

**Scheme of  
Teaching & Examination**

**M. E.  
in  
Wireless Communication & Computing**

**Semester - 1**

Subject Code	Name of the Subjects	Hrs/Week			Credits	Evaluation (marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-WCC1-01	Wireless Communication & Networks	4	0	0	4	30	70	0	0	100
PG-WCC1-02	TCP/IP and Internet	4	0	0	4	30	70	0	0	100
PG-WCC1-03	Digital Signal Processing	4	0	0	4	30	70	0	0	100
PG-WCC1-04	Elective-1	4	0	0	3/4	30	70	0	0	100
PG-WCC1-05	Elective-2	4	0	0	3/4	30	70	0	0	100
PG-WCC1-06	Computer System Lab.-I	0	0	6	4	0	0	25	25	50
PG-WCC1-07	Seminar-I	0	0	2	1	50				50
	<b>TOTAL</b>				<b>23/25</b>					<b>600</b>

**Semester – 2**

Subject Code	Name of the Subjects	Hrs/Week			Credits	Evaluation (marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-WCC2-01	Advances in Algorithms	4	0	0	4	30	70	0	0	100
PG-WCC2-02	Network Security & Cryptography	4	0	0	4	30	70	0	0	100
PG-WCC2-03	Real Time Operating System for Embedded System	4	0	0	4	30	70	0	0	100
PG-WCC2-04	Elective-3	4	0	0	3/4	30	70	0	0	100
PG-WCC2-05	Elective-4	4	0	0	3/4	30	70	0	0	100
PG-WCC2-06	Computer System Lab.-II	0	0	6	4	0	0	25	25	50
PG-WCC2-07	Seminar-II	0	0	2	1	50			50	
PG-WCC2-08	Comprehensive Viva-Voce	0	0	0	3	100			100	
	<b>TOTAL</b>				<b>26/28</b>					<b>700</b>

**Semester – 3**

Subject Code	Name of the Subjects	Hrs/Week			Credits	Evaluation (marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-WCC3-01	Mobile Computing	4	0	0	4	30	70	0	0	100
PG-WCC3-02	Ad Hoc Wireless Networks	4	0	0	4	30	70	0	0	100
PG-WCC3-03	Seminar on Project Spade Work	0	0	3	12	0	0	200	0	200
Total					20					400

**Semester 4**

Subject Code	Name of the Subjects	Hrs/Week			Credits	Evaluation (marks)				
		Lecture	Tutorial	Practical		Theory		Practical		Total
						Int.	Ext.	Int.	Ext.	
PG-WCC4-01	Thesis & Defense	0	0	6	15	0	0	0	400	400

**Elective-1 :-**

- i) Object Oriented Systems
- ii) Distributed Computing
- iii) Multimedia Communication

**Elective-2 :-**

- i) Soft Computing

- ii) Mobile and Adaptive Systems
- iii) Design & Modeling of Mobile Protocols

**Elective-3 :-**

- i) DSP processors & Architecture
- ii) Signal Processing & Smart Antennas for Wireless Communications
- iii) Principles of Embedded Network System Design

**Elective-4 :-**

- i) Embedded Software Design
- ii) Satellite Communication
- iii) Digital Image Processing

**Syllabus for M.E. in  
WIRELESS COMMUNICATION AND COMPUTING**

**PG-WCCI-01**

**WIRELESS COMMUNICATIONS AND NETWORKS**

**UNIT I**

**WIRELESS COMMUNICATION & SYSTEM FUNDAMENTALS:** Introduction to wireless communications systems, examples, comparisons & trends. Cellular concepts frequency reuse. Strategies, interference & system capacity, trucking & grade of service, improving coverage & capacity in cellular systems,

**UNIT II**

**MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION:** FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid techniques), SDMA technique (AS applicable to wireless communications) packet radio, capacity of cellular systems.

**UNIT III**

**WIRELESS NETWORKING :** introduction, differences in wireless & fixed telephone networks, traffic routing in wireless networks-circuit switching packet switching x.25 protocol.

**UNIT IV**

Wireless data services – cellular digital packet data (CDPD), advanced radio data information systems, RAM mobile data ( RMD), Common channel signaling (CCS), ISDN-Broad band ISDN & ATM, Signaling system no 7 (SS7)- protocols, network services part, user part, signaling traffic, services & performance.

**UNIT V**

**MOBILE IP AND WIRELESS APPLICATION PROTOCOL:** Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol,

**WIRELESS LAN TECHNOLOGY:** infrared LANs Spread spectrum LANs, Narrow band microwave LANs, IEEE 802 PROTOCOL Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer

**UNIT VI**

**BLUE TOOTH :** Overview, Radio specification, Base band specification, Links manager specification, Logical Link control and adaptation protocol. Introduction to WLL Technology.

**MOBILE DATA NETWORKS:** introduction, Data oriented CDPD Network, GPRS and higher data rates, Short messaging service in GSM, Mobile application protocol.

