

**ANNA UNIVERSITY TIRUCHIRAPPALLI**  
**Tiruchirappalli - 620 024**  
**Curriculum 2008**

**M.E. COMMUNICATION SYSTEMS**

**SEMESTER I**

S No.	Subject code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MA5131</b>	Applied Mathematics for Electronics Engineers	3	1	0	4
2	<b>CO5101</b>	Advanced Radiation Systems	3	0	0	3
3	<b>CO5102</b>	Modern Digital Communication Techniques	3	0	0	3
4	<b>AN5101</b>	Advanced Digital Signal Processing	3	1	0	4
5	<b>CO5103</b>	Optical Communication Networks	3	0	0	3
6	<b>E1***</b>	Elective I	3	0	0	3
<b>Practical</b>						
7	<b>CO5104</b>	Communication System Laboratory I	0	0	4	3
<b>Total</b>						<b>23</b>

**SEMESTER II**

S No.	Subject code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>CO5151</b>	Mobile Communication Networks	3	0	0	3
2	<b>WS5001</b>	Multimedia Compression Techniques	3	0	0	3
3	<b>CO5152</b>	Microwave Integrated Circuits	3	0	0	3
4	<b>CO5153</b>	Satellite Communication	3	0	0	3
5	<b>E2***</b>	Elective II	3	0	0	3
6	<b>E3***</b>	Elective III	3	0	0	3
<b>Practical</b>						
7	<b>CO5154</b>	Communication System Laboratory II	0	0	4	3
<b>Total</b>						<b>21</b>

### SEMESTER III

S No.	Subject code	Subject	L	T	P	C
<b>Theory</b>						
1	E4***	Elective IV	3	0	0	3
2	E5***	Elective V	3	0	0	3
3	E6***	Elective VI	3	0	0	3
<b>Practical</b>						
4	CO5251	Project Work Phase I	0	0	12	6
<b>Total</b>						<b>15</b>

### SEMESTER IV

S No.	Subject code	Subject	L	T	P	C
<b>Practical</b>						
1	CO5251	Project Work Phase II	0	0	24	12
<b>Total</b>						<b>12</b>

**Total Credits to be Earned for the Award of the Degree = 71**

## LIST OF ELECTIVES

S No.	Subject code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>CO5001</b>	RF System Design	3	0	0	3
2	<b>CO5002</b>	Advanced Microwave Systems	3	0	0	3
3	<b>CO5003</b>	Communication protocol Engineering	3	0	0	3
4	<b>CO5004</b>	DSP Processor Architecture and Programming	3	0	0	3
5	<b>CO5005</b>	Wavelets and Multi resolution Processing	3	0	0	3
6	<b>CO5006</b>	Speech and Audio Signal Processing	3	0	0	3
7	<b>CO5007</b>	Network Routing Algorithms	3	0	0	3
8	<b>CO5008</b>	Simulation of Communication Systems and Networks	3	0	0	3
9	<b>CO5009</b>	Global Positioning Systems	3	0	0	3
10	<b>CO5010</b>	Communication Network Security	3	0	0	3
11	<b>CO5011</b>	Soft Computing	3	0	0	3
12	<b>CO5012</b>	Digital Communication Receivers	3	0	0	3
13	<b>AN5104</b>	Advanced Microprocessors and Microcontrollers	3	0	0	3
14	<b>AN5001</b>	Digital Image Processing	3	0	0	3
15	<b>AN5008</b>	Internetworking Multimedia	3	0	0	3
16	<b>AN5009</b>	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
17	<b>AN5010</b>	High Performance Communication Networks	3	0	0	3
18	<b>AN5154</b>	Embedded Systems	3	0	0	3
19	<b>DC5001</b>	High Speed Switching Architecture	3	0	0	3

# ANNA UNIVERSITY TIRUCHIRAPPALLI

Tiruchirappalli - 620 024

Regulations 2008

Syllabus

M.E.COMMUNICATION SYSTEMS

## SEMESTER I

MA5131 – APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

L	T	P	C
3	1	0	4

**UNIT I      LINEAR ALGEBRAIC EQUATIONS & EIGEN VALUE PROBLEMS      9**

System of Equations – Solutions by Gauss Elimination Methods – Gauss Jordan and LU Decomposition Method Jacobi – Gauss Seidel Method – Eigen Values of Matrix by Jacobi and Power Method.

**UNIT II      THE WAVE EQUATIONS      9**

Solution of Initial and Boundary Value Problems – Characteristics–D'Alembert's Solution– Significance of Characteristic Curves – Laplace Transform Solutions – for Displacement in a Long String – A long String under its Weight – Longitudinal Vibration of a Elastic Bar with Prescribed Force on one end – Free Vibrations of a String .

**UNIT III      SPECIAL FUNCTIONS      9**

Bessel's Equation – Bessel Functions Legendre's Equation – Legendre Polynomials Rodrigue's Formula – Recurrence Relations – Generating Functions and Orthogonal Property for Bessel Functions – Legendre Polynomials.

**UNIT IV      RANDOM VARIABLES      9**

One–Dimensional Random Variables – Moments and Moment Generating Function –Binomial Poisson– Uniform – Exponential Normal and Weibull Distribution – Two Dimensional Random Variables Marginal and Conditional Distribution Covariance – Correlation Coefficient – Function of One Dimensional and Two Dimensional Random Variables.

**UNIT V      QUEUING THEORY      9**

Single and Multiple Server Markovian Queuing Models – Steady State System Size Probabilities– Little's Formula – Customer Impatience Priority Queues – M/G/1 Queuing System – PK Formula .

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. S. Narayanan T. K. Manichvachagam Pillay and G. Ramanaiah, “Advanced Mathematics for Engineering Students”, S.Viswanathan Pvt Ltd, Vol 2, 1986.
2. Taha H. A., “Operations Research An Introduction”, Sixth Edition, PHI, 1997.

### **REFERENCES**

1. Sankara Rao K, “Introduction to Partial Differential Equation”, PHI, 1995.
2. Churchi R. V., “Operational Mathematics”, McGraw Hill, 1972.
3. Richard A. Johnson, “Miller and Freund's Probability and Statistics for Engineers”, Fifth Edition, PHI, 1994.



## CO5102 – MODERN DIGITAL COMMUNICATION TECHNIQUES

**L T P C**  
**3 0 0 3**

### **UNIT I POWER SPECTRUM AND COMMUNICATION OVER MEMORYLESS CHANNEL 9**

PSD of a Synchronous Data Pulse Stream – M-ary Markov Source – Convolutionally Coded Modulation– Continuous Phase Modulation Scalar and Vector Communication over Memoryless Channel – Detection Criteria .

### **UNIT II COHERENT AND NON COHERENT COMMUNICATION 9**

Coherent Receivers – Optimum Receivers in WGN – IQ Modulation & Demodulation– Non-Coherent Receivers in Random Phase Channels– M FSK Receivers– Rayleigh and Rician Channels– Partially Coherent Receivers– DPSK, M PSK, M-DPSK – BER Performance Analysis.

### **UNIT III BANDLIMITED CHANNELS AND DIGITAL MODULATIONS 9**

Eye Pattern– Demodulation in the Presence of ISI and AWGN– Equalization Techniques –IQ Modulations – QPSK, QAM, QBOM– BER Performance Analysis, Continuous Phase Modulation– CPM, CPFSK, MSK ,OFDM.

### **UNIT IV BLOCK CODED DIGITAL COMMUNICATION 9**

Architecture and Performance Binary Block Codes, Orthogonal, Biorthogonal, Transorthogonal Shannon's Channel Coding Theorem, Channel Capacity, Matched Filter– Concepts of Spread Spectrum Communication – Coded BPSK and DPSK Demodulators, Linear Block Codes– Hamming, Golay, Cyclic, BCH, Reed–Solomon Codes.

