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| **logo University of Management & Technology** School of Engineering Department of Electrical Engineering |
| EE415 DIGITAL SIGNAL PROCESSING |
| **Lecture Schedule** | **Sec C**(Tue/Thur: 09:30-11:00):MAB | **Semester** | Fall 2013 |
| **Pre-requisite** | CalculusSignal and Systems | **Credit Hours** | 4 |
| **Instructor(s)** | Muhammad Asim Butt**(MAB)**  | **Contact** | asim.butt@umt.edu.pk, |
| **Office** | 2nd Floor, South Block,S3-33, Room No. 8. | **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:** Applied Digital Signal Processing by Dimitris G. Manolakis, Vinay K. Manolakis**Reference:**1. Discrete‐Time Signal Processing, 2nd /3rd Edition, by Alan V. Oppenheim, Ronald W. Schafer, Published by Pearson Press.2. Digital Signal Processing‐Principles, Algorithms and Applications, 4th Edition, by John G. Proakis and Dimitris G. Manolakis, Published by Pearson Press. |
| **Grading Policy** | * Quizzes: 15%
* Assignments: 10%
* Midterm: 25%
* Final Exam: 50%
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**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 DSP system (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)**Discrete-time signals: SequencesBasic Sequences ( delay, impulse, unit step, unit ramp, exponential)Complex exponential sequence, Periodic and aperiodic discrete-time sinusoids and waveform generation  | Chap-1 |
| 3-5 | **Time-domain Discrete time systems** ( Delay, Moving average and memoryless systems)Linear, Nonlinear and Time-invariant system, Causality, Stability testsLTI System, Response of LTI System, and Properties of LTI Systems

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| Discrete-Time LTI Systems: The Convolution Sum  |

 | Chap 2 |
| 6-7 | **LCC Difference equations** ( The accumulator and Moving Average systems and recursive systems)  | Chap-2 |
| 8 | **Z-Transform** and Region of Convergence (ROC),

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| z-Transforms of Some Common Sequences  |

 | Chap-33.1,3.2 |
| 9-10 | Z-transform Properties, Inverse Z-Transform | 3.3,3.4 |
| 11 | **Fourier representation of Signals** | Chap-4 |
| 12 | Properties of DTFT | Chap-4 |
| 13-14 | **Transform Analysis of LTI Systems**Frequency Response ( magnitude and phase) of LTI System, ideal frequency selective filters, Phase distortion and group delay, All-Pass and Minimum-Phase systems, Properties of Minimum-phase systems | Chap-5 |
| **Mid Term Exam (8th Week)** |
| 17-18 | **Sampling of Continuous-time signals**Digital Processing of Analog signals,Sampling Process, Nyquist Sampling TheoremTime-domain and frequency domain representation of sampling | Chap-6 |
| 19 | Reconstruction of sinusoidal signal, Aliasing in the reconstruction , Reconstruction of Band-limited Signal | Chap-6 |
| 20 | **Structures for discrete time systems**Block diagram and signal Flow graph representation of LCC Difference equationImplementation Structures for IIR Systems | Chap-9 |
| 21 | Transposed forms, Basic Network Architectures for FIR Systems | Chap-9 |
| 22-24 | **Design of FIR Filters**Filter Specifications, approximation and implementationFIR Filters with linear phase, design by windowing and frequency sampling | Chap-10 |
| 25-26 | **Design of IIR Filters**Filter Specifications, approximation and implementationIIR Filter design by Impulse invariance | Chap-11 |
| 27-28 | IIR Filter design by Bilinear Transformation | Chap-11 |
| 29-30 | **The Discrete Fourier Transform( DFT)**Periodic Sequences, Properties of Discrete Fourier SeriesFourier Transform of Periodic Signals, Sampling the Fourier Transform, Discrete Fourier Transform (DFT), Properties of DFT, Linear Convolution using DFT | Chap-7 |
| **Final Term Exam (Comprehensive)** |