M.Tech Course Structure (Computers and Communications) – R19

I Semester

S.No	Course code	Course Name	Category	L	T	P	Credits
1		Digital data communications	PC	3	0	0	3
2		Digital system design	PC	3	0	0	3
3		1. Advanced computer Architecture 2. Information theory and coding Techniques 3. Data base management systems 4.Big data analytics	PE	3	0	0	3
4		1.Wireless communications and networks 2.Internet protocols 3. Image and video processing 4. Object Oriented programming	PE	3	0	0	3
5		Research methodology and IPR		2	0	0	2
6		Digital data communications Lab		0	0	4	2
7		Digital system design Lab		0	0	4	2
8		Audit course-1		2	0	0	0
				Total			18

II Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		Optical communications and networks	PC	3	0	0	3
2		Advanced Operating systems	PC	3	0	0	3
3		1. Advanced digital signal processing 2. Soft computing techniques 3. Artificial Intelligence 4. Internet of Things	PE	3	0	0	3
4		1.Advanced computer networks 2. Embedded system design 3. Radar signal processing 4. Network security and cryptography	PE	3	0	0	3
5		Advanced communications Lab		0	0	4	2
6		ERTOS Lab		0	0	4	2
7		Mini Project with Seminar		0	0	4	2
8		Audit Course – 2		2	0	0	0
				Total			18

*Students be encouraged to go to Industrial Training/Internship for at least 2-3weeks during semester break.

Audit Course 1& 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge

M.Tech Course Structure (Computers and Communications) – R19

4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

III Semester*

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		1. Data Acquisition systems 2. Wireless sensor networks 3. Cyber security systems 4.Wireless LANs and PANs 5. MOOCs-1 (NPTEL/SWAYAM)	PE	3	0	0	3

2		1. Business Analytics
		2. Industrial Safety
		3. Operations Research
		4. Cost Management of Engineering Projects
		5. Composite Materials
		6. Waste to Energy
		7. MOOCs-2 (NPTEL/SWAYAM)-Any 12
		    Week Course on Engineering/
		    Management/ Mathematics offered by
		     other than parent department
			OE	3	0	0	3

3		Dissertation Phase -I /Industrial Project **(to be continued and evaluated next semester)**		0	0	20	10#
				Total			16

#Evaluated and Displayed in IV Sem Marks list.

*Students going for Industrial Project/Thesis will complete these courses through MOOCs

IV Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		Project/ Dissertation Phase-II **(continued from III semester)**		0	0	32	16
				Total			16

L	T	P	C
3	0	0	3

DIGITAL DATA COMMUNICATIONS

OUTCOMES:

 At the end of this course the student can able to:

- Model digital communication system using appropriate mathematical techniques (error probability, constellation diagrams, phasor diagrams).
- Understanding the basic concepts of how digital data is transferred across computer networks.
- Independently understand basic computer network technology.
- Understand and explain Data Communications System and its components.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
- Identify the different types of network devices and their functions within a network
- Understand and building the skills of sub netting and routing mechanisms.
- Familiarity with the basic protocols of computer networks, and how they can be used
- To assist in network design and implementation.

SYLLABUS:

UNIT -I:
Digital Modulation Schemes:

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

UNIT -II:
Basic Concepts of Data Communications, Interfaces and Modems:

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

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

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

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

UNIT -IV:
Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Multiplexing Application, DSL.

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

Metropolitan Area Networks: IEEE 802.6, SMDS

Switching: Circuit Switching, Packet Switching, Message Switching.

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

UNIT -V:
Multiple Access Techniques:

Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code

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

TEXT BOOKS:
1. Data Communication and Computer Networking - B. A.Forouzan, 2nd Ed., 2003, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5th Ed., 2008, PEI.

REFERENCE BOOKS:
1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data and Computer Communications - William Stallings, 8th Ed., 2007, PHI.
3. Data Communication and Tele Processing Systems -T. Housely, 2nd Ed, 2008, BSP.
4. Data Communications and Computer Networks- Brijendra Singh, 2^{nd}Ed., 2005, PHI.

L	T	P	C
3	0	0	3

DIGITAL SYSTEM DESIGN

OUTCOMES:

At the end of this course the student can able to:

- Understand the basic concepts of a Karnaugh Map ("K-map") for a 2-, 3-, 4-, or 5-variable
- logic function and to identify the prime implicants, essential prime implicants, and non-essential prime implicants of a function depicted on a K-map.
- Perform the minimization of a Boolean function using tabular method, QM algorithm and
- CAMP algorithm and determine the Adjacencies, DA, CSC, SSMs, EPCs and SPCs.
- Draw the block diagram of PLA and identify the size of PLA and PLA design aspects.
- Perform the minimization of PLA using IISc algorithm and folding using COMPACT algorithm.
- Can design a digital circuit by steps involving ASM chart.
- Understand the digital system design approaches using CPLDs, FPGAs and ASICs.
- Rectify a single fault and multiple faults in combinational circuits using Path sensitization method, Booleandifference method and Kohavi algorithm.
- Perform fault diagnosis in sequential circuits.

