

**Visweswaraiah Technological University
Belgaum – 590 010**

Syllabus

**of
DIGITAL ELECTRONICS & COMMUNICATION
for
MASTER OF TECHNOLOGY COURSE**

SEMESTER -I

MDEC 101 DIGITAL SIGNAL PROCESSING

Discrete Time Signals and Systems, Frequency Domain Representation, Z-Transforms, Discrete Fourier Transforms, Impulse Response and Transfer functions, Convolution and Correlation.

IIR Filter Design : Filter Approximation, Impulse Invariant Method, Frequency Transformations (LP-LP, LP-HP, LP-BP, LP-BR), Matched Z-Transform method, Bi-linear Transformation method filter structures, Finite word length effects, limitations of IIR filters.

FIR Filter Design : Linear phase response, Windowing technique, Gibb's Phenomenon, Frequency Sampling Method , FIR Filter structures .

Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm, Goertzel's Algorithm, Overlap add and Overlap save methods.

Power Spectrum Estimation, Classical Spectral Estimation, Parametric Modeling - AR, MA, ARMA methods, Minimum variance spectral estimations.

Principles of DSP Architecture.

REFERENCE BOOKS :

Roman Kuc "Introduction to Digital Signal Processing", McGraw Hill 1988.

A.V. Oppenheim and R.W. Schaffer "Discrete Time Signal Processing", PHI 1992.

J.G.Proakis and D.G. Manolakis " Introduction to Digital Signal Processing" McMillan 1992.

Steven M. Kay "Modern Spectral Estimation", PHI 1988.

MDEC 102 DIGITAL SYSTEM DESIGN

Introduction to Computer Aided Synthesis and Optimization, Circuit models, Synthesis, Optimization, Computer Aided Simulation, Verification, Testing, and Design for Testability.

Graphs : Notation, Undirected Graphs, Directed Graphs, Combinatorial. Optimization: Decision and Optimization Problems, Algorithms, Tractable and Intractable problems, Graph Optimization problems and Algorithms, Boolean Algebra and Applications.

Hardware Modelling : Languages, Abstract Models, Compilation and Behavioral Optimization.

Architectural Synthesis : Circuit Specifications for Architectural Synthesis , Fundamental Architectural Synthesis Problems , Area and Performance Estimation , Strategies for Architectural Optimization ,Data Path Synthesis , Control Unit Synthesis , Synthesis of Pipelined Circuits .

Scheduling Algorithms : Model , Scheduling without Resource Constraint , Scheduling with Constraint, Algorithms for Extended Sequencing Models , Scheduling for Pipelined Circuits .

Resource Sharing and Binding : Sharing and Binding for Resource- Dominated Circuits , Sharing and Binding for General Circuits , Concurrent Binding and Scheduling , Resource Sharing and Binding for Non-Scheduled Sequencing , Module Selection Problem , Resource Sharing and Binding for Pipelined Circuits , Sharing and Structural Testability .

Two Level Combinational Logic Optimization: Logic Optimization Principles, Operation on Two Level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems, Minimization of Boolean Relations.

Multiple Level Combinational Optimization : Models and Transformations for Combinational Networks, Algebraic Model , Boolean Model, Synthesis of Testable Network, Algorithms for Delay Evaluation and Optimization, Rule Base System for Logic Optimization.

Sequential Logic Optimization: Sequential Circuit Optimization Using State Based Models, Sequential Circuit Optimization Using Network Models, Implicit Finite State Machine Traversal Methods, Testability Considerations for Synchronous Circuits.

Cell Library Binding: Problem Formulation and Analysis, Algorithms for Library Binding, Specific Problems and Algorithms for Library Binding (Look-Up Table FPGAs and Anti- Fuse Based FPGAs), Rule Based Library Binding.

State of the Art and Future Trends: State of the Art in Synthesis, Synthesis Systems (Production Level Synthesis System, Research Synthesis System, Achievements and Unresolved Issues), Growth of Synthesis in the Near and Distant Future (System Level Synthesis and Hardware Software Co- Design).

