

# **ACADEMIC REGULATIONS & COURSE STRUCTURE**

**For**

**DECS, ECE, DECE**

*(Applicable for batches admitted from 2016-2017)*



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA  
KAKINADA - 533 003, Andhra Pradesh, India**

## I Semester

S. No.	Name of the Subject	L	P	C
1	Digital System Design	4	-	3
2	Detection & Estimation Theory	4	-	3
3	Digital Data Communications	4	-	3
4	Advanced Digital Signal Processing	4	-	3
5	<b>Elective I</b> I. Transform Techniques II. VLSI Technology & Design III. Radar Signal Processing	4	-	3
6	<b>Elective II</b> I. Statistical Signal Processing II. Optical Communication Technology III. Network Security & Cryptography	4	-	3
7	1. System Design & Data Communications Lab	-	3	2
<b>Total Credits</b>				<b>20</b>

## II Semester

S. No.	Name of the Subject	L	P	C
1	Coding Theory & Applications	4	-	3
2	Embedded System Design	4	-	3
3	Image and Video Processing	4	-	3
4	Wireless Communications & Networks	4	-	3
5	<b>Elective III</b> I. CMOS Analog & Digital IC Design II. Advanced Computer Architecture III. Soft Computing Techniques IV. Cyber Security	4	-	3
6	<b>Elective IV</b> I. DSP Processors and Architectures II. EMI / EMC III. Object Oriented Programming	4	-	3
7	Advanced Communications Laboratory	-	3	2
<b>Total Credits</b>				<b>20</b>

### III Semester

<b>S. No.</b>	<b>Subject</b>	<b>L</b>	<b>P</b>	<b>Credits</b>
1	Comprehensive Viva-Voce	--	--	2
2	Seminar – I	--	--	2
3	Project Work Part – I	--	--	16
<b>Total Credits</b>				<b>20</b>

### IV Semester

<b>S. No.</b>	<b>Subject</b>	<b>L</b>	<b>P</b>	<b>Credits</b>
1	Seminar – II	--	--	2
2	Project Work Part - II	--	--	18
<b>Total Credits</b>				<b>20</b>

**I Year I Semester**

<b>L</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>3</b>

## **DIGITAL SYSTEM DESIGN**

### **UNIT-I: Minimization Procedures and CAMP Algorithm:**

Review on minimization of switching functions using tabular methods, k-map, QM algorithm, CAMP-I algorithm, Phase-I: Determination of Adjacencies, DA, CSC, SSMs and EPCs., CAMP-I algorithm, Phase-II: Passport checking, Determination of SPC, CAMP-II algorithm: Determination of solution cube, Cube based operations, determination of selected cubes are wholly within the given switching function or not, Introduction to cube based algorithms.

### **UNIT-II: PLA Design, Minimization and Folding Algorithms:**

Introduction to PLDs, basic configurations and advantages of PLDs, PLA-Introduction, Block diagram of PLA, size of PLA, PLA design aspects, PLA minimization algorithm(IISc algorithm), PLA folding algorithm(COMPACT algorithm)-Illustration of algorithms with suitable examples.

### **UNIT -III: Design of Large Scale Digital Systems:**

Algorithmic state machinecharts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control unit design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

### **UNIT-IV: Fault Diagnosis in Combinational Circuits:**

Faults classes and models, fault diagnosis and testing, fault detection test, test generation, testing process, obtaining a minimal complete test set, circuit under test methods- Path sensitization method, Boolean difference method, properties of Boolean differences, Kohavi algorithm, faults in PLAs, DFT schemes, built in self-test.

### **UNIT-V: Fault Diagnosis in Sequential Circuits:**

Fault detection and location in sequential circuits, circuit test approach, initial state identification, Haming experiments, synchronizing experiments, machine identification, distinguishing experiment, adaptive distinguishing experiments.

### **TEXT BOOKS:**

1. Logic Design Theory-N. N. Biswas, PHI
2. Switching and Finite Automata Theory-Z. Kohavi , 2<sup>nd</sup> Edition, 2001, TMH
3. Digital system Design using PLDD-Lala

### **REFERENCE BOOKS:**

1. Fundamentals of Logic Design – Charles H. Roth, 5<sup>th</sup> Ed., Cengage Learning.
2. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.

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**DETECTION AND ESTIMATION THEORY**

**UNIT –I:**

**Random Processes:**

Discrete Linear Models, Markov Sequences and Processes, Point Processes, and Gaussian Processes.

