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(13A04801) MOBILE COMMUNICATION

Course Objective:

- *To learn about the evolution process analog cellular system and its working operation.*
- *To enable the student to study the mobile radio channels and their effects.*
- *To understand various digital modulation techniques used in cellular systems.*
- *To enable the student to acquire the knowledge about various diversity and other schemes to improve the signal quality at the receiver.*

Learning Outcome:

This course provides the students to learn fundamental concepts of cellular concepts in mobile communications. At the end of the semester, they should be able to:

- *Know the types of mobile channels & their effects on the reception of signal strength.*
- *Analyze the received signal characteristics.*
- *Understand various digital modulation schemes used in cellular communications.*
- *Design suitable receiver systems to Counter balance the effects of the mobile channel on the received signal.*

UNIT I

Mobile Radio & its Signal Environment: Introduction, Cellular network planning, The mobile radio communication medium, Propagation path loss, Multipath fading due to scattering factors, Delay spread, Coherence bandwidth, Multipath fading phenomenon, Review of statistical communication theory – Probability density functions & Level crossing rate.

UNIT II

Path loss over Flat & Hilly Terrains: Path loss prediction based on model analysis, Diffraction loss, Diffraction loss over rounded hills, Path clearance criteria, Lee's Macro-cell & Microcell models, Inbuilding prediction models, Signal threshold prediction, Signal coverage area prediction, Wideband signal propagation.

UNIT III

Received Signal Characteristics: Short term versus long term fading, Model analysis of short term fading, Cumulative probability distribution (CPD) , Level crossing rate, Calculating the average duration of fades, Random variables related to mobile radio signals, Phase correlation characteristics, Simulation models.

UNIT IV

Modulation Technology: Digital modulation for non-fading and fading cases, Constant envelope modulation – QPSK, OQPSK, $\pi/4$ - DQPSK, GMSK, OFDM modem, brief introduction to spread spectrum systems – Direct sequence, Frequency hopped modulation schemes.

UNIT V

Diversity Schemes & Interference Problems: Diversity schemes – Space diversity, Polarization diversity, Frequency diversity, & Time diversity (qualitative treatment only), Effects of interference, Co-channel interference, Adjacent channel interference, Hand off – different types of hand off mechanisms, Near-end, to Far-end ratio interference, inter-modulation interference, Inter-symbol interference.

***Text Books**:*

1. *William C. Y. Lee, "Mobile Communication Engineering – Theory and Applicatons," McGraw Hill Education Private Limited, Second Edition – 2008.*
2. *Gordon L. Stuber, "Principles of Mobile Communication," Kluwer Acadeimic Publishers, Second Edition – 2001.*

Reference Books:

1. *William C. Y. Lee, "Mobile Cellular Telecommunications – Analog and Digital Systems," McGraw Hill, Second Edition – 2006.*
2. *G. Sasibhushana Rao, "Mobile Cellular Communication," Pearson, 2013.*

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(13A04802) COMPUTER NETWORKS

Course Objective:

- *An understanding of the overriding principles of computer networking, including protocol design, protocol layering, algorithm design, and performance evaluation.*
- *An understanding of computer networking theory, including principles embodied in the protocols designed for the application layer, transport layer, network layer, and link layer of a networking stack.*
- *An understanding of specific implemented protocols covering the application layer, transport layer, network layer, and link layer of the Internet (TCP/IP) stack.*
- *An understanding of security issues.*

Learning Outcome:

- *Students will learn to list and classify network services, protocols and architectures, explain why they are layered.*
- *Student will learn to explain key Internet applications and their protocols.*
- *Students will learn to explain security issues in computer networks.*
- *To master the terminology and concepts of the OSI reference model and the TCP- IP reference model.*
- *To master the concepts of protocols, network interfaces, and Design/performance issues in local area networks and wide area networks.*
- *To be familiar with wireless networking concepts.*
- *To be familiar with contemporary issues in networking technologies.*
- *To be familiar with network tools and network programming.*

UNIT I

Theoretical basis for communication, Maximum data rate of channel, communications media, Network goals, Application of networks, protocol hierarchies, OSI reference model, Design issues for the layers in the model, Modulation and keying alternatives, multiplexing, modems, parallel and serial data transmission, handshake procedures, RS 232C, V.14/V.28, RS 449 interfaces, X.21, IEEE protocols, Link switching techniques.