□ Practical based on above syllabus as a part of Computer System Lab-1

**TEXTBOOKS**

Wireless communication and Networking – William Stallings, PHI,2003

2. Wireless Communications, Principles, Practice - Theodore, S, Rappaport, PHI, 2nd Edn., 2002.
- 3, Principles of Wireless Networks - Kaveh Pah Laven and P. Krishna Murthy, Pearson Education, 2002.

#### **REFERENCES**

1. Wireless Digital Communications - Kamilo Feher, PHI, 1999.

#### **PG-WCC1-02**

#### **TCP/IP AND INTERNET**

**UNIT-I:-** The TCP/IP Architecture, The Internet Protocol: IP Packet, IP Addressing, Subnet Addressing, IP Routing, Classless Inter-Domain Routing (CIDR), Address Resolution, Reverse Address Resolution, Fragmentation and Reassembly, ICMP: Error and Control Messages.

IPv6: header format, Network Addressing, Extension Headers

**UNIT-II:-** User Datagram Protocol transmission Control Protocol: TCP Reliable Stream Service, TCP Operation, TCP Protocol, DHCP and Mobile IP: Dynamic Host Configuration Protocol, Mobile IP.

**UNIT-III:-** Internet Routing Protocols: Routing Information Protocol, Open Shortest' Path First, Border Gateway Protocol .Multicast Routing: Reverse-Path Broadcasting, Internet Group Management Protocol (IGMP), Reverse-Path Multicasting, Distance-Vector Multicast Routing Protocol.

**UNIT-IV :- Security Protocols:** Security and Cryptographic Algorithms: Applications of Cryptography to Security, Key Distribution. Security Protocols: IPSec, Secure Sockets Layer and Transport Layer Security Cryptographic Algorithms: DES, RSA,

**UNIT-V :- Multimedia Information and Networking:** Introduction to Digital Audio, Audio compression, Streaming Audio, Internet Radio, Voice over IP, Introduction to video, Video compression, Video on demand The Real time transport Protocol: RTP Scenarios and terminology, RTP Packet format, RTP Control Protocol(RTCP) Session control Protocols: Session initiation Protocol, H.323 Multimedia communication systems, Media Gateway Control Protocols.

**UNIT-VI:-** Network Applications: Client-Server Interaction: The Client-Server Paradigm, The Socket Interface. Naming With The Domain Name System, Electronic Mail Representation And Transfer, File Transfer And Remote File Access, World Wide Web Pages And Browsing, Dynamic Web Document Technologies (CGI, ASP, JSP, PHP, Cold Fusion, Active Web Document Technologies (Java, JavaScript), Network Management (SNMP).

\* Practical based on above syllabus as a part of Computer System Lab-1

## **Books and References:**

1. Communication networks, Leon-Gracia & Widjaja, 2001, *TMH*
2. An Engineering approach to computer networking, S. Keshav, Addison Wesley, 2001
3. TCP/IP Illustrated Volume 1: The protocols, 1/e-- , W. Richard Stevens, Pearson Education
4. TCP/IP Illustrated, Volume 2 : The Implementation, 1/e - © 1996, Gary R. Wright.
5. TCP/IP Illustrated, Volume 3 : TCP for Transactions, HTTP, NNTP, and the UNIX Domain Protocols, 1/e -- © 1999, W. Richard Stevens.
6. Internetworking with TCP/IP Vol. I: Principles, Protocols & Architecture, 4/e – © 2000, Douglas E. Comer.
7. Internetworking with TCP/IP Vol. II: ANSI C Version : Design, Implementation, and Internals, 3/e -- © 1999, Douglas E. Comer.
8. Internetworking with TCP/IP Vol. III: Client-Server Programming and Applications, 2/e -- © 1996, Douglas E. Comer.
9. Computer Networking with Internet Protocols and Technology, 1/e — © 2003 William Stallings.
10. Computer Networks, 4/e — © 2002, Andrew S. Tanenbaum,
11. Computer Networks and Internets, 2/e — © 1998, Douglas E. Comer
12. High-Speed Networks and Internets, 2/e - © 2002, William Stallings
13. TCP/IP PROTOCOL SUITE, FOROUZAN, BEHROUZ A., McGraw Hill
14. RFC's and Internet drafts available from IETF. Articles in various journals and conference proceedings.

## **PG-WCC1-03**

### **DIGITAL SIGNAL PROCESSING**

**UNIT-I:-** Discrete time signals and systems, linearity, time-variance, causality, stability properties of LTI casual system, response of LTI systems to various inputs, convolution, sampling theorem.

**UNIT-II:-** Frequency domain description of signals & Systems. Fourier transform of discrete time signals, properties of DFT, DFTs of typical discrete time signals.

**UNIX-II:-** The Z-transform, properties ROC's relation with fourier transform, system function, inverse Z-transform, solution of difference equation using unilateral Z-transform.

**UNIT-IV :-** Digital filter design techniques: design of FIR filters based on windows, design of OR digital filters from analog filters.

**UNIT-V :-** The discrete fourier transform: It's properties and computation, properties of the DFT, Efficient computation of the DFT. Introduction of FFT algorithms : decimation in time - FFT algorithms, Decimation in frequency- FFT algorithms, DCT.