**UNIT –II:**

**Detection Theory:**

Basic Detection Problem, Maximum A posteriori Decision Rule, Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)- minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses.

**UNIT –III:**

**Linear Minimum Mean-Square Error Filtering:**

Linear Minimum Mean Squared Error Estimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with Stored Data, Real-time Digital Wiener Filters, Kalman Filters.

**UNIT –IV:**

**Statistics:**

Measurements, Nonparametric Estimators of Probability Distribution and Density Functions, Point Estimators of Parameters, Measures of the Quality of Estimators, Introduction to Interval Estimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression, Multiple Linear Regression.

**UNIT –V:**

**Estimating the Parameters of Random Processes from Data:**

Tests for Stationarity and Ergodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions, Power Spectral Density Functions.

**TEXT BOOKS:**

1. Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan & A.M. Breipohl, Wiley India Pvt. Ltd, 2011.
2. Random Processes: Filtering, Estimation and Detection - Lonnie C. Ludeman, Wiley India Pvt. Ltd., 2010.

**REFERENCE BOOKS:**

1. Fundamentals of Statistical Signal Processing: Volume I Estimation Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
2. Fundamentals of Statistical Signal Processing: Volume I Detection Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
3. Introduction to Statistical Signal Processing with Applications - Srinath, Rajasekaran, Viswanathan, 2003, PHI.
4. Statistical Signal Processing: Detection, Estimation and Time Series Analysis – Louis L.Scharf, 1991, Addison Wesley.
5. Detection, Estimation and Modulation Theory: Part – I – Harry L. Van Trees, 2001, John Wiley & Sons, USA.
6. Signal Processing: Discrete Spectral Analysis – Detection & Estimation – Mischa Schwartz, Leonard Shaw, 1975, McGraw Hill.

**I Year I Semester**

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## **DIGITAL DATA COMMUNICATIONS**

### **UNIT -I:**

#### **Digital Modulation Schemes:**

BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

### **UNIT -II:**

#### **Basic Concepts of Data Communications, Interfaces and Modems:**

Data Communication Networks, Protocols and Standards, UART, USB, Line Configuration, Topology, Transmission Modes, Digital Data Transmission, DTE-DCE interface, Categories of Networks – TCP/IP Protocol suite and Comparison with OSI model.

### **UNIT -III:**

**Error Correction:** Types of Errors, Vertical Redundancy Check (VRC), LRC, CRC, Checksum, Error Correction using Hamming code

**Data Link Control:** Line Discipline, Flow Control, Error Control

**Data Link Protocols:** Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocols, Bit-Oriented Protocol, Link Access Procedures.

### **UNIT -IV:**

**Multiplexing:** Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Multiplexing Application, DSL.

**Local Area Networks:** Ethernet, Other Ether Networks, Token Bus, Token Ring, FDDI.

**Metropolitan Area Networks:** IEEE 802.6, SMDS

**Switching:** Circuit Switching, Packet Switching, Message Switching.

**Networking and Interfacing Devices:** Repeaters, Bridges, Routers, Gateway, Other Devices.

### **UNIT -V:**

#### **Multiple Access Techniques:**

Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA), OFDM and OFDMA. Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization.

### **TEXT BOOKS:**

1. Data Communication and Computer Networking - B. A.Forouzan, 2<sup>nd</sup> Ed., 2003, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5<sup>th</sup> Ed., 2008, PEI.

**REFERENCE BOOKS:**

1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data and Computer Communications - William Stallings, 8<sup>th</sup> Ed., 2007, PHI.
3. Data Communication and Tele Processing Systems -T. Housely, 2<sup>nd</sup> Ed, 2008, BSP.
4. Data Communications and Computer Networks- Brijendra Singh, 2<sup>nd</sup>Ed., 2005, PHI.



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## **ADVANCED DIGITAL SIGNAL PROCESSING**

### **UNIT –I:**

#### **Review of DFT, FFT, IIR Filters and FIR Filters:**

**Multi Rate Signal Processing:** Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion.

### **UNIT –II:**

#### **Applications of Multi Rate Signal Processing:**

Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

### **UNIT -III:**

**Non-Parametric Methods of Power Spectral Estimation:** Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods

### **UNIT –IV:**

#### **Implementation of Digital Filters:**

Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

### **UNIT –V:**

**Parametric Methods of Power Spectrum Estimation:** Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

### **TEXT BOOKS:**

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis & D. G. Manolakis, 4<sup>th</sup> Ed., PHI.
2. Discrete Time Signal Processing - Alan V Oppenheim & R. W Schaffer, PHI.
3. DSP – A Practical Approach – Emmanuel C. Ifeachor, Barrie. W. Jervis, 2 Ed., Pearson Education.