REFERENCE BOOKS :

Giovanni De Micheli: "Synthesis and Optimization of Digital Circuits", McGraw-Hill, 1994.

Srinivas Devadas, Abhijith Ghosh and Kurt Keutzer: "Logic synthesis", McGraw-Hill, 1994.

John.F.Wakerly : "Digital Design Principle and Practices", Prentice Hall ,1996.

IEEE Proceeding on Computers and Digital Techniques. IEEE Transaction on Computers.

IEEE Journal on Solid State Circuit. IEEE Transactions on Computer Aided Design and Integrated Circuits. Electronic Letters.

MDEC 103 DIGITAL & SPREAD SPECTRUM COMMUNICATION

Advanced Digital and Demodulation Techniques , QPSK , Continuous Phase PSK (CPPSK), GMSK ,QAM , Trellis Coded Modulation (TCM) Clock and Carrier Recovery Schemes . Chapters 5 and 6 of Reference 1 .

Linear Adaptive and Decision feedback Equalisers , Echo Cancellation .Chapters 8 and 9 of Reference 1 .

Review of Basic Digital Communication Concepts . Chapters 1 of Reference 2.

Introduction to Spread Spectrum Systems . Chapters 2,3,4,5,6 and 9 of Reference 2.

REFERENCE BOOKS :

R.D.Gitlin and others, "Data Communication Principles", McGraw Hill.

R.L.Peterson and others, "Introduction to Spread Spectrum Communication", Prentice Hall International Edition 1995.

Digital Communication (2nd Edition). McGraw Hill.

Marvin K.Simon & others, "Digital Communication Techniques: Signal Design & Detection", Prentice Hall International 1995.

MDEC 1041 MOBILE COMMUNICATION SYSTEMS

Brief Review of Mobile Communication Systems: Concepts of Cellular Communication, Frequency Allocation, Radio Propagation in Mobile Environment.

Cellular Architectures: First Generation Analogue Systems (TACS, AMPS), Second Generation Digital Systems (GSM, ADC, PDC or JDC).

GSM Technology and Specifications : Objectives of GSM System. Architecture, Signaling, Interfaces/Protocols, Mobility, Handover and Power Control.

GSM Additional services : Teletext, Facsimile, Videotext services.

Cordless Telecommunication Systems: Digital Cordless Standards. CT2/CAI Specifications. DECT Specifications and Protocol Architecture, Radio Spectrum.

Micro-Cellular Networks: Cell types, Highway Micro-Cells, Indoor Micro-Cells.

Cellular Multiple Access Technologies: IDMA, FDMA, CDMA and ATDMA Characteristics.

Design of Digital Cellular Systems : A case study.

Future Satellite Mobile Telephone Networks: Mobile Satellite Systems (GEO, MEO and LEO) ex: IRIDIUM , Economic comparison of different systems.

REFERENCE BOOKS :

R.L.Freeman, "Radio System Design for Telecommunications", Wiley Interscience, 1997.

V.K.Garg, "Wireless and Personal Communications", IEEE Press, 1996.

W.C.Y.Lee, "Mobile Cellular Telecommunications", 2nd ed., McGraw Hill, 1995.

J.Walker, "Mobile Information Systems", Artech House, 1990.

N.J.Muller, "Wireless Data Networking", Artech House, 1995.

MDEC 1051 INFORMATION THEORY & CODING

Introduction to Information Theory: Information and Sources Uniquely Decodable Codes. Instantaneous codes. Construction of an Instantaneous code. Kraft's Inequality.

Coding Information Sources: The Average length of a code. Encoding for special Sources. Shannon's Theorems. Finding Binary Compact Codes, Huffman's code. r-ary compact Codes, Code Efficiency and Redundancy.