**UNIT-VI :-**

Sampling theorem; Rate distortion theory; Speech and image waveform characterization. Optimal and adaptive quantization; Predictive coding - DPCM, DM; Transform coding. Filter banks; Subband coding; Wavelet transform - multiresolution analysis, scaling functions and wavelets, its relation to multirate filter banks.

Vector quantization; Codebook design and fast codeword search algorithms; Clustering techniques for codebook design and pattern classification; Problem of cluster validity. Speech and audio coding techniques and standards; Video coding techniques - motion compensation and adaptive vector quantization; JPEG, H.261 and MPEG coding standards.

**Practicals :** Based on above syllabus using MATLAB and TMS C320 C50 as a part of Computer System Lab-1 **Text Books :**

Digital Signal Processing: Alen V. Oppenheim W. Schaffer (PHI) ^Digital Signal Processing : Proskies and Monalkies (PHI) M. Vetterli and J. Kovacevic: *Wavelets and Subband Coding*; Prentice Hall, 1995.

4. P. P. Vaidyanathan: *Multirate Systems and Filter Banks*; Prentice Hall, 1995.

5. A. Gersho and R. Gray: *Vector Quantization and Signal Compression*; Kluwer Acad." Publication.

**Reference Books :**

Theory and Application of Signal Processing by Rabiner & Gold (PHI) Digital Filter Design and Analysis by Andreas Antoniou, Tata McGraw Hill.

**PG-WCC1-04-01**

**OBJECT ORIENTED SYSTEMS (Elective -1)**

Review of programming practices and code-reuse; Object model and object-oriented concepts; Object-oriented programming languages and implementation; Object-oriented analyses and design using UML structural, behavior and architectural modeling \, Unified development process, Software reuse design patterns, components and framework; Distributed object computing, interoperability and middleware standards COM/DCOM and COBRA; Object-oriented database system data model, object definition and query language, object-relational system.

**PG-WCC1-04-02**

**DISTRIBUTED COMPUTING (Elective -1)**

**UNIT-I :-**

**Fundamentals of Distributed Computing:** Architectural models for distributed and mobile computing systems, Basic concepts in distributed computing such as clocks, message ordering, consistent global states, and consensus.



## **UNIT-II :-**

**Basic Algorithms in Message:** Passing Systems, Leader Election in Rings, and Mutual Exclusion in Shared Memory, Fault-Tolerant Consensus, Causality and Time. Message Passing: PVM and MPI.

## **UNIT-III :-**

Distributed Operating Systems: OS and network operating systems, Distributed File systems, Middleware, client/server model for computing, common layer application protocols (RPC, RMI, and streams), distributed processes, network naming, distributed synchronization and distributed object-based systems.

## **UNIT-IV :-**

Notion of time in distributed systems: Logical clocks, vector clocks, bit matrix clocks, virtual clocks, Byzantine agreement, agreement protocols and commit protocols, Mutual exclusion in distributed systems.

## **UNIT-V :-**

Simulation: A Formal Model for Simulations, Broadcast and Multicast, Distributed Shared Memory, Fault-Tolerant Simulations of Read/Write Objects Simulating Synchrony, Improving the Fault Tolerance of Algorithms, Fault-Tolerant Clock Synchronization.

Distributed Environments: Current systems and developments (DCE, CORBA, and JAVA)

## **UNIT-VI :-**

Advanced Topics: Randomization, Wait-Free Simulations of Arbitrary Objects, Problems Solvable in Asynchronous Systems, Solving Consensus in Eventually Stable Systems, High Performance Computing-HPF, Distributed and mobile multimedia systems, Adaptability in Mobile Computing, Grid Computing and applications, Fault tolerant Computing Systems

\*Practical based on above syllabus as a part of Computer System Lab-1

### **Text Books:**

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems: Concepts and Design" *Third Edition* Addison-Wesley, Pearson Education, 2001.
2. Hagit Attiya, Jennifer Welch, "Distributed Computing: Fundamentals, Simulations, and Advanced Topics", 2nd Edition, March 2004
3. Mullendar S. "Distributed Systems", 2<sup>nd</sup> Ed. Addison, Wesley 1994.

### **References:**

1. Tanenbaum, "A. Distributed Operating Systems", Prentice Hall 1995.
1. Helal, Abdelsalam A. *et al* "Anytime, Anywhere Computing: Mobile Computing Concepts and Technology", Kluwer Academic Publishers 1999.
2. Cay S Horst Mann and Gary Cornell, "Java 2 Vol 1 and II" Sun Micro Systems-2001.

## **PG-WCC1-04-03**

### **MULTIMEDIA COMMUNICATION (Elective 1)**

**UNIT-I :-**

**Multimedia communications:** multimedia information representation networks, multimedia applications, network QoS and application QoS.

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**UNIT-II :-**

**Information representation:** text, images, audio and video, Text and image compression, compression principles, text compression, image compression. Audio and video compression, audio compression, video compression, video compression principles, video compression standards: H.261, H.263, H.264, MPEG 1, MPEG 2, Other coding formats for text, speech, image and video.