UNIT II

Local Area Networks: Local communication alternatives, static and dynamic channel allocation in LANs, the ALOHA protocols, LAN protocols, IEEE logical link control, Ethernet, Token bus and Token ring protocols.

Data link layer: Design issues, Error detection and correction, sliding window protocols, Wide area network standards, SDLC, HDLC, X.25 protocols**.**

UNIT III

Network layer Design issues, Routing algorithms, congestion control algorithms, Internetworking, Transport layer design issues, connection management, Transport protocol X.25, session layer design issues, Remote procedure cell.

UNIT IV

Presentation layer, Abstract syntax notation, Data compression techniques, Cryptography, Application such as file transfer, Electronic mail and virtual terminals, X.400 protocol for electrical messaging, overview of ARPANET, MAP, TOP, Novell Netware, PC/NOS, unix support for networking.

UNIT V

World wide web, web browsers, web servers, uniform resource locator, Home pages, Basics of HTML, creating links, Anatomy of URL and kinds of URLs, HTML assignments, Editors and converters, New features of HTML, creating tables, Using images, Using external media, writing and designing web pages, Introduction to CGI scripts.

Text Books:

1. *Andrew S Tenenbaum, "Computer Networks", PHI, 3rd edition, 1997.*
2. *Laura Lemay, web publishing with HTML 3.0, PHI, 2nd edition, 1996.*

Reference Books:

1. *Michael A. Gallo, William M. Hancock, "Computer Communications and Networking Technologies", Cengage Learning.*
2. *Natalia Olifer, Victor Olifer, "Computer Networks-Principles, Technologies and Protocols for Network Design", Wiley India.*
3. *Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition.*
4. *Nader F. Mir, "Computer and Communication Networks", Pearson Education.*

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(13A04803) SATELLITE COMMUNICATION
(Elective-III)

Course Objective:

- *To introduce the basic principles of Satellite Communication systems, orbital mechanics, launchers.*
- *To introduce the basic concepts and designing of Satellite links.*
- *To introduce the basic concepts of earth station transceiver.*
- *To know the basic concepts of various multiple access techniques and GPS systems.*

Learning Outcome:

- *Students can determine the location of Satellite.*
- *Students can design satellite uplink and downlink.*
- *Students can design earth station transmitter, receiver and antenna systems.*

UNIT I
INTRODUCTION TO SATELLITE COMMUNICATIONS:
Origin of satellite communications, Historical background, basic concepts of satellite communications, frequency allocations for satellite services, applications, future trends of satellite communications.
Orbital Mechanics look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

UNIT II
SATELLITE SUBSYSTEMS AND LINK DESIGN:
Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification.
Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design of satellite links for specified C/N, system design example.

UNIT III
EARTH STATION TECHNOLOGY, LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS:
Introduction, transmitters, receivers, Antennas, tracking systems, terrestrial interface, primary power test methods.
Orbit consideration, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs.

UNIT IV
MULTIPLE ACCESS:
Frequency division multiple access (FDMA) Intermodulation, calculation of C/N, Time Division multiple access (TDMA) frame structure, examples. Satellite switched TDMA onboard processing, DAMA, code division multiple access (CDMA), spread spectrum transmission and reception.

UNIT V
SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM:
Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, differential GPS.

Text Books:

1. *Timothi Pratt, Charles Bostian and Jeremy Allnutt, "Satellite communications", WSE, Wiley publications, 2nd Edition, 2003.*
2. *Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, "Satellite communications Engineering", Pearson Publications, 2nd Edition, 2003.*

Reference Books:

1. *Dennis Roddy, "Satellite communications", McGraw Hill, 2nd Edition, 1996.*
2. *M. Richharia, "Satellite communications: Design principles", BS publications, 2nd Edition, 2003.*
3. *D.C.Agarwal, "Satellite communications", Khanna publications, 5th Ed.*
4. *K.N.Raja rao, "Fundamentals of Satellite communications", PHI, 2004.*