Channels and Mutual Information: Information Channels, Probability relations in a channel . Apriori and Aposteriori Entropies, Generalization of Shannon's first theorem, Mutual Information. Properties of Mutual Information, Noiseless and Deterministic channels, Cascaded channels, Channel Capacity, Conditional Mutual Information .

Reliable Messages through Unreliable channels: Error probability and Decision rules, the Fano bound, Hamming distance, Shannon's theorem for the Binary Symmetric channel, Random Coding.

Ensemble performance analysis of block and convolution codes.

REFERENCE BOOKS :

N.Abrahamson, "Information Theory and coding", McGraw Hill Book Co., 1963.

R.G.Gallagar, "Information theory and reliable communication", Wiley New York, 1968.

Richard.E.Balhut, "Principles of Practices of Information Theory", Addison Wesley Pub.Co., 1987.

David Stepian, " Key papers in the development of Information theory", IEEE Press, 1973.

Recent IEE & IEEE Publications in the area of Information Theory and coding .

Semester-II

MDEC 201 PROCESSOR ARCHITECTURE AND APPLICATIONS

Architecture and Applications of Digital Signal Processors : Need for special DSP Processors, Issues involved in processor Design-speed, cost, accuracy, pipelining, parallelism, finite word length effect, quantisation errors etc . Von Neumann Vs Harvard architecture, Key DSP Hardware elements Multiplier, ALU, Shifter, Address generator etc. Architectures and features of sample fixed and floating point processors (TI 5X,3X,6X,27X families) .

VLIW Architecture, Register File Architecture, Memory Architecture, Branch Architecture in DSP Processors .

DSP Development tools- assembler, simulator cross compilers - their features.

Designing DSP based systems, with ADC, DAC Memory, and interfacing consideration.

Application using DSP Processor - Spectral Analysis, Digital Filtering, Speech and Image Processing, Equalizers, Modems, Noise and Echo Cancellation, Digital Control etc.

Architecture of Advanced Microprocessors and Microcontrollers: Introduction to the general structure of advanced microprocessors & microcontrollers , Discussion on architectures, instruction sets, memory hierarchies, pipe-lining and RISC principles.

Memory structure and management - Real mode, Protected mode, dedicated and reserved areas, Multitasking- Protection and task switching, INPUT/OUTPUT and protections, interrupt and exceptions.

Super scalar architecture, MMX Technology, Enhanced power management, Multiprocessing with reference to Pentium processors.

REFERENCE BOOKS :

EC Jfeachor and B.W.Jervis , “ DSP-A practical approach ”.Addison Wesley 1993.

Users manuals of various fixed and floating point DSPs , Application Guides from DSP manufacturers .

TI Website [<http://www.ti.com>] .

Selected papers from IEEE Journals .

R.L.Hummel , “ The Processor and Coprocessor ”,ZD Press 1972.

Douglas V.Hall , “Microprocessors and Interfacing ” McGraw Hill 1992 .

Intel data books .

MDEC 202 ADVANCED DIGITAL SIGNAL PROCESSING

Time frequency analysis, the need for time frequency analysis , Time frequency distribution , Short time Fourier Transform , Wigner distribution .

Principles of Adaptive filtering , LMS and RMS Algorithms , Applications in noise and echo cancellation .

Homomorphic Signal Processing , homomorphic system for convolution, properties of complex spectrum, Applications of homomorphic deconvolution .

Multiresolution Signal analysis,Decompositions, transforms , Subbands and wavelets , Orthogonal transforms : Cosine , sine , Hermite. Walsh Fourier, Theory of Subband decomposition , decimation , interpolation , Design of QMF filter banks ,Wavelet transforms .

International Standards for speech,image and video compression for personnel communication , Digital broadcasting and multimedia systems .

REFERENCE BOOKS :

Leon Cohen, "Time frequency analysis", Prentice Hall, 1995.

Haykins, "Adaptive Filter theory", Prentice Hall, 1986.

A.V.Oppenheim and R.W.Schafer, "Discrete time Signal Processing ", PHI 1992.