**UNIT-III:-**

Detailed study of MPEG 4: coding of audiovisual objects, MPEG 4 systems, MPEG 4 audio and video, profiles and levels. MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework, Significant features of JPEG 2000, MPEG 4 transport across the Internet.

**UNIT-IV :-**

**Synchronization:** notion of synchronization, presentation requirements, reference model for synchronization.

**UNIT-V :-**

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Introduction to SMIL, Multimedia operating systems, Resource management, and process management techniques.

**UNIT-VI :-**

**Multimedia communication across networks:** Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks, Content based retrieval in Digital libraries .

-Assignments / Practicals Writing the programs to encode and decode the various kinds of data by using the algorithms. Students can collect several papers from journals/conferences/Internet on a specific area of multimedia communications and write a review paper and make a presentation. The programs be considered as part of Computer System Lab-1

Text Books:

A. Ze-Nian Li & Mark S.Drew, "Fundamentals of Multimedia", Pearson Edition, 2004  
I. J.-R. Ohm, "Multimedia Communication Technology", Springer International Edition, 2005. References:

1. K.Sayood, "Introduction to Data Compression", 2<sup>nd</sup> Ed, Morgan Kauffman, Indian Edition, 2000.

2. V.Bhaskaran and K.Konstantinedes, "Image and Video Compression Standards, Algorithms and Architecture", 2<sup>nd</sup> ed, Kluwer publications, 1997
3. Fred Halsall, "Multimedia communications", Pearson education, 2001
4. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia communication systems", Pearson education, 2004.
5. Raif steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and applications", Pearson education, 2002
6. Tay Vaughan, "Multimedia: Making it work", 6th edition, Tata McGraw Hill, 2004
7. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002
8. Pallapa Venkataram, Multimedia information systems, Pearson education (In Press), 2005

### **PG-WCC1-05-01**

#### **Soft Computing (Elective-II)**

**UNIT-I** :-Learning and Soft Computing: Examples, basic tools of soft computing, basic mathematics of soft computing, learning and statistical approaches to regression and classification.

#### **UNIT-II** :-

**Single-Layer Networks:** Perceptron, adaptive linear neuron (Adaline), and the LMS algorithm.

#### **UNIT-III** :-

**Multilayer Perceptrons:** Error back propagation algorithm, generalized delta rule, practical aspects of error back propagation algorithm.

#### **UNIT-IV** :-

**Radial Basis Function Networks:** Ill-posed problems and the regularization technique, stabilizers and basis functions, generalized radial basis function networks.

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

**Fuzzy Logic Systems:** Basics of fuzzy logic theory, mathematical similarities between neural networks and fuzzy logic models, fuzzy additive models.

#### **UNIT-VI** :-

**Support Vector Machines:** Risk minimization principles and the concept of uniform convergence, VC dimension, structural risk minimization, support vector machine algorithms.

**Case Studies:** Neural-network based adaptive control, computer graphics.

\*Practical based on above syllabus as a part of Computer System Lab-1

#### **Text Books:**

1. Vojislav Kecman, "Learning and Soft Computing," Pearson Education (Asia) Pte. Ltd. 2004.
2. S. Haykin, "Neural Networks: A Comprehensive Foundation," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2003.
3. M.T. Hagan, H.B. Demuth and M. Beale, "Neural Network Design," Thomson Learning, 2002.

1. Bart Kosko, "Neural Networks and Fuzzy Systems," Prentice Hall of India, 2005.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Application," Prentice Hall of India, 2001.

## **PG-WCC1-05-02**

### **MOBILE AND ADAPTIVE SYSTEMS**

**(Elective 2)**

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

**Introduction and overview:** A look at the general issues that will be addressed on this module. Properties of wireless PANs, LANs, WANs, Basic structure and operation, Ad-hoc and Infrastructure networks. Physical constraints and limitations (transmission & reception)

#### **UNIT-II :-**

**Network structures and architectures:** Hand-off and mobility support at the physical/link level. Technologies at physical link layer. PANs Blue tooth, LANs IEEE802.11, HiperLAN. Basic GSM and GPRS (2G/2.5G) network structure and protocol architecture.

#### **UNIT-III:-**

**Next generation wireless overview (3G/4G):** UMTS, IMT-2000 and W-CDMA.

#### **UNIT-IV :-**

**Mobile IP:** Mobile IPv4 and Mobile IPv6. Problems with routing, QoS and security. Overview of use of intelligence in mobile systems. Power management, replication, adaptation etc. Power management issues. From the lowest (physical device) levels, through communication protocols, broadcast methodologies, trans coding, etc.

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

**File systems:** CODA, Mobile infrastructure support, Mobile middleware. Adaptive and reconfigurable system.

#### **UNIT-VI :-**

**Mobile multimedia and there relationship to proxying:** Programmable networking and applications for mobile systems. Code mobility and control/signaling.

#### **Resources:**

**"Mobility: Processes, computers and agents."** Ed. Dejan Milojicic, Frederick Douglass and Richard Wheeler. ACM Press. ISBN 0-201-37928-7.