**REFERENCE BOOKS:**

1. Modern Spectral Estimation: Theory & Application – S. M .Kay, 1988, PHI.
2. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH
4. Digital Spectral Analysis – Jr. Marple

**I Year I Semester**

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**TRANSFORM TECHNIQUES  
(ELECTIVE – I)**

**UNIT -I:**

**Fourier Analysis:**

Fourier series, Examples, Fourier Transform, Properties of Fourier Transform, Examples of Fourier transform, sampling theorem, Partial sum and Gibbs phenomenon, Fourier analysis of Discrete time Signals, Discrete Fourier Transform.

Time – Frequency Analysis: Window function, Short Time Fourier Transform, Discrete Short Time Fourier Transform, Continuous wavelet transform, Discrete wavelet transform, wavelet series, Interpretations of the Time-Frequency plot.

**UNIT -II:**

**Transforms:**

Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT, Singular value Decomposition – definition, properties and applications

**UNIT -III:**

**Continuous Wavelet Transform (CWT):**

Shortcomings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

**UNIT -IV:**

**Multi Rate Analysis and DWT:**

Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

**UNIT -V:**

**Wavelet Packets and Lifting:** Wavelet Packet Transform, Wavelet packet algorithms, Thresholding-Hard thresholding, Soft thresholding, Multidimensional Wavelets, Bi-orthogonal basis- B-Splines, Lifting Scheme of Wavelet Generation, Multi Wavelets

**TEXT BOOKS:**

1. A Wavelet Tour of Signal Processing theory and applications -RaghuveerM.Rao and Ajit S. Bopardikar, Pearson Edu, Asia, New Delhi, 2003.
2. K.P.Soman and K.I Ramachandran, “ Insight into Wavelets – from theory to practice” PHI, Second edition,2008

**REFERENCE BOOKS:**

1. Fundamentals of Wavelets- Theory, Algorithms and Applications -Jaideva C Goswami, Andrew K Chan, John Wiley & Sons, Inc, Singapore, 1999.
2. JaidevaC.Goswami and Andrew K.Chan, “ Fundamentals of Wavelets” Wiley publishers, 2006
3. A Wavelet Tour of Signal Processing-Stephen G. Mallat, Academic Press, 2 Ed
4. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH,2009

**I Year I Semester**

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**VLSI TECHNOLOGY AND DESIGN  
(ELECTIVE – I)**

**UNIT-I:**

**VLSI Technology:** Fundamentals and applications, IC production process, semiconductor processes, design rules and process parameters, layout techniques and process parameters.

**VLSI Design:** Electronic design automation concept, ASIC and FPGA design flows, SOC designs, design technologies: combinational design techniques, sequential design techniques, state machine logic design techniques and design issues.

**UNIT-II:**

**CMOS VLSI Design:** MOSTechnology and fabrication process of pMOS, nMOS, CMOS and BiCMOS technologies, comparison of different processes.

**Building Blocks of a VLSI circuit:** Computer architecture, memory architectures, communication interfaces, mixed signal interfaces.

**VLSI Design Issues:** Design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design.

**UNIT-III:**

Basic electrical properties of MOS and BiCMOS circuits, MOS and BiCMOS circuit design processes, Basic circuit concepts, scaling of MOS circuits-qualitative and quantitative analysis with proper illustrations and necessary derivations of expressions.

**UNIT-IV:**

**Subsystem Design and Layout:** Some architectural issues, switch logic, gate logic, examples of structured design (combinational logic), some clocked sequential circuits, other system considerations.

**Subsystem Design Processes:** Some general considerations and an illustration of design processes, design of an ALU subsystem.

**UNIT-V:**

**Floor Planning:** Introduction, Floor planning methods, off-chip connections.

**Architecture Design:** Introduction, Register-Transfer design, high-level synthesis, architectures for low power, architecture testing.

**Chip Design:** Introduction and design methodologies.

**TEXT BOOKS:**

1. Essentials of VLSI Circuits and Systems, K. Eshraghian, Douglas A. Pucknell, SholehEshraghian, 2005, PHI Publications.
2. Modern VLSI Design-Wayne Wolf, 3<sup>rd</sup> Ed., 1997, Pearson Education.
3. VLSI Design-Dr.K.V.K.K.Prasad, KattulaShyamala, Kogent Learning Solutions Inc., 2012.