P.P. Vaidyanathan, "Multirate systems and Filter banks", Prentice Hall, 1993.

Steven M . Kay , "Modern Specrum Estimation", Prentice Hall, 1988.

MDEC 203 COMMUNICATION NETWORKS & PROTOCOLS

General issues in the transport of data traffic over networks of digital transmission media- Architectural concepts in ISO's OSI Layers mode for computer communication-physical layer standards-Data link layer ABD schemes and their analysis. Delay models based on queuing theory Network layer-Topology, routing, flow control, congestion control. Multiple access. Local area networks (LANs)-Transport Layer- issues and standards. ISDN, BISDN, ATM Inter networking (TCP/IP Protocols)-Data compression-Network security-cryptography.

REFERENCE BOOKS :

Betsekos.D and Gallager.R, "Data Networks", PHI, 1989.

Tanenbaum.A.S, "Computer Networks", 3rd Ed. PHI.

Mischa Schwartz, "Telecommunication Networks, Protocols, Modeling and Analysis", Addison Wesley, 1987.

Beker and Piper, "Cipher Systems".

MDEC 2042 DIGITAL SIGNAL COMPRESSION

Data Compression : Entropy coding-Huffmann Run length, arithmetic and Ziv-Lempel coding.

Speech & Image waveform characterization-source models, quantization, optimal & adoptive waveform coders for speech & images.

Predictive coding-DPCM, Linear prediction, prediction for video, adoptive prediction, motion compensation for video.

Transform coding: Orthogonal transforms-Fourier, cosine, wavelet based approaches to speech & image compression.

Subband coding, VQ based compression, Fractal coding of images.

High quality video & audio compression for digital broadcasting.

Standards for digital signal compression-data, speech, audio, image & video.

REFERENCE BOOKS :

Jayant & Noll, " Digital coding of waveforms-Principles and Applications to speech & video", PH, 1984.

M.Nelson, "The data compression book", 2ed., BPB Publications.

IEEE Transactions on Speech and Audio processing.

IEEE Transactions on Image Processing.

IEEE Signal Processing Magazine.

CCITT Recommendations .

MDEC 2052 ADVANCED COMPUTER ARCHITECTURE

Introduction : Performance Evaluation – Flynn’s classification – different architectural tracks : RISC & CISC , Control flow and data flow - sub and super scalar architectures .

Pipe-lining : Linear and Non-linear pipelines – Multifunction pipes – Design of pipe lined processors - Pipeline hazards – Instruction scheduling – Dynamic scheduling – score boarding and Tomosulo’s algorithm – Interrupts in pipeline processors .

Review of memory subsystem – Interleaved memory - access methods : C - access – virtual memory.

Array Processors and Associate Processors .

Vector Processing - basic ideas – pipe lining in vector processors – vector chaining - vector instruction Example CRAY X-MP .

Multiprocessor System – Basic ideas – Interconnection networks – instruction primitives – maintaining memory consistency – cache coherency problems – Virtual address cache and physical address cache – cache coherence protocols - shared memory multiprocessors – consistency models weak and sequential .

Introduction to multi threaded architecture - Introduction to data flow computers .

I/O Subsystem – I/O processors- disk arrays I/O strategy and intelligence – Improving data rate by software - Improving data rate by hardware – shadowing , striping and RAIDs .

REFERENCE BOOKS :

Kai Hwang and F.A. Briggs-“Computer Architecture and Parallel Processing” McGraw Hill Publications .

Kai Hwang “Advanced computer architecture - parallelism , scalability , programmability ” McGraw Hill 1993 .

J. Hennessy and D.Patterson . “Computer Architecture , A quantitative approach”. Morgan Kaufman 1993 .

Hockey Jesshope “Parallel Computer 1 & 2” Adam Hilgs .

Herald Stone “High performance computer architecture”.

IEEE Computer Magazine .

IEEE Micro .

Papers from International symposia on Computer Architecture (ICSA) .