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(13A04804) SPREAD SPECTRUM COMMUNICATION
(Elective-III)

***Course Objective**:*

- *To understand the general concepts of spread spectrum*
- *To generate spread spectrum signals.*
- *To study various applications of spread spectrum.*
- *To learn the working operation of CDMA systems.*

***Learning Outcome**:*

At the end of the course the students should be able to:

- *Understand the general concepts of spread spectrum techniques.*
- *Generate spread spectrum signals through hardware and computer simulations.*
- *Know various applications of spread spectrum techniques and working operation of CDMA systems of 2G and 3G standards.*

UNIT I

Fundamentals of Spread Spectrum: General concepts, Direct sequence (DS), Bi-phase and quadri-phase modulations, Pseudo noise (PN) signal characteristics, Direct Sequence receiver, Frequency Hopping – transmitter, receiver, Time Hopping, Comparison of modulation methods.

UNIT II

Analysis of Direct-Sequence & Avoidance type Spread Spectrum Systems: Properties of PN sequences, Properties of m-sequences, Partial Correlation, PN signals from PN sequences, Partial correlation of PN signals, Generation of PN signal, Despreading the PN signal, Interference rejection, Output Signal – to – Noise ratio, Antijam characteristics, Interception, Energy and Bandwidth efficiency. The frequency hopped signal, Interference rejection in a Frequency – Hopping receiver, The Time-Hopped Signal.

UNIT III

Generation and Detection of Spread Spectrum Signals: Shift register sequence generators, Discrete-Frequency Synthesis, Saw device PN generators, Charge coupled devices, Coherent Direct – sequence receivers, Other methods of carrier tracking, Delay lock loop analysis, Tau-Dither loop, Coherent carrier tracking, Non-coherent frequency hop receiver, Acquisition of Spread Spectrum Signals, Acquisition by cell-by-cell searching, Reduction of Acquisition time, Acquisition with matched filter, Matched filters for PN sequences, Matched filters for Frequency Hopped signals, Matched filters with acquisition aiding waveforms.

UNIT IV

Application of Spread Spectrum to Communications: General characteristics of Spread spectrum, Multiple access considerations – number of active users (equal powers), number of active users (unequal powers), bandwidth limited channels, power limited channels, Energy and bandwidth efficiency in multiple access, Selective calling and identification, Antijam considerations, Jamming direct-sequence systems, Jamming Frequency – Hopping Systems, Intercept considerations.

UNIT V

CDMA Digital Cellular Systems:

Introduction, Cellular radio concept, CDMA Digital cellular systems, Specific examples of CDMA digital cellular systems based on 2G, and 3G standards and their technical specifications.

Text Books:

1. *George. R. Cooper and Clare D. McGillem, "Modren Communications and Spread Spectrum", McGraw – Hill Book Company, 1986.*
2. *Roger L. Peterson, Rodger E. Ziemer & David E. Borth, "Introduction to Spread Spectrum Communications", McGraw Hill, 2011.*

Reference Books:

1. *Dr. Kamilo Feher, "Wireless Digital Communications – Modulation & Spread Spectrum Applications", PHI, 1999.*
2. *T. S. Rappaport, "Wireless Communications – Principles and Practice," PHI, 2001.*
3. *Upena Dalal, "Wireless Communication", Oxford Higher Educatiion, 2009.*
4. *Andrea Goldsmith "Wireles Communications", Cambridge University Press, 2005.*

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(13A04805) MULTIMEDIA COMMUNICATION
(Elective-III)

Course objective:

- *This course is to provide students with a background in the engineering aspects of multimedia communications. The course is expected to cover the following topics: representation of multimedia information, Information compression , multimedia storage, internet applications, and multimedia communication over networks.*

Learning Outcome:

- *After completion students will have sufficient knowledge in communication, Data management, Multi media design, web applications. Having at least some basic skills and knowledge in these areas is considered part of the general skills, the so -called "transversal competencies" which are very important regardless of specialization*

UNIT I

MULTIMEDIA COMMUNICATIONS: Introduction, multimedia networks, multimedia applications.