**REFERENCE BOOKS:**

1. VLSI Design Technologies for Analog and Digital Circuits, Randall L.Geiger, Phillip E.Allen, Noel R.Strader, TMH Publications, 2010.
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective- Ming-BO Lin, CRC Press, 2011.
3. Principals of CMOS VLSI Design-N.H.E Weste, K. Eshraghian, 2<sup>nd</sup> Edition, Addison Wesley.

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	<b>4</b>	<b>0</b>	<b>3</b>

**RADAR SIGNAL PROCESSING  
(ELECTIVE -I)**

**UNIT -I:**

**Introduction:**

Radar Block Diagram, Bistatic Radar, Monostatic Radar, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, MTI and Pulse Doppler Radar.

Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.

**UNIT -II:**

**Detection of Radar Signals in Noise:**

Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors–Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection-CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management–Schematics, Component Parts, Resources and Constraints.

**UNIT -III:**

**Waveform Selection [3, 2]:**

Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noise Like Waveforms, Waveform Design Requirements, Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.

**UNIT -IV:**

**Pulse Compression in Radar Signals:**

Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.

**UNIT V:**

**Phase Coding Techniques:**

Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.

Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Sidelobe Reduction for Phase Coded PC Signals.

**TEXT BOOKS:**

1. Radar Handbook - M.I. Skolnik, 2<sup>nd</sup> Ed., 1991, McGraw Hill.
2. Radar Design Principles : Signal Processing and The Environment - Fred E. Nathanson, 2<sup>nd</sup> Ed., 1999, PHI.
3. Introduction to Radar Systems - M.I. Skolnik, 3<sup>rd</sup> Ed., 2001, TMH.

**REFERENCE BOOKS:**

1. Radar Principles - Peyton Z. Peebles, Jr., 2004, John Wiley.
2. Radar Signal Processing and Adaptive Systems - R. Nitzberg, 1999, Artech House.



I Year I Semester

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## STATISTICAL SIGNAL PROCESSING

(ELECTIVE - II)

### UNIT I

**Signal models and characterization:** Types and properties of statistical models for signals and how they relate to signal processing, Common second-order methods of characterizing signals including autocorrelation, partial correlation, cross-correlation, power spectral density and cross-power spectral density.

### UNIT II

**Spectral estimation:** Nonparametric methods for estimation of power spectral density, autocorrelation, cross-correlation, transfer functions, and coherence from finite signal samples.

### UNIT III

**Review of signal processing:** A review on random processes, A review on filtering random processes, Examples.

**Statistical parameter estimation:** Maximum likelihood estimation, maximum a posteriori estimation, Cramer-Rao bound.

### UNIT IV

**Eigen structure based frequency estimation:** Pisarenko, MUSIC, ESPRIT their application sensor array direction finding.

**Spectrum estimation:** Moving average (MA), Auto Regressive (AR), Auto Regressive Moving Average (ARMA), Various non-parametric approaches.

### UNIT V

**Wiener filtering:** The finite impulse case, causal and non-causal infinite impulse responses cases, Least mean squares adaptation, recursive least squares adaptation, Kalman filtering.

### TEXT BOOKS:

1. Steven M. Kay, fundamentals of statistical signal processing: estimation Theory, Prentice-Hall, 1993.
2. Monsoon H. Hayes, Statistical digital signal processing and modeling, USA, Wiley, 1996.

### REFERENCE BOOKS:

1. Dimitris G. Manolakis, Vinay K. Ingle, and Stephen M. Kogon, Statistical and adaptive signal processing, Artech House, Inc, 2005, ISBN 1580536107

**I Year I Semester**

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**OPTICAL COMMUNICATIONS TECHNOLOGY  
(ELECTIVE – II)**

**UNIT –I:**

**Signal propagation in Optical Fibers:**

Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self-Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.

**UNIT –II:**

**Fiber Optic Components for Communication & Networking:**

Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.

**UNIT –III:**

**Modulation and Demodulation:**

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

**UNIT -IV:**

**Transmission System Engineering:**

System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.

**UNIT –V:**

**Fiber Non-linearities and System Design Considerations:**

Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

**TEXT BOOKS:**

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2<sup>nd</sup> Ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. Optical Fiber Communications – Gerd Keiser, 3<sup>rd</sup> Ed., 2000, McGraw Hill.