## **PG-WCC1-05-03**

### **DESIGN AND MODELING OF MOBILE PROTOCOLS (Elective 2)**

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

##### **Introduction:**

Problems inherent in mobile applications. An Introduction to the mobile-pi calculus and tool support for using the mobile-pi calculus.

#### **UNIT-II :-**

**Design of mobile protocols:**

**Applying the mobile-pi calculus to the design of mobile protocols. Analysis of mobile protocols modeled using the mobile-pi calculus.**

#### **UNIT-III :-**

**Mobility and the Internet:**

**Computer Networking: Protocol Layer Model; Internet Protocol (IP); Routing; addressing; Transmission Control Protocol (TCP).**

#### **UNIT-IV :-**

**Mobile IP Network Concepts: Basic MIP routing; Route optimization; Mobile IP Fundamentals: Agent Discovery; Advertisement and Registration; Routing; Datagram.**

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

**Tunneling:**

**IP Fragmentation; IP Encapsulation; Minimal Encapsulation; Generic Routing Encapsulation; Comparison of MIPv4 with MIPv6 Mobility support in MIPv6. Ad Hoc Networks and Mobile Agents.**

#### **UNIT-VI :-**

**Data communication over mobile networks:**

**2G mobile technologies, GSM Modeling, GSM networks with single and multiple services, GSM Phase 2+ GPRS, Modeling Data services in mobile networks, 3G mobile networks, UMTS Modeling aspects and limitations in UMTS. \*Practical based on above syllabus as a part of Computer System Lab-1**

#### **PG-WCC2-01**

**Advances in Algorithms**

**Algorithmic paradigms : Dynamic Programming, Greedy, Branch-and-Bound,**

**Asymptotic complexity, Amortized analysis, Graph Algorithms, Shortest paths, Flow networks, NP-completeness, Approximation algorithms, Randomized algorithms, Linear programming, Special topics, Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations), Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).**

**\* Practical based on above syllabus as a part of Computer System Lab-II.**

#### **PG-WCC2-02**

**NETWORK SECURITY AND CRYPTOGRAPHY**

## **UNIT I:**

**Overview:** Services, Mechanisms and attacks, OS1 security architecture, Model for network security.

## **UNIT II:**

**Classical Encryption Techniques:** Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography, Problems. **Block Ciphers and DES (Data Encryption Standards):** Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

## **UNIT III:**

**Public Key Cryptography and RSA:** Principles of public key cryptosystems, RSA algorithm, Problems.

**Other Public Key Crypto Systems and Key Management:** Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems.

## **UNIT IV:**

Message **Authentication and Hash Functions:** Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of Hash functions and MAC's, Problems.

## **UNIT V:**

**Digital Signature and Authentication Protocol:** Digital signature, Authentication protocols, Digital signature standard.

**Authentication Applications:** Kerberos, X.509 authentication service, Kerberos encryption technique, Problems.

## **UNIT VI:**

**Electronic Mail Security:** Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.

**IP Security:** Overview, IP security architecture, Authentication header, ESP (encapsulating security payload), Security associations, Key management, Problems.) **Firewalls:** Firewall design principles; trusted systems, Problems.

## **UNIT V**

**Wireless Security Issues:**The Unique Security Environment of Wireless, "Notable Security Failures With WiFi and GSM, Authentication, Authorization and Accounting, IEEE 802.11 (WiFi) Solutions; Initial and Revised Virtual Private Networks.

\* Practical based on above syllabus as a part of Computer System Lab-II

## **Text Books:**

2) William Stallings, "Cryptography and Network Security," 3<sup>rd</sup> edition, Pearson Education (Asia) Pte. Ltd./ Prentice Hall of India, 2003.

3) C. Kaufman, R. Perlman, and M. Speciner, "Network Security: Private Communication in a Public World," 2<sup>nd</sup> edition, Pearson Education (Asia) Pte. Ltd., 2002.

Kahate, "Cryptography and Network Security," Tata McGraw-Hill, 2003.

## **References:**

1) Eric Maiwald, "Fundamentals of Network Security," McGraw-Hill, 2003. John Hershey, "Cryptography Demystified," McGraw-Hill, 2002

### **PG-WCC2-03**

#### **REAL TIME OPERATING SYSTEMS FOR EMBEDDED SYSTEMS**

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

Introduction to Unix, Overview of commands, File I/O. (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec), Signals, Interprocess Communication (pipes, fifos, message queues, semaphores, shared memory).

##### **UNIT - 2:**

Real Time Systems: Typical real time application, Hard Vs soft real time systems, A reference model of Real Time Systems: Processors and resources, Temporal parameters of Real time workload, periodic task model, precedence constraints and data dependency functional parameters, Resource parameters of jobs and parameters of resources.

##### **UNIT-3:**

Commonly used approaches to Real Time Scheduling: Clock driven, Weighted Round Robin, priority driven, Dynamic Vs State Systems, Effective release times and Dead lines, offline Vs online scheduling.