Multimedia information representation: Introduction, digitization principles, representation of text, images, audio & video.

UNIT II

TEXT & IMAGE COMPRESSION: Various compression principles.

TEXT COMPRESSION: Static Huffmann coding, dynamic Huffman coding, arithmetic coding, Lempel-ziv coding

IMAGE COMPRESSION: Graphics Interchange format, tagged image file format, digitized document, digitized pictures, JPEG (Introduction)

UNIT III

AUDIO & VIDEO COMPRESSION: Audio compression: Differential PCM, Adaptive differential PCM, Code excited LPC, MPEG audio coders, Dolby audio coders.

VIDEO COMPRESSION: Basic principles, Video compression standard H.26 J, h.263, MPEG (Basic introduction)

UNIT IV

INTERNET APPLICATIONS: Domain name system, name structure and administration, DNS resource records, Electronic mail message structure, content transfer, Basic concept of internet telephony, World Wide Web

UNIT V

MULTIMEDIA NETWORKING: Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP

Text Books:

I. Fred Hulsall, "Multimedia communications", Pearson Education Asia.

2. K. Thakkar, "Multimedia SystemsDesign", PHI

Reference Books:

1, Ralf Stein Metz & Klara Nahrstedt, "Multimedia: Computing, Communications & Applications", Pearson Education.

2. Steve Rimmer, "Advanced Multimedia Programming",MB!

3. Tay Vaughan, "Multimedia: Making it Work", TMH, 3rd edition.

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(13A04806) BIO-MEDICAL INSTRUMENTATION
(Elective-IV)

Course Objective:

- *To understand the functioning of Human Cell and its electrical characteristics.*
- *To get Sufficient knowledge about Cardiovascular measurement and circulatory System of heart*
- *To get familiarize with pace makers and Defibrillators*
- *To understand about the electrical hazards that may occur during the usage of medical instruments*

Learning Outcome:

After completion of this course the student will be able to

- *Understand the functioning of Human Cell and its electrical characteristics*
- *Acquire sufficient knowledge about Cardiovascular measurement and circulatory System of heart*
- *Get familiarize with pace makers and Defibrillators*
- *Understand about the electrical hazards that may occur during the usage of medical instruments*

UNIT I

Human cell and its Electrical characteristics neuron and impulses, Recording Electrodes – Electrode-Electrolyte interface, polarizable – Non-polarizable Electrodes, body surface recording Electrodes, internal Electrodes, Micro Electrodes, Electrode array & Practical hints in using Electrodes.

UNIT II

Bioelectric potential and cardiovascular measurement circulatory system of heart – ECG Anatomy & Function of heart abnormal cardiac Rhythms – Arrhythmias – Einthoven triangle.
EEG recording system (10-20 electrode System) Biorhythms – Sleep pattern

UNIT III

Therapeutic and prosthetic devices, Cardiac pace maker, Types – Asynchronous and Synchronous modes of operation (Demand). Asynchronous pace maker – Working principle and Function demand PM – Working principle – QRS triggered and atrioventricular Synchronized PM lead wires and Electrodes, Cardioverter.
Defibrillator : Working principle of DC Defibrillation Electrodes used. Infant incubator and Lithotripry.

UNIT IV

Electrical Hazards in medical instruments macro and micro shock – devices to protect against electrical hazards – Ground fault interrupter, isolation transformer, line isolation monitor, receptacle tester, electrical safety analyzer equipment, preventive maintenance.

UNIT V

Image Systems: Introduction, Basic principle and block diagram of x-ray machine, x-ray computed topography (C.T. Scanner) and Nuclear Magnetic resonance (NMR) Short-wave Diathermy, Microwave Diathermy, Ultrasound Therapy unit.
Recent trends : Ultrasonography -Introduction, medical ultrasound, block diagram of pulse echo-system, A-Scan, M-mode, B-scanner and real time ultrasound imaging systems – lasers principle and

operation of laser types of lasers – Pulsed Ruby laser – ND-YAG laser – Helium –Neon laser-Argon laser-C02 laser exciner laser, Semiconductor lasers – Laser safety.