SYLLABUS:

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

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

UNIT -III: Design of Large Scale Digital Systems:
Algorithmic state machinecharts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control unit design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

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

UNIT-V: Fault Diagnosis in Sequential Circuits:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

ADVANCED COMPUTER ARCHITECTURE
(ELECTIVE- I)

OUTCOMES:

At the end of this course the student can able to:

- Through this course, students are expected to become conversant with a large body of concepts and accompanying terminology in computer architecture.
- The course will be helpful for students to read and understand technical articles or promotional brochures that describe new computer architectures and appreciate the design issues and tradeoffs of that architecture.
- This course will introduce the current trends in computer architecture so that students have some sense of the future directions of computational machines.
- Students will also learn how to quantitatively analyze, compare, and evaluate the performance of computer systems.

SYLLABUS:

UNIT -I:
Fundamentals of Computer Design:
Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, quantitative principles of computer design, Amdahl's law.
Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, operations in the instruction set.

UNIT –II:
Pipelines:
Introduction ,basic RISC instruction set ,Simple implementation of RISC instruction set, Classic five stage pipe line for RISC processor, Basic performance issues in pipelining , Pipeline hazards, Reducing pipeline branch penalties.

Memory Hierarchy Design:
Introduction, review of ABC of cache, Cache performance , Reducing cache miss penalty, Virtual memory.

UNIT -III:
Instruction Level Parallelism - The Hardware Approach:
Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.

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

UNIT –IV:
Multi Processors and Thread Level Parallelism:
Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization

UNIT – V:
Inter Connection and Networks:
Introduction, Interconnection network media, Practical issues in interconnecting networks,
Examples of inter connection, Cluster, Designing of clusters.
Intel Architecture:
Intel IA- 64 ILP in embedded and mobile markets Fallacies and pit falls

TEXT BOOKS:
John L. Hennessy, David A. Patterson, Computer Architecture: A Quantitative Approach, 3rd
Edition, An Imprint of Elsevier.

REFERENCE BOOKS:

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

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INFORMATION THEORY AND CODING TECHNIQUES
(ELECTIVE- I)

OUTCOMES:
At the end of this course the student can able to:

- Understand the Basic Concepts of Information theory Probabilistic (stochastic) systems. Reasoning under uncertainty Quantifying information State and discuss coding theorems
- Understand the overview of coding theory and practice Properties and coding for discrete memory less sources, prefix codes, Kraft inequality etc. Data compression (Source coding) Error Detection and Correction (Channel coding).

SYLLABUS:

UNIT I
INFORMATION THEORY AND SOURCE CODING

Uncertainty, information, entropy andits properties, entropy of binary memoryless source and its extension to discretememoryless source, source coding theorem, data compression, prefix coding,Huffman coding, Lempel-Ziv coding, Source with memory and its entropy.

UNIT II
DISCRETE CHANNELS

Binary Symmetric Channel, mutual information & itsproperties, Channel capacity, channel coding theorem and its application to BSC,Shannon's theorem on channel capacity, capacity of a channel of infinitebandwidth, bandwidth - S/N trade off, practical communication systems in light ofShannon's theorem, Fading channel, channels with memory.

UNIT III
GROUPS, FIELDS AND LINEAR BLOCK CODES

Galois field and its construction in $GF(2^m)$ and its basic properties, vector spaces and matrices in GF(2), Linear blockcodes, systematic codes and its encoding circuit, syndrome and error detection,minimum distance, error detecting and correcting capabilities of block code,decoding circuit, probability of undetected error for linear block code in BSC,Hamming code and their applications.

UNIT IV
CYCLIC CODES AND BCH CODES

Basic properties of Cycliccodes, Generator and parity check matrix of cyclic codes, encoding and decodingcircuits, syndrome computation and error detection, cyclic Hamming codes,encoding and decoding of BCH codes, error location and correction.

UNIT V
CONVOLUTIONAL CODES

Introduction to convolution code, its construction andViterbi algorithm for maximum likelihood decoding.Automatic repeat requeststrategies and their throughput efficiency considerations.

Reference Books

1. Lathi B. P., Modern Analog and Digital Communication Systems, Oxford Univ. Press
2. Shu Lin and Costello, Error Control Coding :Fundamentals and Applications, 2nd Edition, Pearson.
3. Sklar, Digital Communication, Pearson Education Asia.
4. Haykin Simon, Digital Communication, Wiley Publ.
5. Proakis, Digital Communication, McGraw Hill.
6. Schaum's Outline Series, Analog and Digital Communication, TMH.