**REFERENCE BOOKS:**

1. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2<sup>nd</sup> Ed., 2000, PE.
2. Fiber Optics Communication – Harold Kolimbris, 2<sup>nd</sup> Ed., 2004, PEI
3. Optical Networks: Third Generation Transport Systems – Uyles Black, 2<sup>nd</sup> Ed., 2009, PEI
4. Optical Fiber Communications – GovindAgarwal, 2<sup>nd</sup> Ed., 2004, TMH.
5. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.

I Year I Semester

L	P	C
4	0	3

**NETWORK SECURITY AND CRYPTOGRAPHY  
(ELECTIVE -II)**

**UNIT -I:**

**Introduction:**

Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

**Modern Techniques:**

Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

**UNIT -II:**

**Encryption Algorithms:**

Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block ciphers. **Conventional Encryption** : Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

**UNIT -III:**

**Public Key Cryptography:** Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. **Number Theory:** Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

**UNIT -IV:**

**Message Authentication and Hash Functions:** Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. **Hash and Mac Algorithms**

MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.

**Authentication Applications** : Kerberos, X.509 directory Authentication service. Electronic Mail Security: Pretty Good Privacy, S/MIME.

**UNIT -V:**

**IP Security:**

Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

**Intruders, Viruses and Worms**

Intruders, Viruses and Related threats.

**Fire Walls:** Fire wall Design Principles, Trusted systems.

**TEXT BOOKS:**

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

**REFERENCE BOOKS:**

1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Introduction to Cryptography, Buchmann, Springer.

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## **SYSTEMS DESIGN AND DATA COMMUNICATION LAB**

**A student has to do at least 6 Experiments from each Part.**

### **Part A:**

#### **Systems Design experiments**

- **The students are required to design the logic to perform the following experiments using necessary Industry standard simulator to verify the logical /functional operation, perform the analysis with appropriate synthesizer and to verify the implemented logic with different hardware modules/kits (CPLD/FPGA kits).**
- **Consider the suitable switching function and data to implement the required logic if required.**

#### **List of Experiments:**

11. Determination of EPCs using CAMP-I Algorithm.
12. Determination of SPCs using CAMP-I Algorithm.
13. Determination of SCs using CAMP-II Algorithm.
14. PLA minimization algorithm (IISc algorithm)
15. PLA folding algorithm (COMPACT algorithm)
16. ROM design.
17. Control unit and data processor logic design
18. Digital system design using FPGA.
19. Kohavi algorithm.
20. Hamming experiments.

#### **Lab Requirements:**

**Software:** Industry standard software with perpetual licence consisting of required simulator, synthesizer, analyzer etc. in an appropriate integrated environment.

**Hardware:** Personal Computer with necessary peripherals, configuration and operating System and relevant VLSI (CPLD/FPGA) hardware Kits.

## **Part-B:**

### **Data Communications Experiments**

1. Study of serial interface RS – 232
2. Study of pc to pc communication using parallel port
3. To establish pc-pc communication using LAN
4. Study of LAN using star topology, bus topology and tree topology
5. Study and configure modem of a computer
6. To configure a hub/switch
7. To study the interconnections of cables for data communication
8. Study of a wireless communication system

### **Software and Equipment required**

- Data Communication Trainer kits
- Computers
- LAN Trainer kit
- ST 5001 Software/ NS2 Software
- Serial and parallel port cables
- Patch cords (2 mm), FOE/LOE Cables, Main power cords
- Ethernet Cables (CAT5, CAT5E, CAT6, CAT7)
- Hubs, Switches, MODEMs
- RS 232 DB25/DB9 Connectors

**I Year II Semester**

<b>L</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>3</b>

## **CODING THEORY AND APPLICATIONS**

### **UNIT –I:**

#### **Coding for Reliable Digital Transmission and Storage:**

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

#### **Linear Block Codes:**

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

### **UNIT –II:**

#### **Cyclic Codes:**

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

### **UNIT –III:**

#### **Convolutional Codes:**

Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

### **UNIT –IV:**

#### **Burst –Error-Correcting Codes:**

Decoding of Single-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes, Phased-Burst –Error-Correcting Cyclic and Convolutional codes.

### **UNIT -V:**

#### **BCH – Codes:**

BCH code- Definition, Minimum distance and BCH Bounds, Decoding Procedure for BCH Codes- Syndrome Computation and Iterative Algorithms, Error Location Polynomials and Numbers for single and double error correction



**TEXT BOOKS:**

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing.