##### **UNIT - 4:**

Operating Systems : Overview, Time Services and Scheduling mechanisms, other basic operating system function, processor reserves and resource kernel. Capabilities of commercial Real time Operating Systems.

##### **UNIT - 5:**

Fault Tolerance Techniques: Introduction, Fault causes, Types, Detection, Fault and error containment, Redundancy: Hardware, Software, Time. Integrated Failure handling.

##### **UNIT - 6:**

Case Studies: VX works: Memory Managements task state transition diagram, preemptive priority, scheduling, context switches - semaphore - Binary mutex, Counting: watch dogs, I/O System RT Linux: Process Management, scheduling, Interrupt management, and synchronization.

\*Practical based on above syllabus as a part of Computer System Lab-II

#### **SUGGESTED BOOKS**

1. Advanced Unix Programming - Richard Stevens
2. Real Time Systems - Jane W.S. Liu - Pearson Education
3. Real Time Systems - C.M.Krishna, KANG G. Shin - M.G.Hill
4. VxWorks Programmers Guide

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**04-01**



## **DSP PROCESSORS AND ARCHITECTURES (Elective 3)**

### **UNIT I:-**

#### **INTRODUCTION TO DIGITAL SIGNAL PROCESING**

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

### **UNIT II:-**

#### **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 III :-**

#### **ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES**

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

#### **EXECUTION CONTROL AND PIPELINING**

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

### **UNIT IV:-**

#### **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.

#### **IMPLEMENTATIONS OF BASIC DSP ALGORITHMS**

The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

### **UNIT V:-**

#### **IMPLEMENTATION OF FFT ALGORITHMS**

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

### **UNIT VI:-**

#### **INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES**

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

#### **TEXT BOOKS**

I/Digital Signal Processing - Avtar Singh and S. Srinivasan, Thomson Publications, 2004.  
JL. DSP Processor Fundamentals, Architectures & Features - Lapsley et al. S. Chand & Co, 2000.

## **PG-WCC2-04-02**

### **SIGNAL PROCESSING AND SMART ANTENNAS FOR WIRELESS COMMUNICATION (Elective 3)**

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

**Overview of wireless and mobile:** Cellular system concepts, standards and Evolution of mobile & wireless communication technologies.

#### **UNIT II:-**

**Wireless channel characterization:** Attenuation, Shadowing, Fading, Doppler Shift, Delay Spread, Co-channel, Adjacent Channel and other forms of interferences. Modulation techniques: QAM, Multitone, MSK, OMSK, CPM, TFM and OFDM.

#### **UNIT III:-**

**Receiver architecture and algorithms:** Digital IF receivers, Sub-sampling digital receivers, I & Q channel sampling, Noncoherent and Coherent techniques, Rake receiver. Equalization and Synchronization: MLSE, Adaptive Equalization: LMS, RLS & Blind adjustment, Timing recovery and carrier recovery.

#### **UNIT IV:-**

**Smart Antennas systems:** Generalized array signal processing, Beam forming concepts: DOB, TRB & SSBF, Switched beam antennas, spatial diversity, and fully adaptive antennas for enhanced coverage, range extension & improvement in frequency reuse, interference Nulling for LOS & Multipath systems.

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

SDMA concepts and Smart antennas implementation issues.

#### **UNIT VI:-**

**RF ICs:** LNA, IQ Modulator, Mixers, DSPs & Micro-controllers in wireless communications, ASICs and FPGAs.

#### **Texts/ References:**

- 1.T.S. Rappaport, *Wireless Communication: Principles & Practices*, 2/e, 2002, Prentice Hall.
- 2.J. Liberti & T.S. Rappaport, *Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA applications*, 1999, Prentice Hall.

3. B. Pattan, *Robust Modulation Methods and Smart Antennas in Wireless communications*, 2000, Prentice Hall.

**PG-WCC2-04-03**

**Principles of Embedded Networked System Design(ELECTIVE -3)**

**UNIT I:**

Embedded Network Systems, Representation of signals, Signal Propagation Sensor Principles, Source detection and identification.

**UNIT II:**

Digital Communication, Multiple source estimation and multiple access communication Networking, Network position & Synchronization services.

**UNIT III:**

Energy Management, Data Management, Articulation, Mobility, & infrastructure

**UNIT IV:**

Node Architecture, Network data integrity.

**UNIT V:**

Experimental system design, Ethical, legal and social implications of Ents  
.Design Principles of ENS.

**UNIT VI:**

Application A: Gaussian Q function

Application B: Optimization \* Practical based on above syllabus as apart of Computer System Lab-II

**TEXT BOOK:**

Principles of Embedded Networked System Design By Gregorg Poltic, William Kaiser PG-WCC2-05-01

**EMBEDDED SOFTWARE DESIGN (Elective 4)**

**UNIT 1**

Pentium Processor: Introduction to the Pentium Microprocessor, Special Pentium Registers, Pentium Memory management.

