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| **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**  **DEPARTMENT OF TELECOMMUNICATION ENGINEERING þÿ** | | | |
| Title of Subject: | **Advanced Digital Signal Processing** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide an advanced level understanding and the concepts of digital signal processing. | | |
| **Objectives:** | After completion of this course, the students should be able to   * Solve DT systems to check their characteristics and response in time domain * Analyze discrete time signals and systems using transform domain techniques * Analyze and design digital filters | | |
| **Contents:** | Introduction:  Review of discrete-time signals and systems along with their representation, analogue-to-digital conversion, uniform sampling theorem, quantisation and its effects, quantisation noise to signal ratio.  Time-Domain DSP:  Characterization of a discrete-time system using difference equation and pulse transfer function, signal energy and signal power of a DT signal, convolution sum and its use in DT systems, correlation, and normalized correlation, the concept of self-similarity and autocorrelation, using autocorrelation for timing recovery.  Fourier Transform:  Discrete-Time fourier transform, periodicity of DTFT and the proof of nyquist theorem, discrete fourier transform (DFT), properties of DFT, introduction to fast fourier transform (radix-2, decimation in time, decimation in frequency), magnitude and phase response using DFT.  Z Transform:  Z-transform for the analyses of discrete-time systems, inverse Z-transform, solution of difference equations using Z-transforms, obtaining the pulse transfer function from the difference equation, pole-zero maps in the Z-domain, stability of discrete-time systems  Digital Filters:  Concepts of FIR and IIR digital systems, design of digital filters using discrete-time fourier transform - window method, introduction to window functions, comparison of the properties of the window functions.  Spectrum Estimation:  Stationary and non-stationary signals, estimating energy density spectrum of non-stationary signals using window functions, advantages and disadvantages of the window functions in terms of spectral resolution and leakage, periodogram or power density spectrum.  Multi-rate Digital Signal Processing:  Advantages for multi-rate digital signal processing, decimation, interpolation, sampling rate conversion by a rational factor, applications for multi-rate signal processing in telecommunication engineering. | | |
| `**Recommended Books:**   1. Discrete-Time Signal Processing - Alan V. Oppenheim, Ronald W. Schafer (3rd Edition, ISBN-10: 0131988425 or ISBN-13: 978-0131988422) 2. Digital Signal Processing: A Practical Approach - Emmanuel Ifeachor, Barrie Jervis (2nd Edition, ISBN-10: 0201596199 or ISBN-13: 978-0201596199) 3. Digital Signal Processing - John G. Proakis, Dimitris K Manolakis (4th Edition, ISBN-10: 0131873741 or ISBN-13: 978-0131873742) 4. Understanding Digital Signal Processing - Richard G. Lyons (3rd Edition, ISBN-10: 0137027419 or ISBN-13: 978-0137027415) | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 25.09.2018 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
|  | **Academic Council** | Resolution No. | Dated: |

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| **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**  **DEPARTMENT OF TELECOMMUNICATION ENGINEERING þÿ** | | | |
| Title of Subject: | **Smart Antenna Systems for Wireless Networks** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide an advanced level understanding and the concepts of microwave engineering and antennae design | | |
| **Objectives:** | After completion of this course, the students should be able to   * Underline the functions and types of antennas * Identify the atmospheric and terrestrial effects on radio wave propagation.l 6) * Evaluate the fundamental parameters of antennas and arrays operating at various frequencies from LF to microwave applications. | | |
| **Contents:** | Review:  Maxwell's equation, elecromagnetic waves (radio), the speed of light, resonance, index of refraction, poynting vector, oscillating charges, and polarization, refraction and dispersion, polarizers, malus's law, brewster angle, and polarization by relection/scattering, doppler effect, traveling waves and standing waves.  Uniform Plane Wave Propagation:  Uniform plane wave propagation, uniform plane waves, the wave equations for conducting medium, sinusoidal time variations, phase and group velocity, conductors and dielectrics, poynting theorem and flow of power, reflection and refraction of waves at the boundary of two dielectrics, application of boundary value problems and their solutions, surface impedance.  Guided Waves:  Waves between parallel planes, TE (transverse electric), waves, TM (transverse magnetic) waves, TEM (traverse electromagnetic) waves, attenuation in parallel plane guides, wave impedance.  Ground Wave Propagation:  Plane earth reflection, space and surface waves, spherical earth propagation, tropospheric waves.  Ionospheric Waves:  Introduction to ionosphere, wave propagation in the ionosphere, reflection and refraction by the ionosphere, regular and irregular variations of the ionosphere, attenuation factor.  Antennas:  Introduction, network theorems, directional properties of dipole antennas, two-element array, horizontal patterns in broadcast arrays, linear arrays, multiplication patterns, binomial array, antenna gain and effective area, antenna terminal impedance, transmission loss between antennas resistance and reciprocity theorem. | | |