### **UNIT V CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9**

Representation of Codes using Polynomial State Diagram, Tree Diagram, and Trellis Diagram – Decoding Techniques using Maximum Likelihood –Viterbi Algorithm –and Threshold Methods –Error Probability Performance for BPSKand Viterbi Algorithm – Turbo Coding.

**Total: 45**

### **TEXT BOOKS**

1. Bernarl Sklar, Digital Communications, Pearson Education, Asia.
2. M.K. Simon, S.M. Hinedi and W.C. Lindsey, “Digital Communication Techniques, Signalling and Detection “, Prentice Hall of India, 1995.

### **REFERENCES**

1. Simon Haykin, “Digital communications”, John Wiley and sons, 1998.
2. Wayne Tomasi, “Advanced electronic communication systems”, 4<sup>th</sup> Edition, Pearson Education, Asia, 1998.
3. B.P. Lathi, “Modern digital and analog communication systems”, 3<sup>rd</sup> Edition, Oxford University Press, 1998.

# AN5101 – ADVANCED DIGITAL SIGNAL PROCESSING

L T P C  
3 1 0 4

[Review of discrete time signals and systems– DFT and FFT, Z –Transform, Digital Filters is recommended]

## UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes – Ensemble Averages, Stationary Processes, Autocorrelation and Auto Covariance Matrices – Parseval’s Theorem, Wiener– Khintchine Relation – Power Spectral Density – Periodogram Spectral Factorization– Filtering Random Processes – Low Pass Filtering of White Noise – Parameter Estimation: Bias and Consistency.

## UNIT II SPECTRUM ESTIMATION 9

Estimation of Spectra from Finite Duration Signals Non–Parametric Methods –Correlation Method – Periodogram Estimator – Performance Analysis of Estimators Unbiased, Consistent Estimators – Modified Periodogram, Bartlett and Welch Methods, Blackman – Tukey Method Parametric Methods – AR, MA, ARMA Model Based Spectral Estimation – Parameter Estimation – Yule, Walker Equations – Solutions using Durbin's Algorithm.

## UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear Prediction– Forward and Backward Predictions, Solutions of the Normal Equations – Levinson –Durbin Algorithms – Least Mean Squared Error Criterion– Wiener Filter for Filtering and Prediction – FIR Wiener Filter and Wiener IIR –Filters Discrete Kalman Filter.

## UNIT IV ADAPTIVE FILTERS 9

FIR Adaptive Filters – Adaptive Filter Based on Steepest Descent Method – Widrow – Hoff LMS Adaptive Algorithm, Normalized LMS – Adaptive Channel Equalization – Adaptive Echo Cancellation– Adaptive Noise Cancellation – Adaptive Recursive Filters (IIR) – RLS Adaptive Filters – Exponentially Weighted RLS – Sliding Window RLS.

## UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical Description of Change of Sampling Rate Interpolation and Decimation, Decimation by an Integer Factor – Interpolation by an Integer Factor – Sampling Rate Conversion by a Rational Factor – Filter Implementation for Sampling Rate Conversion – Direct Form FIR Structures – Polyphase Filter Structures– Time Variant Structures – Multistage Implementation of Multirate System – Application to Sub Band Coding –Wavelet Transform and Filter Bank Implementation of Wavelet Expansion of Signals.

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Monson H Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., 2002.
2. Dimitris GManolakis et al, “Statistical and adaptive signal processing”, McGraw Hill,2000.

### REFERENCES

1. John G. Proakis Dimitris G. Manolakis, “Digital Signal Processing”, Pearson Education, 2002.
2. John GProakis et al, “Algorithms for Statistical Signal Processing”, Pearson Education, 2002.
3. Rafael C Gonzalez and Richard E Woods, “Digital Image Processing”, Second Edition, Pearson Education, Inc, 2004 (For Wavelet Transform Topic).

## CO5103 – OPTICAL COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

### UNIT I OPTICAL NETWORKING COMPONENTS 9

First and Second Generation Optical Networks – Components – Couplers – Isolators, Circulators – Multiplexers – Filters – Amplifiers – Switches and Wavelength Converters.

### UNIT II SONET and SDH NETWORKS 9

Integration of TDM Signals – Layers – Framing – Transport Overhead – Alarms, Multiplexing – Network Elements – Topologies – Protection Architectures – Ring Architectures – Network Management.

### UNIT III BROADCAST AND SELECT NETWORKS 9

Topologies, Single-hop, Multihop, and Shufflenet Multihop Network – Media – Access control Protocols – Test Beds.

### UNIT IV WAVELENGTH ROUTING NETWORKS 9

Node Design – Issues In Network Design and Operation – Optical Layer Cost Tradeoffs – Routing and Wavelength Assignment – Wavelength Routing Test Beds.

### UNIT V HIGH CAPACITY NETWORKS 9

SDM, TDM, and WDM Approaches – Application Areas – Optical TDM Networks – Multiplexing and Demultiplexing – Synchronization – Broadcast Networks – Switch Based Networks – OTDM Test Beds.

**Total: 45**

### TEXT BOOKS

1. Rajiv Ramaswami and Kumar Sivarajan, “Optical Networks: A practical perspective”, Morgan Kaufmann, 2<sup>nd</sup> edition, 2001.
2. Biswanath Mukherjee, “Optical Communication Networks”, McGraw Hill, 1997

### REFERENCES

1. Vivek Alwayn, “Optical Network Design and Implementation”, Pearson Education, 2004.
2. Hussein T. Mouftab and Pin-Han Ho, “Optical Networks: Architecture and Survivability”, Kluwer Academic Publishers, 2002.

## CO5104 – COMMUNICATION SYSTEM LABORATORY I

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

1. Antenna Radiation Pattern Measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters Periodogram and Multistage Multirate System in DSP Processor.
4. Performance Evaluation of Digital Data Transmission through Fiber Optic Link.
5. Study of Spread Spectrum Techniques.
6. Simulation of QMF using Simulation Packages.
7. Implementation of Video Link using Optical Fiber.
8. Implementation of Linear and Cyclic Codes.

## SEMESTER II

### CO5151 – MOBILE COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

#### UNIT I OPERATION OF MOBILE COMMUNICATION NETWORKS 9

Operation Of First Second and Third Generation Wireless Networks – Cellular Systems Medium Access Techniques – Mobile Networks – Elementary Principles of Cellular Telephony – Channel Division Techniques (TDMA FDMA CDMA) – Cellular Coverage Methods Network Planning and Resource Allocation – Network Dimensioning – Mobility Management Procedures.

#### UNIT II PROPAGATION MODELS AND AIR PROTOCOLS 9

Radio Propagation Models – Error Control Techniques – Handoff Power Control – Soft Handover – Forward Link – Reverse Link – Common Air Protocols (AMPS IS 95 IS 136 GSM GPRS EDGE WCDMA Cdma2000 Etc).

#### UNIT III MOBILE NETWORK ARCHITECTURE 9

General Architecture Definition – Mobile Terminals (MT – SIM) Radio Section (BTS – BSC)– Core Network (MSC , G –MSC , VLR HLR– Auc) User and Control Plane Protocol Stack, MAP & SS#7 – The Key Role of Signaling Interfaces And Network Entities Relation the Physical Channel – The Logical Channels Terminal – Call and Network Management Procedures – Network Planning

#### UNIT IV WIRELESS LOCAL AREA NETWORKS 9

Wireless Local Area Networks – General Characteristics of the Hyper LAN System – 802.11 Standard – Basic DCF Access Scheme – DCF Access Scheme With Handshaking – PCF Access Scheme – The 802.11a Standard – Mobile Ad Hoc Networks – Wireless Sensor Networks – Routing Energy Efficiency Localization – Clustering .