**REFERENCE BOOKS:**

1. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2. Digital Communications- John G. Proakis, 5<sup>th</sup> Ed., 2008, TMH.
3. Introduction to Error Control Codes-Salvatore Gravano-oxford
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2<sup>nd</sup> Ed, 2009, TMH.

**I Year II Semester**

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## **EMBEDDED SYSTEM DESIGN**

### **UNIT-I: Introduction**

An Embedded System-Definition, Examples, Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, software development, processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts.

### **UNIT-II: Embedded Hardware**

Embedded hardware building blocks, Embedded Processors – ISA architecture models, Internal processor design, processor performance, Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.

Embedded board Input / output – Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses – Bus arbitration and timing, Integrating the Bus with other board components, Bus performance.

### **UNIT-III: Embedded Software**

Device drivers, Device Drivers for interrupt-Handling, Memory device drivers, On-board bus device drivers, Board I/O drivers, Explanation about above drivers with suitable examples.

Embedded operating systems – Multitasking and process Management, Memory Management, I/O and file system management, OS standards example – POSIX, OS performance guidelines, Board support packages, Middleware and Application Software – Middle ware, Middleware examples, Application layer software examples.

### **UNIT-IV: Embedded System Design, Development, Implementation and Testing**

Embedded system design and development lifecycle model, creating an embedded system architecture, introduction to embedded software development process and tools- Host and Target machines, linking and locating software, Getting embedded software into the target system, issues in Hardware-Software design and co-design.

Implementing the design-The main software utility tool, CAD and the hardware, Translation tools, Debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

## **UNIT-V: Embedded System Design-Case Studies**

Case studies- Processor design approach of an embedded system –Power PC Processor based and Micro Blaze Processor based Embedded system design on Xilinx platform-NiosII Processor based Embedded system design on Altera platform-Respective Processor architectures should be taken into consideration while designing an Embedded System.

### **TEXT BOOKS:**

1. Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier(Singapore) Pvt.Ltd.Publications, 2005.
2. Frank Vahid, Tony D. Givargis, “Embedded system Design: A Unified Hardware/Software Introduction”, John Wily & Sons Inc.2002.

### **REFERENCE BOOKS:**

1. Peter Marwedel, “Embedded System Design”, Science Publishers, 2007.
2. Arnold S Burger, “Embedded System Design”, CMP.
3. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, TMH Publications, Second Edition, 2008.

**I Year II Semester**

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## **IMAGE AND VIDEO PROCESSING**

### **UNIT –I:**

#### **Fundamentals of Image Processing and Image Transforms:**

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing

Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

### **UNIT –II:**

#### **Image Enhancement:**

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

#### **Image Restoration:**

Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution

### **UNIT –III:**

#### **Image Segmentation:**

Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour

#### **Image Compression:**

Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.

### **UNIT -IV:**

#### **Basic Steps of Video Processing:**

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

## **UNIT –V:**

### **2-D Motion Estimation:**

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

### **TEXT BOOKS:**

1. Digital Image Processing – Gonzaleze and Woods, 3<sup>rd</sup> Ed., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quinZhang. 1<sup>st</sup> Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, “Digital Image processing, Tata McGraw Hill publishers, 2009

### **REFERENCE BOOKS:**

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – ScotteUmbaugh, 2<sup>nd</sup> Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH, 2009.
4. Multidimensional Signal, Image and Video Processing and Coding – John Woods, 2<sup>nd</sup> Ed, Elsevier.
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5<sup>th</sup> Ed., Elsevier.

I Year II Semester

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## WIRELESS COMMUNICATIONS AND NETWORKS

### UNIT -I:

#### **The Cellular Concept-System Design Fundamentals:**

Introduction, Frequency Reuse, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, **Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations**, Trunking and Grade of Service

### UNIT –II:

#### **Mobile Radio Propagation: Large-Scale Path Loss:**

Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Basic Propagation Mechanisms, **Reflection**: Reflection from Dielectrics, Brewster Angle, Reflection from perfect conductors, Ground Reflection (Two-Ray) Model, **Diffraction**: Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

### UNIT –III:

#### **Mobile Radio Propagation: Small –Scale Fading and Multipath**

Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

### UNIT -IV:

#### **Equalization and Diversity**

Introduction, Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity -Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection

Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

#### **UNIT -V:**

##### **Wireless Networks**

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, HiperLan, WLL.