| `**Recommended Books:**   1. Electromagnetic Waves and Radiating Systems - Edward Conrad Jordan, Keith George Balmain (2nd Edition, ISBN-10: 8120300548 or ISBN-13: 978-8120300545) 2. Engineering Electromagnetics - William Hayt, John Buck (8th Edition, ISBN-10: 0073380660 or ISBN-13: 978-0073380667) 3. Electromagnetics - John Daniel Kraus, John D. Kraus (4th Edition, ISBN-10: 0070356211 or ISBN-13: 978-0070356214) 4. Electromagnetic Concepts and Applications - Richard E. Dubroff, S. V. Marshall, G. G. Skitek (4th Edition, ISBN-10: 0133011518 or ISBN-13: 978-0133011517) | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 07.09.2020 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
|  | **Academic Council** | Resolution No. | Dated: |
| **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**  **DEPARTMENT OF TELECOMMUNICATION ENGINEERING þÿ** | | | |
| Title of Subject: | **Optical Communication Systems and Network** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide an advanced level understanding and the concepts of digital image processing and machine vision techniques and algorithm. The course contents mainly focus on automated image processing models and analytical techniques. | | |
| **Objectives:** | After completion of this course, the students should be able to   * Explain the properties of optical fiber, propagation characteristics and transmission properties * Apply the knowledge to design optical fiber links and demonstrate limitations in the performance to the limitations of the components and subsystems used. * Analyze the optical networks and calculate their bit error rates and other parameters. CLO4 Psychomotor Domain (Level 2) Cognitive Domain (Level 4) | | |
| **Contents:** | **Introduction:**  History of optical communication, elements of optical fiber communication (OFC) transmission link, evolution of fiber optic system, advantages of OFC system.  **Optical Fiber Wave Guides:**  Optical fiber waveguide, Ray theory transmission, electromagnetic mode theory for optical propagation, cylindrical fibers, single mode fiber, multimode fibers, step index fibers, graded index fibers, single mode/multimode fiber transmission characteristics.  **Transmission Characteristics:**  Attenuation, absorption losses (intrinsic and extrinsic), scattering losses, fiber bend loss, linear scattering losses (Rayleigh and Mir scattering), non-linear scattering losses (stimulated brillouin and stimulated raman scattering), pulse broadening, intra-modal and inter-modal dispersion, overall fiber dispersion, polarization, non-linear effects.  **Optical Fiber Cables and Connectors:**  Optical fibers, fiber strength and durability, cable design, fiber-to-fiber joints, fiber splicing.  **Optical Fiber Communication System:**  Components of fiber optic networks, optical amplifiers, semiconductor optical amplifiers (SOA), erbium doped fiber amplifiers (EDFA), advanced multiplexing strategies, operational principles of wavelength division multiplexing (WDM), basic on concepts of SONET/SDH network.  **Optical Fiber Measurements:**  Fiber attenuation measurements, fiber dispersion measurements, field measurements, optical time domain reflectormeter (OTDR). | | |
| `**Recommended Books:**   1. Optical Fiber Communications: Principles and Practice - John Senior (3rd Edition, ISBN-10: 013032681X or ISBN-13: 978-0130326812) 2. Understanding Optical Fiber Communications - A. J. Rogers (1st Edition, ISBN-10: 0890064784 or ISBN-13: 978-0890064788) 3. Fiber-Optic Communication Systems - Govind P. Agrawal (2nd Edition, ISBN-10: 0471175404 or ISBN-13: 978-0471175407) 4. Fiber Optic Networks - Paul E. Green (1st Edition, ISBN-10: 0133194922 or ISBN-13: 978-0133194920) | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 07.09.2020 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
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| **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**  **DEPARTMENT OF TELECOMMUNICATION ENGINEERING þÿ** | | | |
| Title of Subject: | **Spread Spectrum Communications** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide an advanced level understanding and the concepts of wireless communication system, in particular those based on spread spectrum communications | | |
| **Objectives:** | After completion of this course, the students should be able to   * Understand the principles of spread spectrum communications * Appreciate the characteristics of pseudorandom noise-like (PN) sequences * Design and use PN sequence for spread spectrum communications | | |
| **Contents:** | Introduction to Spread Spectrum (SS) Communications:  Concept and definitions of SS communications as compared with conventional types of communications, origin of SS communications, implementations of SS communications, spreading sequences, orthogonal and semi-orthogonal sequences.  PN sequences: pseudo-noise (PN) sequences generation and its properties (balance, run and correlation properties).  M-sequences: generation of M-sequence using shift registers (fibonacci and galois feedback generators), characteristics of M-sequence (near balance, correlation and security etc.), polynomial representation of M-sequences, gold sequences: why gold codes, generation of gold codes, finding preferred pair of M-sequences, correlation properties of gold sequences.  Orthogonal sequences: walsh codes, motivation, generation and its properties, application of walsh codes, variable length orthogonal codes (motivation, generation and properties).  Spread Spectrum Communication Systems:  Fundamental of spread spectrum:: concept of spectrum and bandwidth, definition of SS signals, types of SS signals, benefits of SS techniques.  Analysis of SS systems: direct sequence SS systems, frequency-hopped SS systems, synchronization of SS communication system (acquisition and tracking)  Application of spread spectrum: anti-jamming, ranging, multipath suppression, code-division multiple access, recent commercial applications.  CDMA systems: introduction to 2G/3G standards, CDMA 2000 systems and architecture, WCDMA system and architecture | | |