#### UNIT V SECURITY ISSUES IN WIRELESS NETWORKS 9

Security in Wireless Networks – Secure routing – Key Pre–Distribution and Management – Encryption and Authentication – Security in Group Communication – Trust Establishment and Management – Denial of Service Attacks– Energy Aware Security Mechanisms Location Verification – Security on Data Fusion.

**Total: 45**

#### TEXT BOOKS

1. Leon Garcia and I Widjaja, “Communication Networks Fundamental Concepts and Key Architectures”, McGraw Hill, 2000.
2. T S Rappaport, “Wireless Communications Principles & Practice”, 2<sup>nd</sup> Edition, Prentice Hall, 2002.

#### REFERENCES

1. W. Stallings, “Wireless Communications and Networks”, Prentice Hall, 2002.
2. V. K. Garg, “IS 95 CDMA and CDMA 2000”, Prentice Hall, PTR, 2000.
3. J Schiller, “Mobile Communications”, Addison Wesley, 2000.
4. Fred Halsall, “Multimedia Communications Applications Networks Protocols and Standards”, Addison Wesley, 2001.

## WS5001 – MULTIMEDIA COMPRESSION TECHNIQUES

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

### **UNIT I FUNDAMENTALS 9**

Special Features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage Requirements for Multimedia Applications – Need for Compression – Taxonomy of Compression Techniques – Overview of Source Coding – Source Models – Scalar and Vector Quantization Theory – Evaluation Techniques – Error Analysis and Methodologies.

### **UNIT II TEXT COMPRESSION 9**

Compaction Techniques – Huffmann Coding – Adaptive Huffmann Coding– Arithmetic Coding – Shannon Fano Coding – Dictionary Techniques – LZW Family Algorithms .

### **UNIT III AUDIO COMPRESSION 9**

Audio Compression Techniques –  $\mu$ -Law and A-Law Companding – Frequency Domain and Filtering – Basic Sub Band Coding– Application to Speech Coding G 722 – Application to Audio Coding – MPEG Audio – Progressive Encoding for Audio – Silence Compression Speech Compression Techniques – Formant and CELP Vocoders .

### **UNIT IV IMAGE COMPRESSION 9**

Predictive Techniques – DM– PCM –DPCM – Optimal Predictors and Optimal Quantization – Contour Based Compression – Transform Coding – JPEG Standard – Sub Band Coding Algorithms: Design of Filter Banks– Wavelet Based Compression: Implementation Using Filters – EZW – SPIHT Coders – JPEG 2000 Standards – JBIG, JBIG2 Standards .

### **UNIT V VIDEO COMPRESSION 9**

Video Compression Techniques and Standards – MPEG Video Coding I : MPEG 1 And 2 – MPEG Video Coding II: MPEG 4 And 7 – Motion Estimation and Compensation Techniques – H.261 Standard – DVI Technology – PLV Performance –DVI Real Time Compression – Packet Video .

**Total: 45**

### **TEXT BOOKS**

1. Khalid Sayood, “Introduction to Data Compression”, 2<sup>nd</sup> Edition, Morgan Kauffman Harcourt, India, 2000.
2. Watkinson J., “Compression in Video and Audio”, Focal Press, London, 1995.

### **REFERENCES**

1. David Salomon, “Data Compression The Complete Reference”, 2<sup>nd</sup> Edition, Springer Verlag, New York Inc., 2001.
2. Peter Symes , “Digital Video Compression” , McGraw Hill Pub, 2004.
3. Mark Nelson, “Data compression BPB”, Publishers, New Delhi, 1998.
4. Yun Q. Shi Huifang, “Sun Image and Video Compression for Multimedia Engineering Fundamentals Algorithms & Standards”, CRC press, 2003.





## CO5154 – COMMUNICATION SYSTEM LABORATORY II

L	T	P	C
0	0	4	3

1. Simulation of Audio and Speech Compression Algorithms.
2. Simulation of EZW / SPIHT Image Coding Algorithm.
3. Simulation of Microstrip Antennas.
4. S parameter estimation of Microwave Devices.
5. Study of Global Positioning System.
6. Performance Evaluation of Simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of  $\lambda/4$  and  $\lambda/2$  Transmission Lines.

## ELECTIVES

### CO5001 – RF SYSTEM DESIGN

L	T	P	C
3	0	0	3

#### UNIT I RF ISSUES 9

Importance of RF Design – Electromagnetic Spectrum – RF behaviour of Passive Components – Chip components and Circuit Board Considerations – Scattering Parameters – Smith Chart and Applications.

#### UNIT II RF FILTER DESIGN 9

Overview – Basic Resonator and Filter Configuration – Special Filter Realizations – Filter Implementations – Coupled Filter.

#### UNIT III ACTIVE RF COMPONENTS & APPLICATIONS 9

RF Diodes – BJT, RF FETs – High Electron Mobility Transistors, Matching and Biasing Networks – Impedance Matching using Discrete Components – Microstrip Line Matching Networks – Amplifier Classes of Operation and Biasing Networks.

#### UNIT IV RF AMPLIFIER DESIGNS 9

Characteristics – Amplifier Power Relations – Stability Considerations – Constant Gain Circles – Constant VSWR Circles– Low Noise Circuits – Broadband – High Power and Multistage Amplifiers

#### UNIT V OSCILLATORS MIXERS & APPLICATIONS 9

Basic Oscillator Model – High Frequency Oscillator Configuration – Basic Characteristics of Mixers – Phase Locked Loops – RF Directional Couplers and Hybrid Couplers – Detector and Demodulator Circuits.

**Total: 45**

#### TEXT BOOKS

1. Reinhold Ludwig and Powel Bretchko “RF Circuit Design Theory and Applications”, 1<sup>st</sup> Edition, Pearson Education Asia, 2001.
2. Ulrich L. Rohde and David P. NewKirk, “Microwave Circuit Design”, John Wiley and Sons USA, 2000.

#### REFERENCES

1. Joseph J. Carr, “Secrets of RF Circuit Design”, 3<sup>rd</sup> Edition, McGraw Hill Publishers 2000.
2. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, 2<sup>nd</sup> Edition, Pearson Education Asia, 2002.
3. Roland E., “Best Phase Locked Loops Design simulation and applications”, 5<sup>th</sup> edition, McGraw Hill Publishers, 2003.

## CO5002 – ADVANCED MICROWAVE SYSTEMS

L	T	P	C
3	0	0	3

### UNIT I      FIELD ANALYSIS OF PLANAR TRANSMISSION LINES      9

Microstrip Transmission Lines – Attenuation – High frequency properties of Microstrip lines – Coupled Microstrip lines – Even and Odd Modes – Strip Transmission Lines – Coupled Strip Lines Fin Lines.

### UNIT II      CIRCUIT THEORY FOR WAVE GUIDE SYSTEMS      9

Equivalent Voltages and Currents – Impedance Description of Waveguide Elements and Circuits – One Port Circuit – Foster's Reactance Theorem. N-Port Circuits – Two Port Junctions, Excitation of Waveguides – Probe Coupling in Rectangular Waveguide – Radiation from Linear Current Elements and Current Loops – Waveguide Coupling by Apertures.

### UNIT III      PERIODIC STRUCTURES AND FILTERS      9

Wave Analysis of Periodic Structures – Periodic Structures Composed of Unsymmetrical Two Port Networks – Terminated Periodic Structures – Matching of Periodic Structures– Floquet's Theorem and Spatial Harmonics– Microwave Filters – Image Parameter Method – Filter Design by Insertion Loss Method – Low pass Filter Design – Microstrip Parallel Coupled Filter .

