processors),Applications of DSP (IMAGE, Communication, Biomedical, AUDIO, MULTIMEDIA, RADAR, GPS, Control, Machine vision, Navigation etc.  **Signal Types ( Discrete-time, digital and continuous-time)**  Basic Sequences ( delay, impulse, unit step, unit ramp, exponential)  Complex exponential sequence, Periodic and aperiodic discrete-time sinusoids and waveform generation | Chap-2  Sec 2.0-2.1 |
| 3-4 | **Time-domain Discrete time systems** ( Delay, Moving average and memoryless systems)  Linear, Nonlinear and Time-invariant system, Causality, Stability tests  LTI System, Response of LTI System, and Properties of LTI Systems   |  | | --- | | Discrete-Time LTI Systems: The Convolution Sum  Continuous-Time LTI Systems: The Convolution Integral | | Chap 2  Sec 2.3 and 2.4 |
| 5 | **LCC Difference equations** ( The accumulator and Moving Average systems and recursive systems)  **Frequency-domain Discrete-time signals and systems**  Eigen function of LTI System,Frequency response of ideal delay, Sinusoidal response of LTI system | Chap-2  Sec 2.5-2.6 |
| 6-7 | **Discrete-time Fourier Transform ( DTFT),** Magnitude and Phase spectrum , Symmetric sequence and function, Symmetry properties of Fourier Transform, Properties of DTFT, | Chap-2  Sec 2.7-2.8 |
| 8-9 | **Fourier Transform theorems** and examples (Convolution, windowing, Parseval’s theorem etc.) | Chap-2  Sec 2.9 |
| 10 | **Z-Transform** and Region of Convergence (ROC),   |  | | --- | | z-Transforms of Some Common Sequences | | Chap-3  Sec 3.1-3.2 |
| 11 | Z-transform Properties, Inverse Z-Transform | Chap-3  Sec 3.3-3.4 |
| 12-13 | **Sampling of Continuous-time signals**  Digital Processing of Analog signals,  Sampling Process, Nyquist Sampling Theorem  Time-domain and frequency domain representation of sampling | Chap-4  Sec 4.8 ( Fig 4.41)  Sec 4.1-4.2 |
| 14 | Reconstruction of sinusoidal signal, Aliasing in the reconstruction , Reconstruction of Band-limited Signal | Chap-4  Sec 4.2-4.3 |
| 15 | C/D and D/C signal processing and examples | Chap-4  Sec 4.4 |
|  | **Mid Term Exam (8thWeek)** |  |
| 16 | **Transform Analysis of LTI Systems**  Frequency Response ( magnitude and phase) of LTI System, ideal frequency selective filters, Phase distortion and group delay | Chap-5  Sec 5.1-5.2 |
| 17 | FIR and IIR systems, Impulse response and Frequency response of FIR and IIR systems, Pole-zero plots of IIR systems, stability and causality tests | Chap-5  Sec 5.3 |
| 18 | All-Pass and Minimum-Phase systems, Properties of Minimum-phase systems | Chap-5  Sec 5.4 |
| 19 | **Basic Structures of FIR and IIR Digital Filter systems**  Block diagram and signal Flow graph representation of LCC Difference equation  Implementation Structures for IIR Systems | Chap-6  Sec 6.1-6.3 |
| 20 | Transposed forms, Basic Network Architectures for FIR Systems | Chap-6  Sec 6.5-6.6 |
| 21 | **Design of IIR Filters**  Filter Specifications, approximation and implementation  IIR Filter design by Impulse invariance | Chap-7  Sec 7.1.1 |
| 22 | IIR Filter design by Bilinear Transformation | Chap-7  Sec 7.1.2 |
| 23 | Design examples of IIR Filter Design | Chap-7  Sec 7.1.3 |
| 24 | **Design of FIR Filters by Windowing**  Properties of commonly used windows | Chap-7  Sec 7.2.1 |
| 25-26 | Generalized Linear Phase Filters and Design of FIR filters by Windows method and frequency sampling method. | Chap-7  Sec 7.2.2 |
| 27 | **The Discrete Fourier Transform( DFT)**  Periodic Sequences, Properties of Discrete Fourier Series | Chap-8  Sec8.1-8.2 |
| 28 | Fourier Transform of Periodic Signals, Sampling the Fourier Transform, Discrete Fourier Transform (DFT) | Chap-8  Sec8.3-8.5 |
| 29 | Properties of DFT | Chap-8  Sec 8.6 |
| 30 | Linear Convolution using DFT | Chap-8  Sec 8.7 |
| **Final Term Exam (Comprehensive)** | | |