| `**Recommended Books:**   1. Introduction to Spread Spectrum Communications - Rodger E. Ziemer, Roger L. Peterson, David E. Borth (1st Edition, ISBN-10: 0024316237 or ISBN-13: 978-0024316233) 2. Spread Spectrum Systems with Commercial Applications - Robert C. Dixon (3rd Edition, ISBN-10: 8126527862 or ISBN-13: 978-8126527861) 3. CDMA: Principles of Spread Spectrum Communication - Andrew J. Viterbi (1st Edition, ISBN-10: 0201633744 or ISBN-13: 978-0201633740) | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 07.09.2020 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
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| Title of Subject: | **Internet of Things** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide an understanding of principles and basic components of internet of things | | |
| **Objectives:** | After completion of this course, the students should be able to   * Understand the fundamental concepts of internet of things * Understand various types of wired and wireless technologies which enable internet of things * Appreciate various challenges in internet of things, especially in terms of data security | | |
| **Contents:** | What is the IoT and why is it important? Introduction to the Elements of an IoT ecosystem. Understanding of Technology and business drivers. Description of IoT applications, trends and implications. Analysis of Sensing components and devices, Sensor modules, nodes and systems.  Wireless technologies for the IoT as well as Edge connectivity and protocols. Introduction to the Wireless sensor networks (WSNs) and Internet connectivity and MGC architecture, CortexM and BLE.  Analysis of Typical costs and computing an energy budget, Energy management and sleep states. Introduction to the Microcontrollers: Peripherals, buses and DMA Brief explanation of Operating systems and introduction to the concepts of multiprogramming.  Overview of IoT and Big Data overlap – stream processing and Data Aggregation. Network as a distributed query processor? Concepts of Time Synchronization, Localization, IoT Security Energizing IoT devices: battery/harvesting/wirelessly Discussion about Future Research and Development Opportunities, Analytics and applications. Basic understanding of Signal processing, real-time and local analytics,  Databases, cloud analytics and applications. | | |
| `**Recommended Books:**   1. Greengard, Samuel. “The internet of things”. MIT press, latest edition. 2. Schwab, Klaus, and Nicholas Davis. “Shaping the future of the fourth industrial revolution”. Currency, latest edition. 3. Pfister, Cuno. “Getting started with the Internet of Things: connecting sensors and microcontrollers to the cloud”, O'Reilly Media, Inc., latest edition. 4. Waher, Peter, “Learning internet of things”, Packt Publishing Ltd, latestedition. | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 07.09.2020 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
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| **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**  **DEPARTMENT OF TELECOMMUNICATION ENGINEERING þÿ** | | | |
| Title of Subject: | **Crowd Sourcing and Big Data Analytic** | | |
| Disciplines: | Telecommunication Engineering | | |
| Pre-requisites: |  | | |
| Assessment: | Sessional: 10%,  Mid Semester: 30%,  Final Examination: 60% | | |
| Credit Hours: | 3 + 0 | | |
| Max Marks: | 100 | | |
| Contact Hours: | 42 + 0 | | |
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| **Aims:** | This course is designed to provide hands-on training on big data analytics | | |
| **Objectives:** | After completion of this course, the students should be able to   * Appreciate the fundamentals of data science * Understand fundamentals of developing predictive models * Analyze data using Pandas and Sklearn packages using python | | |
| **Contents:** | Introduction to Data Science. Data Science Life cycle & Process (Asking Right Questions, Obtaining Data, Understanding Data  Building Predictive Models, Generating Visualizations) For Building Data Products. Introduction to Data (Types of Data and Datasets), Data Quality (Measurement and Data Collection Issues)  Data pre-processing Stages (Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation etc.)  Introduction to Python Data Science Stack (Python, Numpy, Pandas, Matplotlib). Relational Algebra & SQL, Scraping & Data Wrangling (assessing, structuring, cleaning & munging of data). Introduction to Scikit Learn, Bias-Variance Tradeoff, Model Evaluation & Performance Metrics (Accuracy, Contingency Matrix, Precision-Recall, F-1 Score, Lift, etc.) | | |
| `**Recommended Books:**   1. Python for Data Analysis, latest Edition, William McKinney 2. Computational and Inferential Thinking: The Foundations of Data Science, latest Edition, A. Adhikari and J. DeNero 3. Data Mining and Analysis: Fundamental Concepts and Algorithms, latest Edition, M. Zaki & W. Meira, 4. Data Science from Scratch, latest Edition, Joel Grus 5. Doing Data Science, latest Edition, Cathy O'Neil and Rachel Schutt 6. Introduction to Data Science. A Python Approach to Concepts, Techniques and Applications, latest Edition, Laura Igual. | | | |
| **Approvals:** |  |  |  |
|  | **Board of Studies** | Resolution No. 09.01 | Dated: 07.09.2020 |
|  | **ASRB** | Resolution No. 168.23 (a) | Dated: 06.10.2020 |
|  | **Academic Council** | Resolution No. | Dated: |