### UNIT IV      MICROWAVE SOLID STATE AMPLIFIERS      9

S-Parameters – Unilateral Design of Amplifiers – Simultaneous Conjugate Match – Bilateral Design of Amplifiers – Amplifier Stability – Conditional and Unconditional Stability Criteria – Amplifier Power Gain – Constant Gain Circles – Noise Temperature Concept – Noise Factor and Noise Figure – Noise Temperature for Cascaded Stages – Constant Noise Figure Circles – Design of Single Stage Microwave Amplifiers .

### UNIT V      MICROWAVES AND OPTICS      9

Geometrical Optics as a Limiting Case of Wave Optics – Ray Matrices for Paraxial Ray Optics Gaussian Beams – Generation of Gaussian Beams at Microwave Frequencies – The Beam Waist – Propagation of Gaussian Beams in Homogeneous Medium – Transformation of Gaussian Beams With Lenses.

**Total : 45**

### TEXT BOOKS

1. E Collin, "Foundations for Microwave Engineering", McGraw Hill, 1992.
2. Ramo Whinnery and Van Duzer, "Fields and Waves in communication electronics", 3<sup>rd</sup> Edition, Wiley, 1997.

## CO5003 – COMMUNICATION PROTOCOL ENGINEERING

**L T P C**  
**3 0 0 3**

### **UNIT I NETWORK REFERENCE MODEL 9**

Communication Model – Software, Subsystems, Protocol – Protocol Development Methods, Protocol Engineering Process – Layered Architecture – Network Services and Interfaces – Protocol Functions – OSI Model – TCP/IP Protocol Suite

### **UNIT II PROTOCOL SPECIFICATIONS 9**

Components of Protocol – Specifications of Communication Service – Protocol Entity– Interface – Interactions – Multimedia Protocol – Internet Protocol – SDL, SDL Based Protocol – other Protocol Specification Languages.

### **UNIT III PROTOCOL VERIFICATION/VALIDATION 9**

Protocol Verification – Verification of a Protocol Using Finite State Machines – Protocol Validation – Protocol Design Errors – Protocol Validation Approaches – SDL Based Protocol Verification and Validation.

### **UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9**

Conformance Testing Methodology and Frame Work – Conformance Test Architectures – Test Sequence Generation Methods – Distributed Architecture by Local Methods – Conformance Testing With TTCN – Systems with Semi Controllable Interfaces – RIP, SDL Based Tools for Conformance Testing – SDL Based Conformance Testing of MPLS Performance Testing – SDL Based Performance Testing of TCP and OSPF – Interoperability Testing – SDL Based Interoperability Testing of CSMA/CD And CSMA/CA Protocol Using Bridge – Scalability Testing.

### **UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9**

Protocol Synthesis – Interactive Synthesis Algorithm – Automatic Synthesis Algorithm – Automatic Synthesis of SDL From MSC– Protocol Re Synthesis, Requirements of Protocol – Implementation – Object Based Approach to Protocol Implementation – Protocol Compilers – Tool for Protocol Engineering.

**Total: 45**

### **TEXT BOOKS**

1. Pallapa, Venkataram and Sunilkumar S. Manvi, “Communication protocol Engineering”, Eastern Economy edition, 2004.
2. V Ahuja, “Design and Analysis of Computer Communication networks”, McGraw Hill, London, 1982.

### **REFERENCES**

1. Richard Lai and Jirachiefpattana, “Communication Protocol Specification and Verification”, Kluwer Publishers, Boston, 1998.
2. Tarnay K., “Protocol Specification and Testing”, Plenum New York, 1991.
3. Mohamed G. Gouda, “Elements of Network Protocol Design”, John Wiley and Sons Inc, New York USA, 1998.
4. G. J. Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York, 1991.

## CO5004 – DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

### UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

Multiplier and Multiplier Accumulator – Modified Bus Structures and Memory Access in P–Dsps – Multiple Access Memory – Multi Port Memory – VLIW Architecture – Pipelining – Special Addressing Modes In P–Dsps – on Chip Peripherals.

### UNIT II TMS320C5X PROCESSOR 9

Architecture – Assembly Language Syntax – Addressing Modes – Assembly Language Instructions – Pipeline Structure – Operation – Block Diagram of DSP Starter Kit – Application Programs for Processing Real Time Signals.

### UNIT III TMS320C3X PROCESSOR 9

Architecture – Data Formats – Addressing Modes – Groups of Addressing Modes– Instruction Sets – Operation – Block Diagram of DSP Starter Kit – Application Programs for Processing Real Time Signals – Generating and Finding The Sum of Series, Convolution of Two Sequences – Filter Design.

### UNIT IV ADSP PROCESSORS 9

Architecture of ADSP–21XX and ADSP 210XX Series of DSP Processors –Addressing Modes and Assembly Language Instructions – Application Programs –Filter Design, FFT Calculation.

### UNIT V ADVANCED PROCESSORS 9

Architecture of TMS320C54X: Pipe Line Operation, Code Composer – Studio Architecture of TMS320C6X – Architecture of Motorola DSP563XX – Comparison of the Features Of DSP Family Processors.

**Total: 45**

### TEXT BOOKS

1. B. Venkataramani and M. Bhaskar, “Digital Signal Processors Architecture Programming and Applications”, McGraw Hill, Publishing Company Limited, New Delhi, 2003.
2. User guides, Texas Instrumentation Analog Devices, Motorola.

## CO5005 – WAVELETS AND MUTI RESOLUTION PROCESSING

**L T P C**  
**3 0 0 3**

### **UNIT I FUNDAMENTALS 9**

Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals– Generalised Fourier Expansion

### **UNIT II MULTI RESOLUTION ANALYSIS 9**

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

### **UNIT III CONTINUOUS WAVELET TRANSFORMS 9**

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT .

### **UNIT IV DISCRETE WAVELET TRANSFORM 9**

Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by Filter Banks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – Multi Band Wavelet Transforms Lifting Scheme Wavelet Transform Using Polyphase Matrix Factorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z –Domain.

### **UNIT V APPLICATIONS 9**

Signal Compression – Image Compression Techniques: EZW–SPHIT Coding – Image De–Noising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions – Edge Detection and Object Isolation, Image Fusion, and Object Detection – Curve and Surface Editing – Variational Modeling and Finite Element Method Using Wavelets .

**Total: 45**

### **TEXT BOOKS**

1. Rao R M and A S Bopardikar, “Wavelet Transforms Introduction to theory and Applications”, Pearson Education, Asia, 2000.
2. Strang Q Nguyen T, “Wavelets and Filter Banks”, Wellesley Cambridge Press, 1996.

### **REFERENCES**

1. K P Soman and K I Ramachandran, “Insight into Wavelets From Theory to practice”, Prentice Hall, 2004.
2. Vetterli M Kovacevic J, “Wavelets and Sub band Coding”, Prentice Hall, 1995.
3. Mallat S, “Wavelet Signal Processing”, Academic, Press, 1996.

## CO5006 – SPEECH AND AUDIO SIGNAL PROCESSING

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### UNIT I MECHANICS OF SPEECH 9

Speech Production Mechanism – Nature of Speech Signal – Discrete Time Modelling of Speech Production – Representation of Speech Signals – Classification of Speech Sounds – Phones – Phonemes – Phonetic and Phonemic Alphabets– Articulatory Features – Music Production – Auditory Perception – Anatomical Pathways from the Ear to the Perception of Sound – Peripheral Auditory System Psycho Acoustics.

### UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 9

Time Domain Parameters of Speech Signal – Methods for Extracting the Parameters Energy, Average Magnitude – Zero Crossing Rate – Silence Discrimination Using ZCR and Energy – Short Time Auto Correlation Function – Pitch Period Estimation Using Auto Correlation Function.

### UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

Short Time Fourier Analysis – Filter Bank Analysis – Formant Extraction – Pitch Extraction – Analysis by Synthesis – Analysis Synthesis Systems – Phase Vocoder– Channel Vocoder – Homomorphic Speech Analysis: Cepstral Analysis of Speech– Formant and Pitch Estimation – Homomorphic Vocoders .

### UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 9

Formulation of Linear Prediction Problem in Time Domain – Basic Principle – Auto Correlation Method – Covariance Method – Solution of LPC Equations – Cholesky Method – Durbin's Recursive Algorithm – Lattice Formation and Solutions– Comparison of Different Methods – Application of LPC Parameters – Pitch Detection using LPC Parameters – Formant Analysis – VELP – CELP

### UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, Dynamic Time Warping, Hidden Markov Model – Music Analysis – Pitch Detection – Feature Analysis for Recognition – Music Synthesis – Automatic Speech Recognition – Feature Extraction for ASR– Deterministic Sequence Recognition – Statistical Sequence Recognition – ASR Systems – Speaker Identification and Verification – Voice Response System – Speech Synthesis: Text to Speech – Voice Over IP .

**Total: 45**

### TEXT BOOKS

1. L R Rabiner and R W Schaffer, “Digital Processing of Speech signals”, Prentice Hall, 1978.
2. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing”, John Wiley and Sons, Inc., Singapore 2004.

### REFERENCES

1. Quatieri, “Discrete time Speech Signal Processing”, Prentice Hall 2001.
2. J L Flanagan, “Speech analysis Synthesis and Perception”, 2<sup>nd</sup> edition, Berlin 1972.
3. I H Witten, “Principles of Computer Speech”, Academic Press, 1982.

## CO5007 – NETWORK ROUTING ALGORITHMS

**L T P C**  
**3 0 0 3**

### **UNIT I CIRCUIT SWITCHING NETWORKS 9**

AT & T's Dynamic Routing Network, Routing in Telephone Network – Dynamic Non Hierarchical Routing – Trunk Status Map Routing – Real Time Network Routing, Dynamic Alternative Routing– Distributed Adaptive Dynamic Routing Optimized Dynamic Routing

### **UNIT II PACKET SWITCHING NETWORKS 9**

Distance Vector Routing, Link State Routing, Inter Domain Routing – Classless Inter-Domain Routing (CIDR), Interior Gateway Routing Protocols (IGRP) – Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) , Border Gateway Protocol (BGP) , Apple Talk Routing and SNA Routing

### **UNIT III HIGH SPEED NETWORKS 9**

Routing in Optical Networks – The Optical Layer, Node Designs, Network Design and Operation – Optical Layer Cost Tradeoffs – Routing and Wavelength Assignment – Architectural Variations – Routing in ATM Networks – ATM Address Structure , ATM Routing, PNNI Protocol, PNNI Signaling Protocol, Routing in the PLANET Network and Deflection Routing.

### **UNIT IV MOBILE NETWORKS 9**

Routing in Cellular Mobile Radio Communication Networks – Mobile Network Architecture – Mobility Management in Cellular Systems – Connectionless Data Service for Cellular Systems – Mobility and Routing in Cellular Digital Packet Data (CDPD) Network – Packet Radio Routing – DARPA Packet Radio Network – Routing Algorithms, for Small Medium and Large Sized Packet Radio Networks.

### **UNIT V MOBILE AD HOC NETWORKS (MANET) 9**

Internet Based Mobile Ad-Hoc Networking, Communication Strategies, Routing Algorithms – Table Driven Routing – Destination Sequenced Distance Vector (DSDV), Source Initiated On Demand Routing Dynamic Source Routing (DSR) Ad Hoc On- Demand Distance Vector (AODV), Hierarchical Based Routing – Cluster Head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA) Quality Of Service .

**Total: 45**

### **TEXT BOOKS**

1. William Stallings, “High Speed Networks TCP/IP and ATM Design Principles”, Prentice, Hall International, New York, 1998.
2. Sumit Kasera and Pankaj sethi, “ATM Networks”, Tata McGraw Hill Publishing, Company limited, New Delhi, 2001.

### **REFERENCES**

1. M Steen strub, “Routing in Communication networks”, Prentice Hall, International, New York, 1995.
2. Mohammad Ilyas, “The Handbook of Ad hoc Wireless Networks”, CRC Press, 2002.
3. Behrouz A Forouzan, “Data Communications and Networking (3/e) T MH 2004.
4. William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM” PHI, New Delhi, 2004.

# CO5008 – SIMULATION OF COMMUNICATION SYSTEMS AND NETWORKS

**L T P C**  
**3 0 0 3**

## **UNIT I MODELLING OF COMMUNICATION SYSTEM 9**

Model of Speech and Picture Signals – Pseudo Noise Sequences – Non Linear Sequences, Analog Channel Model – Noise and Fading, Digital Channel Model – Gilbert Model Of Bursty – Channels – HF, Troposcatter and Satellite Channels – Switched Telephone Channels – Analog and Digital Communication System Models – Light Wave System Models

## **UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9**

Univariate and Multivariate Models – Transformation of Random Variables – Bounds and Approximation – Random Process Models – Markov and ARMA Sequences – Sampling Rate for Simulation – Computer Generation and Testing of Random Numbers.

## **UNIT III ESTIMATION OF PERFORMANCE MEASURES 9**

Quality of an Estimator – Estimator for SNR – Probability Density Functions of Analog Communication System – BER of Digital Communication Systems – Monte Carlo Method and Importance of Sampling Method – Estimation of Power Spectral Density.

## **UNIT IV COMMUNICATION NETWORKS 9**

Queuing Models– M/M/I and M/M/I/N Queues – Little Formula– Burke’s Theorem –M/G/I Queue – Embedded Markov Chain Analysis of TDM Systems – Polling, Random Access Systems.

## **UNIT V NETWORK OF QUEUES 9**

Queues in Tandem – Store and Forward Communication Networks – Capacity Allocation – Congestion and Flow Chart – Routing Model – Network Layout and Reliability

**Total: 45**

### **TEXT BOOKS**

1. M C Jeruchim Philip Balaban and K Sam Shanmugam, “Simulation of communication systems”, Plenum Press, New York 1992.
2. J F Hayes, “Modelling and Analysis of Computer Communication networks”, Plenum Press, New York, 1984.

### **REFERENCES**

1. A M Law and W David Kelton, “Simulation Modelling and analysis”, Mc Graw Hill Inc, New York, 1991.
2. Jerry Banks and John S Carson, “Discrete event System Simulation”, Prentice Hall Inc, New Jersey 1984.

## CO5009 – GLOBAL POSITIONING SYSTEMS

**L T P C**

**3 0 0 3**

### **UNIT I** **9**

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment– Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – Reporting Anti Spoofing (AS)– Selective Availability (SA) – DOP Factors .

### **UNIT II** **9**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations – Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services .

### **UNIT III** **9**

C/A Code, P-code, Y code, L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Un differenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination – Narrow Lane– Wide Lane – OTF Ambiguity .

### **UNIT IV** **9**

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay– Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise Bias – Blunders – Tropospheric Effects on GPS Observables – Multipath Effect – Antenna Phase Centre Problems and Correction .

### **UNIT V** **9**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping un – Atmospheric Occultation – Surveying – Geophysics – Air Borne GPS – Ground Transportation – Space Borne GPS – Metrological and Climate Research using GPS .