Text Books:

1. *John G.Webser, "Medical Instrumentation Applications and Design" John Wiley & Sons (1998).*
2. *Seslie Cromwell, Fred J.Weibell and Esich A.Plefittes, "BioMedical Instrumentation & measurements", Pearson Education, 9th edition.*

Reference Books:

1. *RS Khandpur, "Handbook of BioMedical Instrumentation", Tata Mc Graw Hill.*
2. *Walter Welko- Witiz and Sid Doutsch, "Biomedical Instruments: Theory and Design"*

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(13A04807) SPEECH PROCESSING
(Elective-IV)

Course Objective:

- *To understand how speech signals are processed for Analysis and Synthesis. Also to understand speech processing in the context of its creation (anatomy, classification of sounds, etc.) as well as in its perception (psychology & neuroscience).*
- *To analyze tools that are needed for analysis and synthesis, in the areas of digital signal processing for time-frequency analysis.*

Learning Outcome:

- *After completing the course, the student will be familiar with the principles and the techniques*
  used in speech processing. This includes speech synthesis, speech coding and speech recognition.

UNIT I

FUNDAMENTALS OF DIGITAL SPEECH PROCESSING: Anatomy & Physiology of Speech organs, the process of speech production, the acoustic theory of speech production, Digital models for speech signals.

TIME DOMAIN MODELS FOR SPEECH PROCESSING: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate ,Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT II

LINEAR PREDICTIVE CODING (LPC) ANALYSIS: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT III

HOMOMORPHIC SPEECH PROCESSING: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, the Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder.

SPEECH ENHANCEMENT: Nature of interfering sounds, Speech enhancement techniques, Spectral subtraction, Enhancement by re-synthesis.

UNIT IV

AUTOMATIC SPEECH RECOGNITION: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System

SPEAKER RECOGNITION: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

UNIT V

HIDDEN MARKOV MODEL (HMM) FOR SPEECH: Hidden markov model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS, Adapting to variability in speech, Language models.

Text Books:

1. *L.R Rabiner and S.W.Schafer, "Digital processing of speech signals", Pearson.*
2. *Douglas O Shaughnessy, "Speech communication", Second Edition Oxford University press, 2000.*
3. *L.R Rabinar and B.H.Juang, "Fundamentals of Speech Recognition"*

Reference Books:

1. *Thomas F. Quateri, "Discrete Time Speech Signal Processing", 1/e, Pearson*
2. *Ben Gold & Nelson Morgan, "Speech & Audio Signal Processing", 1/e, Wiley*

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(13A04808) DSP PROCESSORS & ARCHITECTURES

(Elective-IV)

Course Objective:

- *To understand the concept of DSP Architecture & comparison of this with that of microprocessors.*
- *To understand addressing modes, instruction sets , pipelining and application programs in TMS320C54XX processor*
- *To understandthe architectural issues of programmable DSP devices and their relationship to the algorithmic requirements, architectures of commercially popular programmable devices and the use of such devices for software development and system design*
- *To highlight the suitability of programmable DSP devices for various application areas and motivate to design systems around these devices.*

Learning Outcome:

- *To become familiar with fundamentals of DSP Processors & architectures.*
- *To gain in knowledge about the different types of processors and their operation.*
- *Will demonstrate the ability to design a system component or process as per needs & specifications.*
- *Will demonstrate the ability to identify, formulate & solve engineering problems.*

UNIT I

Introduction to Digital Signal Processing: Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT II

Architectures for Programmable DSP Devices : Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

Execution Control and Pipelining : Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

UNIT III

Programmable Digital Signal Processors : Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On- Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT IV

Implementations of Basic DSP Algorithms : The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

Implementation of FFT Algorithms : An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT V

Interfacing Memory And I/O Peripherals to Programmable DSP Devices : Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

1. *Avtar Singh and S. Srinivasan, "Digital Signal Processing", Thomson Publications, 2004.*
2. *Lapsley et al. S. Chand & Co, "DSP Processor Fundamentals, Architectures & Features", 2000.*

Reference Books:

1. *B. Venkata Ramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", TMH, 2004.*
2. *Jonatham Stein, "Digital Signal Processing", John Wiley, 2005.*