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DATABASE MANAGEMENT SYSTEMS
(ELECTIVE- I)

OUTCOMES:

At the end of this course the student can able to:
Learn the basic concepts and applications of database systems.

- Able to construct queries using SQL.
- Understands relational database theory and be able to write relational algebra expressions.
- Knows the design principles for logical design of databases, including the E-R model and normalization approach.
- Understands basic database storage structures and access techniques: file and page organizations, indexing methods including B-trees, and hashing.
- Applies query evaluation techniques and query optimizations.
- Learn basic issues of transaction processing and solve concurrency control problems.
- Able to design and development of a database application system.

SYLLABUS:

UNIT -I:

Introduction-Database System Applications:

Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas, Data Models, Database Languages – DDL, DML, Database Access from Application Programs, Transaction Management, Data Storage and Querying, Database Architecture, Database Users and Administrators, History of Data base Systems.

Introduction to Data base design, ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views – Destroying /altering Tables and Views.

UNIT –II:

Relational Algebra and Calculus:
Relational Algebra – Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.
Form of Basic SQL Query – Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set – Comparison Operators, Aggregate Operators, NULL values – Comparison using Null values – Logical connectives – AND, OR and NOT – Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT -III:

Introduction to Schema Refinement:
Problems Caused by redundancy, Decompositions – Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST, SECOND, THIRD

Normal forms – BCNF –Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design – Multi valued Dependencies – FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

UNIT –IV:
Transaction Management-Transaction Concept:
Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability.
Concurrency Control- Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity.
Recovery System-Failure Classification-Storage Structure-Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

UNIT -V:
Overview of Storage and Indexing:
Data on External Storage, File Organization and Indexing – Clustered Indexes, Primary and Secondary Indexes, Index data Structures – Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.
Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, and Delete.
Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:
1. Data base Management Systems- Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Data base System Concepts- A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw hill, VI edition, 2006.

REFERENCE BOOKS:
1. Database Systems - RamezElmasri, ShamkantB.Navathe, 6th Edition, Pearson Education, 2016.
2. Database - Principles, Programming, and Performance - P.O'Neil, E.O'Neil, 2nd Ed., Elsevier.
3. Database Systems - A Practical Approach to Design Implementation and Management - Thomas Connolly, Carolyn Begg, Fourth edition, Pearson education.
4. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
5. Fundamentals of Relational Database Management Systems - S.Sumathi, S.Esakkirajan, Springer.
6. Database Management System Oracle SQL and PL/SQL - P.K.Das Gupta, PHI.
7. Introduction to Database Management - M.L.Gillenson and others, Wiley Student Edition.
8. Database Development and Management - Lee Chao, Auerbach publications, Taylor & Francis Group.
9. Introduction to Database Systems - C.J.Date, Pearson Education.
10. Database Management Systems - G.K.Gupta, TMH.

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BIG DATA ANALYTICS
(ELECTIVE- I)

OUTCOMES:
- Preparing for data summarization, query, and analysis.
- Applying data modeling techniques to large data sets
- Creating applications for Big Data analytics
- Building a complete business data analytic solution

UNIT-I
Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

UNIT-II
Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

UNIT-III
Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner

UNIT-IV
Hadoop I/O: The Writable Interface, WritableComparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, BytesWritable, NullWritable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a RawComparator for speed, Custom comparators

UNIT-V
Pig: Hadoop Programming Made Easier
Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

TEXT BOOKS:
1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

REFERENCE BOOKS:
1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, SrinathPerera, ThilinaGunarathne
SOFTWARE LINKS:
1. Hadoop:http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

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WIRELESS COMMUNICATIONS AND NETWORKS
(ELECTIVE- II)

OUTCOMES:
At the end of this course the student can able to:

- Understand the concepts of Cellular communications.
- Analyse the concepts of Diversity, equilisation,
- Know about the Wireless systems and Standards(1G/2G/3G systems)
- Understand different Multiple access techniques: FDMA, TDMA, CDMA, ALOHA, Slotted ALOHA, CSMA
- Learn about Wireless networks and some important protocols and IEEE standards

SYLLABUS:

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

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

UNIT –III:
Mobile Radio Propagation: Small –Scale Fading and Multipath
Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat

fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT -IV:

Equalization and Diversity

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

UNIT -V:

Wireless Networks

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

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

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

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INTERNET PROTOCOLS
(ELECTIVE II)

OUTCOMES:
At the end of this course the student can able to:
- Understanding basic network routing concepts and algorithms;
- Understanding how to apply them into given topologies;
- Understanding how the Internet protocol suite operates; describe the functions of various protocols;
- Explain the concept and usage of node addressing; classify addresses into network layers.