**Total: 45**

### **TEXT BOOKS**

1. B Hoffman, Wellenhof H, Lichtenegger and J Collins, “GPS Theory and Practice”, 4th revised edition, Springer, Wein, New york 1997.
2. B Parkinson J Spilker Jr (Eds), “GPS Theory and Applications”, Vol I & Vol II AIAA 370 L'Enfant Promenade, SW Washington, DC 20024, 1996.

### **REFERENCES**

1. A Leick, “GPS Satellites Surveying”, 2<sup>nd</sup> edition, John Wiley & Sons, NewYork, 1995.
2. A Kleusberg and P Teunisen(Eds), “GPS for Geodesy”, Springer Verlag Berlin 1996.
3. L Adams, “The GPS A Shared National Asset”, Chair National Academy Press, Washington, DC 1995.

### **Websites**

[http //www auslig gov au](http://www.auslig.gov.au)

[http //igs.csb jpl nasa gov](http://igs.csb.jpl.nasa.gov)

[http //gibs leipzig ifag de](http://gibs.leipzig.ifag.de)

[http //www navcen uscg mil](http://www.navcen.uscg.mil)

# CO5010 – COMMUNICATION NETWORK SECURITY

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## **UNIT I SYMMETRIC CIPHERS (Techniques and Standards) I 9**

Services – Mechanisms and Attacks – OSI security Architecture – Model for Network Security – Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines– Stenography – Block Ciphers and Data Encryption Standard – Simplified DES – Block Cipher Principles, Data Encryption Standard – Strength of DES – Differential and Linear Crypt Analysis, Block Cipher Design Principles – Block Cipher Modes of Operation.

## **UNIT II SYMMETRIC CIPHERS (Techniques and Standards) II 9**

Advanced Encryption Standard – Evaluation Criteria for AES, AES Cipher– Contemporary Symmetric Ciphers – Triple DES, Blowfish, RC5 – Characteristics of Advanced Symmetric Block Ciphers – RC4 Stream Cipher – Confidentiality using Symmetric Encryption – Placement of Encryption Function – Traffic Confidentiality – Key Distribution and Random Number Generation.

## **UNIT III PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS 9**

Public Key Cryptography and RSA – Principles of Public Key Cryptosystems – RSA Algorithm– Key Management and other public key cryptosystems – Key Management– Diffie–Hellman Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions and MACs; Hash Algorithms – MD5 Message Digest Algorithm, Secure Hash Algorithm RIPEMD 160, HMAC– Digital Signatures and Authentication Protocols – Digital Signature Standards .

## **UNIT IV NETWORK SECURITY PRACTICE 9**

Authentication Applications – Kerberos – X.509 Authentication Service– Electronic Mail Security – Pretty Good Privacy – S/MIME– IP Security – IP Security Overview– IP Security Architecture– Authentication Header – Encapsulating Security Payload – Combining Security Associations – Web Security – Web Security Considerations – Secure Sockets Layer and Transport Layer Security – Secure Electronic Transaction .

## **UNIT V SYSTEM SECURITY 9**

Intruders – Intruder Detection – Password Management – Malicious Software – Virus and Related Threats – Virus Counter Measures – Firewalls Firewall Design Principles – Trusted Systems .

**Total: 45**

### **TEXT BOOKS**

1. William Stallings, “Network Security Essentials”, 2<sup>nd</sup> edition, Prentice Hall of India New Delhi, 2004.
2. Charlie Kaufman, “Network Security Private Communication in Public World” 2<sup>nd</sup> edition, Prentice Hall of India New Delhi, 2004.

### **REFERENCES**

1. William Stallings, “Cryptography and Network Security”, 3<sup>rd</sup> edition, Prentice Hall of India, New Delhi, 2004.

## CO5011 – SOFT COMPUTING

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### UNIT I ARTIFICIAL NEURAL NETWORKS 9

Basic concepts – Single Layer Perception – Multi Layer Perception – Adaline – Madaline – Learning Rules – Supervised Learning – Back Propagation Networks – Training Algorithm – Practical Difficulties – Advanced Algorithms – Adaptive Network – Radial Basis – Network – Modular Network – Applications.

### UNIT II UNSUPERVISED NETWORKS 9

Unsupervised Learning – Competitive Learning Networks – Kohonen self organising networks – Learning Vector Quantization – Hebbian Learning – Hopfield Network –Content Addressable Nature – Binary Hopfield Network – Continuous Hopfield Network Traveling Salesperson Problem – Adaptive Resonance Theory – Bidirectional Associative Memory – Principle Component Analysis

### UNIT III FUZZY SYSTEMS 9

Fuzzy Sets–Fuzzy Rules: Extension Principle, Fuzzy Relation – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Model – Sugeno Model – Tsukamoto Model– Fuzzy decision Making – Multiobjective Decision Making – Fuzzy Classification– Fuzzy Control Methods – Application.

### UNIT IV NEURO FUZZY MODELLING 9

Adaptive Neuro Fuzzy Based Inference Systems – Classification and Regression Trees: Decision Tress – Cart Algorithm – Data Clustering Algorithms: K Means Clustering, Fuzzy C Means Clustering, Mountain Clustering, Subtractive Clustering, Rule Base Structure Identification – Neuro Fuzzy Control – Feedback Control Systems– Expert Control – Inverse Learning – Specialized Learning – Back Propagation Through Real Time Recurrent Learning .

### UNIT V GENETIC ALGORITHM 9

Fundamentals of Genetic Algorithm – Mathematical Foundations – Genetic Modeling –Survival of The Fittest – Crossover – Inversion and Deletion – Mutation – Reproduction Generational Cycle – Rank Method – Rank Space Method – Other Derivative Free Optimization – Simulated Annealing – Random Search – Downhill Simplex Search – Application .

**Total: 45**

### TEXT BOOKS

1. Jang J S R Sun C T and Mizutani E, “Neuro Fuzzy and Soft computing”, Pearson Education, (Singapore) 2004.
2. Timothy J Ross, “Fuzzy Logic Engineering Applications”, McGrawHill NewYork, 1997

### REFERENCES

1. David E Goldberg, “Genetic Algorithms in Search Optimization and Machine Learning”, Pearson Education, Asia, 1996.
2. Laurene Fauseett, “Fundamentals of Neural Networks” Prentice Hall, India, New Delhi, 1994.
3. S Rajasekaran and G A Vijayalakshmi Pai, “Neural networks Fuzzy logics and Genetic algorithms”, Prentice Hall of India, 2003.
4. George J Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic”, Prentice Hall Inc, New Jersey, 1995.

## CO5012 – DIGITAL COMMUNICATION RECEIVERS

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### UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

Base Band and Band Pass Communication – Signal Space Representation – Linear and Non-Linear Modulation Techniques – Spectral Characteristics Of Digital Modulation.

### UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

Correlation Demodulator – Matched Filter – Maximum Likelihood Sequence Detector – Optimum Receiver For CPM Signals – M–Ary Orthogonal Signals – Envelope Detectors for M–Ary and Correlated Binary Signals.

### UNIT III RECEIVERS FOR FADING CHANNELS 9

Characterization of Fading Multiple Channels – Statistical Models – Slow Fading – Frequency Selective Fading – Diversity Technique – RAKE Demodulator – Coded Waveform for Fading Channel.

### UNIT IV SYNCHRONIZATION TECHNIQUES 9

Carrier and Symbol Synchronization – Carrier Phase Estimation PLL, Decision Directed Loops – Symbol Timing Estimation, Maximum Likelihood And Non–Decision Directed Timing – Estimation – Joint Estimation.