#### **TEXT BOOKS:**

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2<sup>nd</sup> Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – GottapuSasibhushanaRao, Pearson Education, 2012.

#### **REFERENCE BOOKS:**

1. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications – KamiloFeher, 1999, PHI.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communication – UpenDalal, Oxford Univ. Press
5. Wireless Communications and Networking – Vijay K. Gary, Elsevier.

**I Year II Semester**

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**CMOS ANALOG AND DIGITAL IC DESIGN  
(Elective-III)**

**UNIT-I:**

**MOS Devices and Modeling**

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

**MOS Design**

Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

**UNIT-II:**

**Combinational MOS Logic Circuits:**

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

**Sequential MOS Logic Circuits**

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

**UNIT -III:**

**Dynamic Logic Circuits**

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

**Semiconductor Memories**

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.



## **UNIT -IV:**

### **Analog CMOS Sub-Circuits**

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors- Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

## **UNIT-V:**

### **CMOS Amplifiers**

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

### **CMOS Operational Amplifiers**

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

## **TEXT BOOKS:**

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3<sup>rd</sup> Ed., 2011.
3. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
4. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

## **REFERENCE BOOKS:**

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2016.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.
4. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, 2<sup>nd</sup> Ed., PHI.

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**ADVANCED COMPUTER ARCHITECTURE  
(ELECTIVE-I)**

**UNIT-I: Fundamentals of Computer Design:**

Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, Quantitative principles of computer design, Amdahl's law.

Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, Operations in the instruction set.

**UNIT-II:**

**Pipelines:**

Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe lined RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

**Memory Hierarchy Design:**

Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

**UNIT-III:**

**Instruction Level Parallelism (ILP)-The Hardware Approach:**

Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, High performance instruction delivery- Hardware based speculation.

**ILP Software Approach:**

Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues - Hardware verses Software.

#### **UNIT-IV: Multi Processors and Thread Level Parallelism:**

Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – Memory architecture, Synchronization.

#### **UNIT-V:**

##### **Inter Connection and Networks:**

Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.

**Intel Architecture:** Intel IA-64 ILP in embedded and mobile markets Fallacies and pit falls.

#### **TEXT BOOKS:**

1. John L. Hennessy, David A. Patterson - Computer Architecture: A Quantitative Approach, 3<sup>rd</sup> Edition, an Imprint of Elsevier.

#### **REFERENCE BOOKS:**

1. John P. Shen and Miikko H. Lipasti -, Modern Processor Design : Fundamentals of Super Scalar Processors
2. Computer Architecture and Parallel Processing - Kai Hwang, Faye A.Brigs., MC Graw Hill.
3. Advanced Computer Architecture - A Design Space Approach, DezsoSima, Terence Fountain, Peter Kacsuk, Pearson Ed.

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**I Year II Semester**

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**SOFT COMPUTING TECHNIQUES**

**(ELECTIVE -III)**

**UNIT –I:**

**Introduction:**

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, Rule-based systems, the AI approach, Knowledge representation - Expert systems.

**UNIT –II:**

**Artificial Neural Networks:**

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

**UNIT –III:**

**Fuzzy Logic System:**

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control, Fuzzy logic control for nonlinear timedelay system.

**UNIT –IV:**

**Genetic Algorithm:**

Basic concept of Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like Tabu search and anD-colony search techniques for solving optimization problems.

## **UNIT –V:**

### **Applications:**

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox, Stability analysis of Neural-Network interconnection systems, Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Stability analysis of fuzzy control systems.

### **TEXT BOOKS:**

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.

### **REFERENCE BOOKS:**

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. & Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2<sup>nd</sup> Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa, 1/e, TMH, New Delhi.

**I Year II Semester**

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**Cyber Security  
(ELECTIVE - II)**

**I Year II Semester**

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**DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES  
(ELECTIVE -IV)**

**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.

**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.

**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:**

**Analog Devices Family of DSP Devices:**

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

**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).

**TEXT BOOKS:**

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. EmbeddedSignalProcessingwiththeMicroSignalArchitecturePublisher: Woon-SengGan, Sen M. Kuo, Wiley-IEEE Press, 2007

**REFERENCE BOOKS:**

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing –Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
4. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI
5. *The Scientist and Engineer's Guide to Digital Signal Processing* by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997
6. *Embedded Media Processing* by David J. Katz and Rick Gentile of Analog Devices, Newnes , ISBN 0750679123, 2005



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**ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC  
COMPATIBILITY (EMI / EMC)**

**(ELECTIVE-IV)**

**UNIT -I:**

**Introduction, Natural and Nuclear Sources of EMI / EMC:**

Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations, An overview of EMI / EMC, Natural and Nuclear sources of EMI.