**UNIT-2:**

Embedded Design Life Cycle: Introduction, Product Specification, Hardware/software partitioning, Iteration and Implementation, Detailed hardware and software design, Hardware/Software integration, Product Testing and Release, Maintaining and upgrading existing products. Selection Process: Packaging the Silicon, Adequate Performance, RTOS Availability, Tool chain Availability, Other issues in the Selection process, Partitioning decision : Hardware/Software Duality, Hardware Trends, Asics and Revision Costs.

**UNIT 3:-**

Development Environment: The Execution Environment, Memory Organization, System Startup. Special Software Techniques: Manipulating the Hardware, Interrupts and Interrupt service Routines (ISRs), Watchdog Times, Flash Memory, Design Methodology. Basic Tool Set: Host - Based Debugging, Remote Debuggers and Debug Kernels, ROM Emulator, Logic Analyzer.

#### **UNIT 4:-**

**BDM:** Background Debug Mode, Joint Test Action Group (JTAG) and Nexus. ICE - Integrated Solution: Bullet Proof Run Control, Real time trac, Hardware Break points, Overlay memory, Timing Constrains, Usage Issue, Setting the Trigger. Testing: Why Test? When to Test? Which Test? When to Stop? Choosing Test cases, Testing Embedded Software, Performance Testing Maintenance and Testing, The Future.

#### **UNIT 5:-**

**Writing Software for Embedded Systems:** The compilation Process, Native Versus Cross-Compilers, Runtime Libraries, Writing a Library, Using alternative Libraries, using a standard Library, Porting Kernels, C extensions for Embedded Systems, Downloading. Emulation and debugging techniques.

#### **UNIT 6:-**

**Buffering and Other Data Structures:** What is a buffer? Linear Buffers, Directional Buffers, Double Buffering, Buffer Exchange, Linked Lists, FIFOs, Circular Buffers, Buffer Under run and Overrun, Allocating Buffer Memory, Memory Leakage. Memory and Performance Trade-offs.

\* Practical based on above syllabus as a part of Computer System Lab-II

#### **TEXTBOOKS**

1. Intel Microprocessors by Barry B Brey PHI
2. Embedded System Design - Introduction to Processes, Tools, Techniques, Arnold S Burger, CMP Books
3. Embedded Systems Design by Steve Heath, Newnes

#### **PG-WCC2-05-02**

#### **SATELLITE COMMUNICATION (Elective 4)**

##### **UNIT I:**

**Introduction:** Origin and brief history of satellite communications, an overview of satellite system engineering, satellite frequency bands for communication.

**Orbital theory:** Orbital mechanics look angle determinations, numerical examples, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication system performance, Azimuth & elevation calculations

**Spacecraft systems:** Attitude and orbit control system(AOCS), telemetry, tracking,command (TT&C) and monitoring, power systems, communications subsystems,transponders, spacecraft antennas, Equipment reliability and space qualification.

##### **UNIT II:**

Satellite link design: Basic transmission theory, noise figure and noise temperature , and G/T ratio, Satellite down link design, Satellite systems using small earth stations

satellite uplink design, design for specified C/N ratio, Combining C/N and C/I values in Satellite links, System design examples.

#### **UNIT III:**

##### **Modulation, Multiplexing, Multiple access Techniques:**

Analog telephone transmission, Fm theory, FM Detector theory, analog TV transmission, S/N ratio Calculation for satellite TV linking, Digital transmission, base band and band pass transmission of digital data, BPSK, QPSK , FDM, TDM, Access techniques: FDMA, TDMA, CDMA and Random access.

#### **UNIT IV:**

**Encoding & FEC for Digital satellite links:** Channel capacity, error detection coding, linear block, binary cyclic codes, and convolution codes, Implementation of error detection on satellite links.

#### **UNIT V:**

**Propagation on satellites** - earth paths and its influence on link design: propagation effects, rain and ice effects, elimination of the above effects.

#### **UNIT VI:**

**Earth station technology** -Design of large antennas, equipments for earth stations video receiver, frequency coordination, , VSAT technology, Direct Broadcast by satellite (DBS), Intelsat and Imarsat.

#### **Text Books:**

1. Timothy Pratt, Charles W. Bostian, "Satellite communication:", John Wiley &sons, *f* 1986
2. Dennis Roddy, "Satellite Communication", TMH, 3ed, 2001
3. Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson, "**Satellite Communication Systems Engineering**," Prentice Hall, January 1993,

#### **References:**

1. Tom Logs Don, "Mobile communication satellites: theory and applications", McGraw Hill,1995
2. J.J. Spilker, Digital Communication by satellite, PH Publication, 1997
4. J. Martin, Communication satellite systems, PH, 4<sup>th</sup> Edition, 2005

#### **PG-WCC2-05-03**

##### **DIGITAL IMAGE PROCESSING( Elective 4)**

**UNIT-I:-** Introduction : Introduction , Fundamental Steps in Image Processing, Elements of DIP systems .

Element of Visual Perception. Fundamentals of Image processing : A Simple Image Model, Sampling and Quantization, Some Basic Relationships Between Pixel, Image Geometry in 2D.

**UNIT-II :-** Image Enhancement in the Spatial Domain : Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

**UNIT-III:-**Transforms : Introduction to the Fourier Transformation, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2D FT, inverse Fourier transform.