### UNIT V ADAPTIVE EQUALIZATION 9

Zero Forcing Algorithm – Lms Algorithm, Adaptive Decision – Feedback Equalizer and Equalization of Trellis–Coded Signals – Kalman Algorithm – Blind Equalizers and Stochastic Gradient Algorithm – Echo Cancellation.

**Total: 45**

### TEXT BOOKS

1. John G Proakis, “Digital Communication”, 4<sup>th</sup> Edition, McGraw Hill, New York, 2001.
2. Heinrich Meyer Mare Moeneclacy and Stefan A Fechtel, “Digital Communication Receivers”, Vol 1 & 2 John Wiley, New York 1997.

### REFERENCES

1. E A Lee and D G Messerschmitt, “Digital Communication”, 2<sup>nd</sup> Edition Allied Publishers, New Delhi, 1994.
2. Simon Marvin, “Digital Communication Over Fading channel– An unified approach to performance Analysis”, John Wiley, New York, 2000.
3. Bernard Sklar, “Digital Communication Fundamentals and Applications”, Prentice Hall, 1998.

# AN5104 – ADVANCED MICROPROCESSORS AND MICRO CONTROLLERS

**L T P C**  
**3 0 0 3**

## **UNIT I MICROPROCESSOR ARCHITECTURE 9**

Instruction Set – Data Formats – Instruction Formats – Addressing Modes – Memory Hierarchy – Register File – Cache – Virtual Memory And Paging – Segmentation – Pipelining – The Instruction Pipeline – Pipeline Hazards – Instruction Level Parallelism – Reduced Instruction Set – Computer Principles – RISC versus CISC – RISC properties RISC evaluation – On chip register Files Versus Cache Evaluation .

## **UNIT II HIGH PERFORMANCE CISC ARCHITECTURE PENTIUM 9**

The Software Model – Functional Description– CPU Pin Descriptions – RISC Concepts – Bus Operations – Super Scalar Architecture – Pipe Lining – Branch Prediction – The Instruction And Caches – Floating Point Unit – Protected Mode Operation – Segmentation – Paging – Protection – Multitasking – Exception and Interrupts – Input /Output – Virtual 8086 Model – Interrupt Processing– Instruction Types – Addressing Modes – Processor Flags – Instruction Set – Programming The Pentium Processor .

## **UNIT III HIGH PERFORMANCE RISC ARCHITECTURE ARM 9**

The ARM Architecture – ARM Assembly Language Program – ARM Organization And Implementation – The ARM Instruction Set – The Thumb Instruction Set – ARM CPU Cores.

## **UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9**

Instructions And Addressing Modes – Operating Modes – Hardware Reset – Interrupt System – Parallel I/O Ports – Flags – Real Time Clock – Programmable Timer – Pulse Accumulator – Serial Communication Interface – A/D Converter – Hardware Expansion – Assembly Language Programming .

## **UNIT V PIC MICRO CONTROLLER 9**

CPU Architecture – Instruction Set – Interrupts – Timers – I/O Port Expansion – I<sup>2</sup>C Bus For Peripheral Chip Access – A/D Converter – UART.

**Total: 45**

### **TEXTBOOKS**

1. Daniel Tabak, “Advanced Microprocessors”, McGraw Hill Inc , 1995.
2. Steve Furber, “ARM System On Chip architecture”, Addison, Wesley, 2000.

### **REFERENCES**

1. James L Antonakos , “An Introduction to the Intel family of Microprocessors”, Pearson Education, 1999.
2. Barry B Breg , “The Intel Microprocessors Architecture Programming and Interfacing”, PHI, 2002.
3. James L Antonakos, “The Pentium Microprocessor”, Pearson Education, 1997.
4. John B Peatman, “Design with PIC Microcontroller”, Prentice hall, 1997.

### **Web links**

[www ocw nit edu](http://www.ocw.nit.edu)

[www arm com](http://www.arm.com)

## AN5001 – DIGITAL IMAGE PROCESSING

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### **UNIT I            DIGITAL IMAGE FUNDAMENTALS**

**9**

Elements Of Digital Image Processing Systems – Elements Of Visual Perception – Psycho Visual Model – Brightness – Contrast, Hue, Saturation, Mach Band Effect Color Image Fundamentals – Rgb – Hsi Models – Image Sampling, Quantization– Dither– Two– Dimensional Mathematical Preliminaries .

### **UNIT II            IMAGE TRANSFORMS**

**9**

1D DFT 2D transforms – DFT DCT Discrete Sine Walsh Hadamard – Slant – Haar – KLT – SVD – Wavelet Transform

### **UNIT III           IMAGE ENHANCEMENT AND RESTORATION**

**9**

Histogram Modification And Specification Techniques – Noise Distributions – Spatial Averaging – Directional Smoothing Median – Geometric Mean – Harmonic Mean Contraharmonic And Yp Mean Filters – Homomorphic Filtering – Color Image Enhancement Image Restoration – Degradation Model – Unconstrained And Constrained Restoration – Inverse Filtering – Removal Of Blur Caused By Uniform Linear Motion – Wiener Filtering – Geometric Transformations – Spatial Transformations Gray Level– Interpolation .

### **UNIT IV            IMAGE SEGMENTATION AND RECOGNITION**

**9**

Edge Detection – Image Segmentation by Region Growing – Region Splitting and Merging – Edge Linking – Image Recognition – Patterns and Pattern Classes – Matching By Minimum Distance Classifier – Matching by Correlation – Back Propagation Neural Network – Neural Network Applications in Image Processing .

### **UNIT V            IMAGE COMPRESSION**

**9**

Need for Data Compression – Huffman – Run Length Encoding – Shift Codes – Arithmetic Coding – Vector Quantization – Block Truncation Coding – Transform Coding – DCT and Wavelet JPEG MPEG Standards – Concepts of Context Based Compression .

**Total: 45**

### **TEXT BOOKS**

1. Rafael C Gonzalez and Richard E Woods, “Digital Image Processing”, Second Edition, Pearson Education Inc, 2004.
2. Milman Sonka Vaclav Hlavac Roger Boyle, “Image Processing Analysis and Machine Vision”, 2<sup>nd</sup> Edition, Brooks/Cole Vikas Publishing House, 1999.

### **REFERENCES**

1. Anil K Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 2002.
2. David Salomon, “Data Compression The Complete Reference”, 2<sup>nd</sup> Edition Springer Verlag, New York Inc, 2001.
3. Rafael C Gonzalez Richard E Woods Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education Inc, 2004.
4. William K Pratt, “Digital Image Processing”, John Wiley, New York, 2002.

**UNIT I MULTIMEDIA NETWORKING 9**

Digital Sound, Video and Graphics – Basic Multimedia Networking – Multimedia Characteristics – Evolution of Internet Services Model – Network Requirements for Audio/ Video Transform – Multimedia Coding and Compression for Text, Image Audio And Video.

**UNIT II BROADBAND NETWORK TECHNOLOGY 9**

Broadband Services – ATM and IP, IPV6, High Speed Switching – Resource Reservation, Buffer Management – Traffic Shaping – Caching – Scheduling and Policing, Throughput, Delay and Jitter Performance – Storage and Media Services – Voice and Video Over IP – MPEG–2 over ATM/IP – Indexing Synchronization of Requests – Recording and Remote Control .

**UNIT III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 9**

Multicast over Shared Media Network – Multicast Routing and Addressing – Scaling Multicast and NBMA Networks – Reliable Transport Protocols – TCP Adaptation Algorithm – RTP, RTCP – MIME – Peer-to-Peer Computing – Shared Application – Video Conferencing, Centralized And Distributed Conference Control – Distributed Virtual Reality – Light Weight Session Philosophy .

**UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9**

Objective of MPEG – 7 Standard – Functionalities and Systems of MPEG–7 MPEG–21 Multimedia Framework Architecture – Content Representation – Content Management and Usage – Intellectual Property Management – Audio Visual System – H322: Guaranteed QOS LAN Systems – MPEG\_4 Video Transport Across Internet .

**UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9**

Packet Audio/Video in The Network Environment –Video Transport across Generic Networks – Layered Video Coding– Error Resilient Video Coding Techniques – Scalable Rate Control – Streaming Video Across Internet – Multimedia Transport Across ATM Networks and IP Network – Multimedia Across Wireless Networks .

**Total: 45**

**TEXT BOOKS**

1. B O Szuprowicz, “Multimedia Networking”, McGraw Hill, Newyork, 1995.
2. K R Rao, Zoran S, Bojkovic and Dragorad A, Milovanovic “Multimedia Communication systems”, PHI, 2003.

**REFERENCES**

1. Jon Crowcroft Mark Handley Ian, “Wakeman Internetworking Multimedia” Harcourt, Singapore, 1998.
2. Tay Vaughan, “Multimedia Making it to work”, 4<sup>th</sup> edition Tata McGraw Hill, NewDelhi, 2000.

# **AN5009 – ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN**

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## **UNIT I EMI ENVIRONMENT 9**

EMI/EMC Concepts and Definitions – Sources of EMI, Conducted and Radiated EMI – Transient EMI – Time Domain Vs Frequency Domain EMI – Units of Measurement Parameters – Emission and Immunity Concepts – ESD .

## **UNIT II EMI COUPLING PRINCIPLES 9**

Conducted, Radiated and Transient Coupling – Common Impedance Ground Coupling – Radiated Common Mode and Ground Loop Coupling – Radiated Differential Mode Coupling – Near Field Cable to Cable Coupling – Power Mains and Power Supply Coupling .

## **UNIT III EMI/EMC STANDARDS AND MEASUREMENTS 9**

Civilian Standards – FCC, CISPR, IEC, EN, Military Standards – MIL, STD 461D/462 – EMI Test Instruments /Systems – EMI Shielded Chamber – Open Area Test Site – TEM Cell – Sensors/Injectors/Couplers – Test Beds for ESD And EFT– Military Test Method and Procedures (462) .

## **UNIT IV EMI CONTROL TECHNIQUES 9**

Shielding – Filtering – Grounding – Bonding – Isolation Transformer – Transient Suppressors – Cable Routing Signal – Control Component Selection and Mounting

## **UNIT V EMC DESIGN OF PCBs 9**

PCB Traces Cross Talk – Impedance Control – Power Distribution Decoupling –Zoning – Motherboard Designs And Propagation Delay Performance Models .

**Total: 45**

### **TEXT BOOKS**

1. V P Kodali, “Engineering EMC Principles Measurements and Technologies” IEEE Press, 1996.
2. C R Paul, “Introduction to Electromagnetic Compatibility”, John Wiley and Sons, Inc., 1992.

### **REFERENCES**

1. Henry W. Ott, “Noise Reduction Techniques in Electronic Systems”, John Wiley and Sons, New York, 1988.
2. Bernhard Keiser, “Principles of Electromagnetic Compatibility”, 3<sup>rd</sup> Edition, Artech house, 1986.



**UNIT I EMBEDDED ARCHITECTURE 9**

Embedded Computers – Characteristics of Embedded Computing Applications – Challenges in Embedded Computing System Design – Embedded System Design – Process Requirements – Specification – Architectural Design – Designing Hardware and Software Components – System Integration – Formalism for System Design – Structural Description, Behavioral Description – Design Example: Model Train Controller.

**UNIT II EMBEDDED PROCESSOR AND COMPUTING PLATFORM 9**

ARM Processor – Processor and Memory Organization – Data Operations – Flow of Control – SHARC Processor – Memory Organization – Data Operations – Flow of Control – Parallelism with Instructions – CPU Bus Configuration, ARM Bus, SHARC Bus – Memory Devices, Input/output Devices – Component Interfacing – Designing with Microprocessor Development and Debugging – Design Example Alarm Clock .

**UNIT III NETWORKS 9**

Distributed Embedded Architecture – Hardware and Software Architectures – Networks for Embedded Systems – I2C, CAN Bus – SHARC Link Ports – Ethernet – Myrinet– Internet, Network – Based Design – Communication Analysis – System Performance Analysis – Hardware Platform Design – Allocation and Scheduling – Design Example Elevator Controller

**UNIT IV REAL TIME CHARACTERISTICS 9**

Clock Driven Approach – Weighted Round Robin Approach – Priority Driven Approach – Dynamic versus Static Systems – Effective Release Times and Deadlines – Optimality of the Earliest Deadline First (EDF) Algorithm – Challenges in Validating Timing Constraints in Priority Driven Systems – Off–Line versus On–Line Scheduling.

**UNIT V SYSTEM DESIGN TECHNIQUES 9**

Design Methodologies – Requirement Analysis – Specification – System Analysis and Architecture Design – Quality Assurance – Design Example: Telephone PBX – System Architecture – Ink Jet printer – Hardware Design and Software Design – Personal Digital Assistants – Set top Boxes

**Total: 45****TEXT BOOKS**

1. Wayne Wolf, “Computers as Components Principles of Embedded Computing System Design”, Morgan Kaufman Publishers, 2001.
2. Frank Vahid and Tony Givargi, “Embedded System Design A Unified Hardware/Software”, John Wiley & Sons, 2000.

**REFERENCES**

1. Jane W S Liu, “Real Time systems”, Pearson Education, Asia, 2000.
2. C M Krishna and K G Shin, “Real Time Systems”, McGraw Hill 1997.

## CO1621 – HIGH SPEED SWITCHING ARCHITECTURE

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### UNIT I HIGH SPEED NETWORK 9

Concepts of LAN, WAN, Network Evolution through ISDN to B-ISDN – Transfer Mode and Control of B-ISDN – SDH Multiplexing Structure – ATM Standard – ATM Adaptation Layers .

### UNIT II LAN SWITCHING TECHNOLOGY 9

Switching Concepts – Switch Forwarding Techniques – Switch Path Control – LAN Switching, Cut Through Forwarding – Store and Forward – Virtual Lans .

### UNIT III ATM SWITCHING ARCHITECTURE 9

Switch Model, Blocking Networks – Basic and Enhanced Banyan Networks – Sorting Networks – Merge Sorting – Re Arrangable Networks – Full and Partial Connection Networks – Non Blocking Networks – Recursive Network Construction – Comparison of Non-Blocking Network – Switching With Deflection Routing – Shuffle Switch – Tandem Banyan .

### UNIT IV QUEUES IN ATM SWITCHES 9

Internal Queuing – Input Output and Shared Queuing – Multiple Queuing Networks – Combined Input, Output And Shared Queuing – Performance Analysis of Queued Switches.

### UNIT V IP SWITCHING 9

Addressing model – IP Switching Types – Flow Driven and Topology Driven Solutions – IP Over ATM Address and next hop Resolution – Multicasting, Ipv6 over ATM.

**Total: 45**

### TEXT BOOKS

1. Achille Pattavina Swtching, “Theory Architectures And Performance In Broadband ATM Networks”, John Wiley & Sons Ltd, New York, 1998.
2. Rainer Handel Manfred N. And Huber Stefan Schroder, “ATM Networks Concepts Protocols Applications” 2<sup>nd</sup> Edition, Addison Wesley, New York 1999.

### REFERENCES

1. Christopher Y Metz, “Switching protocols & Architectures” McGraw Hill, Professional Publishing, New York, 1998.
2. John A Chiong, “Internetworking ATM for the internet and enterprise networks” McGraw Hill, New York, 1998.