**UNIT -II:**

**EMI from Apparatus, Circuits and Open Area Test Sites:**

Electromagnetic emissions, Noise from relays and switches, Non-linearities in circuits, passive intermodulation, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites and measurements.

**UNIT -III:**

**Radiated and Conducted Interference Measurements and ESD:**

Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents / voltages, Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements, ESD, Electrical fast transients / bursts, Electrical surges.

**UNIT -IV:**

**Grounding, Shielding, Bonding and EMI filters:**

Principles and types of grounding, Shielding and bonding, Characterization of filters, Power lines filter design.

**UNIT -V:**

**Cables, Connectors, Components and EMC Standards:**

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

**TEXT BOOKS:**

1. Engineering Electromagnetic Compatibility - Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9.

**REFERENCE BOOKS:**

1. Introduction to Electromagnetic Compatibility - Ny, John Wiley, 1992, by C.R. Pal.

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**OBJECT ORIENTED PROGRAMMING  
(ELECTIVE IV)**

*Objective: Implementing programs for user interface and application development using core java principles*

**UNIT I:**

*Objective: Focus on object oriented concepts and java program structure and its installation*

**Introduction to OOP**

Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Installation of JDK1.6

**UNIT II:**

*Objective: Comprehension of java programming constructs, control structures in Java*

**Programming Constructs**

Variables , Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching,Conditional, loops.,

**Classes and Objects-** classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments

**UNIT III:**

*Objective: Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling*

**Inheritance:** Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class

**Interfaces, Packages and Enumeration:** Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, java.lang package

**Exceptions & Assertions** - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Assertions

**UNIT IV:**

*Objective: Understanding of Thread concepts and I/O in Java*

**MultiThreading :**java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading, Synchronization, suspending and Resuming threads, Communication between Threads

**Input/Output:** reading and writing data, java.io package

## **UNIT V:**

*Objective: Being able to build dynamic user interfaces using applets and Event handling in java*

**Applets-** Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint()

**Event Handling** -Introduction, Event Delegation Model, java.awt.event Description, Event Listeners, Adapter classes, Inner classes

## **UNIT VI:**

*Objective: Understanding of various components of Java AWT and Swing and writing code snippets using them*

### **Abstract Window Toolkit**

Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar

### **Swing:**

Introduction , JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScrollPane, Split Pane, JTabbedPane, Dialog Box

### **Text Books:**

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabhchoudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH
5. Introduction to Java programming, 7<sup>th</sup>ed, Y Daniel Liang, Pearson

### **Reference Books:**

1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, NageswaraRao, Wiley, Dream Tech
3. Core JAVA for Beginners, RashmiKanta Das, Vikas.
4. Object Oriented Programming through JAVA , P Radha Krishna , University Press.

**I Year II Semester**

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**ADVANCED COMMUNICATIONS LAB**

**Note:**

- E. Minimum of 10 Experiments have to be conducted
- F. All Experiments may be Simulated using MATLAB and to be verified using related training kits.

1. Measurement of Bit Error Rate using Binary Data
2. Verification of minimum distance in Hamming code
3. Determination of output of Convolutional Encoder for a given sequence
4. Determination of output of Convolutional Decoder for a given sequence
5. Efficiency of DS Spread- Spectrum Technique
6. Simulation of Frequency Hopping (FH) system
7. Effect of Sampling and Quantization of Digital Image
8. Verification of Various Transforms (FT / DCT/ Walsh / Hadamard) on a given Image ( Finding Transform and Inverse Transform)
9. Point, Line and Edge detection techniques using derivative operators.
10. Implementation of FIR filter using DSP Trainer Kit (C-Code/ Assembly code)
11. Implementation of IIR filter using DSP Trainer Kit (C-Code/ Assembly code)
12. Determination of Losses in Optical Fiber
13. Observing the Waveforms at various test points of a mobile phone using Mobile Phone Trainer
14. Study of Direct Sequence Spread Spectrum Modulation & Demodulation using CDMA-DSS-BER Trainer
15. Study of ISDN Training System with Protocol Analyzer
16. Characteristics of LASER Diode.