**UNIT-IV** :-Image Enhancement in the frequency Domain : Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters , Homomorphism Filtering, Implementation.

**UNIT-V** :-Morphological : Preliminaries, Dilation and Erosion, Opening and Closing, hit-or-miss Transformation, Some Basic Morphological Algorithms, Extension to Gray-Scale Images

**UNIT VI**:-.Image Segmentation : Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.Representation : Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region.

**Assignments** : Implementation of Image Processing in 'C'/C++/'MATLAB'.

\* Practical based on above syllabus as apart of Computer System Lab-II

**Text Book :**

.Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 2nd edition, Prentice Hall, 2002.

**PG-WCC3-01**

**MOBILE COMPUTING**

**UNIT-I** :-

**Wireless and Mobile Network Architecture:** Principle of Cellular Communication. Overview 1G, 2G, 2.5G and 3G and 4G technologies. GSM Architecture and Mobility management hand off management, Network signaling. Mobile Computing fundamental challenges, Mobile Devices -PDA and mobile OS, PalmOs, Win CE and Symbian.

**UNIT-II** :-

**Mobile IP Protocol Architecture:** Mobile IP and IP v 6 and its application in mobile computing, Cellular Digital Packet Data CDPD, VOIP, GPRS Services, Wireless Local Loop-WLL system.

**UNIT-III**:-

**Wireless Application Protocol (WAP):** The Wireless Application Protocol application environment, wireless application protocol client software, hardware and websites, wireless application protocol gateways, implementing enterprise wireless application protocol strategy,

**UNIT-IV** :-

**Wireless Mark-up Language:** An Introduction to Wireless Technologies, Markup Languages, An Introduction to XML, Fundamentals of WML., Writing and Formatting Text, Navigating between Cards and Decks, Displaying Images, Tables, Using Variables, Acquiring User Input

**Wireless Mark-up Language Script:** An Introduction to WMLScript, WMLScript Control Structures, Events, Phone.com Extensions, Usability.

## **UNIT-V :-**

**Application of Mobile computing:** ASP and Dynamic WAP Sites, XML and XSLT, Dynamic WML Generation with ASP and XSLT, Developing WAP Applications using Emulators.

## **UNIT-VI:-**

**Distributed Mobile Computing:** Distributed OS and file systems, Mobile Computing Software (Pervasive Computing) Development Strategies and tools, Data Management for Mobile Computing.

### **Text Books:**

1. Yi Bing Lin, "Wireless and Mobile Networks Architecture", John Wiley "
2. Wrox "The Beginning WML and WML Script", Wrox Publication
3. Tomasz Imielinski et.al, "Mobile Computing", Kluwer Academic Press 1996

### **References:**

1. Uwe Hansmann, "Pervasive Computing Handbook. The Mobile World", IEE publication 2002

## **PG-WCC3-02**

### **AD HOC WIRELESS NETWORKS**

#### **UNIT 1**

**Wireless WANS AND MANS:** Cellular architecture, Wireless in local loops, Wireless ATM, IEEE 802.16.

**WIRELESS INTERNET:** Wireless internet, mobile IP, TCP in wireless domain, WAP

#### **UNIT II**

**AD HOC wireless networks:** Cellular and ad hoc wireless networks, Issues in Ad Hoc wireless networks, Issues in designing MAC protocol for Ad Hoc wireless networks, Design goals of MAC protocols for Ad Hoc wireless networks, Classification of MAC protocols, Contention -Based protocols with reservation and scheduling mechanism, MAC protocols that use directional antennas.

#### **UNIT III**

Routing protocols for Ad Hoc wireless networks: Designing issues, classification of routing protocols, table driven routing protocols, On demand routing protocol, Hybrid routing protocol, Hierarchical routing protocols.

Multicast routing in Ad Hoc wireless networks: Operations and classification of multicast routing protocols, Tree based multicast routing protocol, Mesh based multicast routing protocol.

#### **UNIT IV**

**Transport layer security protocols for Ad Hoc wireless networks:** Designing issues, classification of transport layer solutions, feed back TCP, TCP bus, Ad Hoc TCP, Security in Ad hoc wireless networks, Issues and challenges in security provisioning, Key management, Secure routing in Ad hoc wireless networks.

**Quality of Service:** Issues and challenges in providing QoS in Ad Hoc wireless networks, classification of QoS solutions, MAC layer solutions, network layer solutions.

## **UNIT V**

**Energy management in Ad Hoc wireless networks:** Need for energy management, classification of energy management, battery management schemes, transmission power management schemes, system power management schemes.

**Wireless sensor networks:** Sensor network architecture, data dissemination, data gathering, MAC protocol sensor networks, Location discovery.

## **UNIT VI**

Hybrid wireless networks: Introduction, routing in hybrid wireless networks, pricing in multi hop wireless networks, Power control schemes in hybrid wireless networks, Load balancing in hybrid wireless networks.

**Text book:** Ad Hoc Wireless Networks: Architecture and Protocols, C. Siva Ram Murthy, B.S. Manoj, Pearson education