SYLLABUS:

UNIT -I:
Internetworking Concepts:
Principles of Internetworking, Connectionless Internetworking, Application Interconnections, Network level Interconnection, Properties of thee Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite.
IP Address:
Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting
Classless Addressing: Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router.
ARP and RARP: ARP, ARP Package, RARP.
UNIT -II:
Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6.
Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times.
Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control.
Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.
Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.
UNIT -III:
Unicast Routing Protocols (RIP, OSPF, and BGP): Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.
Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast
Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.

UNIT -IV:
Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet.
Remote Login TELNET: Concept, Network Virtual Terminal (NVT).
File Transfer FTP and TFTP: File Transfer Protocol (FTP).
Electronic Mail: SMTP and POP.
Network Management-SNMP: Concept, Management Components, World Wide Web- HTTP Architecture.
UNIT -V:
Multimedia:
Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

TEXT BOOKS:
1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH
2. Internetworking with TCP/IP Comer 3 rd edition PHI

REFERENCE BOOKS:
1. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
2. Data Communications & Networking – B.A. Forouzan– 2nd Edition – TMH
3. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.
4. Data and Computer Communications, William Stallings, 7th Edition., PEI.
5. The Internet and Its Protocols – AdrinFarrel, Elsevier, 2005.

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3	0	0	3

IMAGE and VIDEO PROCESSING
(ELECTIVE II)

OUTCOMES:
At the end of this course the student can able to:
- Defining the digital image, representation of digital image, importance of image resolution, applications in image processing.
- Know the advantages of representation of digital images in transform domain, application of various imagetransforms.
- Know how an image can be enhanced by using histogram techniques, filtering techniques etc
- Understand image degradation, image restoration techniques using spatial filters and frequency domain
- Know the detection of point, line and edges in images, edge linking through local processing, global processing.
- Understand the redundancy in images, various image compression techniques.
- Know the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing.
- Know the general methodologies for 2D motion estimation, various coding used in video processing.

SYLLABUS:
UNIT –I:

Fundamentals of Image Processing and Image Transforms:

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

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

UNIT –II:

Image Enhancement:

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

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

Image Restoration:

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

UNIT –III:

Image Segmentation:

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

Image Compression:

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

UNIT -IV:

Basic Steps of Video Processing:

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

UNIT –V:

2-D Motion Estimation:

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

TEXT BOOKS:
1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata McGraw Hill publishers, 2009

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

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OBJECT ORIENTED PROGRAMMING
(ELECTIVE II)

OUTCOMES:
At the end of this course the student can able to:
- The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
- Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
- How to test, document and prepare a professional looking package for each business project using java doc.

SYLLABUS:

UNIT I:
Introduction to OOP
Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Installation of JDK1.6
Programming Constructs
Variables , Primitive Datatypes, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching,Conditional, loops.,
UNIT II:
Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments
Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class
UNIT III:
Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, java.lang package
Exceptions & Assertions - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Assertions

UNIT IV:

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

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

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

UNIT V:

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

Abstract Window Toolkit: Use of AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar

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

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

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

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Research Methodology and IPR

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit II: Effective literature studies approaches, analysis Plagiarism, Research ethics.Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit III: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit IV: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit V: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:
- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
- Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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DIGITAL DATA COMMUNICATION LAB

List of Experiments:
1. Block Codes
2. Implementation of PC to PC communication.
3. Implementation of different Topologies
4. Study of IP address generation
5. Phase Shift Keying
6. Differential Phase shift Keying
7. Time Divisioin Multiplexing
8. Frequency Division Multiplexing.
9. Error Correction Codes.
10. Frequency Division Multiple Access..

Lab Requirements:

Software and Equipment required:

1.MATLAB along with Simulink Licensed simulation software tool with communication and Signal processing toolbox.

2. Computer Systems with required specifications

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

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Digital System Design Lab

_ The students are required to design the logic to perform the following experiments using necessary Industry standard simulator to verify the logical /functional operation, perform the analysis with appropriate synthesizer and to verify the implemented logic with different hardware modules/kits (CPLD/FPGA kits).

List of Experiments:

1. Determination of EPCs using CAMP-I Algorithm.
2. Digital system design using FPGA.
3. ROM design.
4. Kohavi algorithm.
5. RAM
6. Traffic Light Controller
7. Hamming experiments.
8. ALU
9. Binary Multiplier
10. FSM

Lab Requirements:

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

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

SEMESTER II

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OPTICAL COMMUNICATION AND NETWORKS

OUTCOMES:
At the end of this course the student can able to:
• Able to analyze characteristics of circular optical fiber and calculate the mode numbers. Also understand the types of fibers and their characteristics.
• Know the working principle and characteristics of LED/Laser optical sources and photo detectors of PIN/APD diodes.
• Understand the process of fabrication of fiber and able to design optical digital data link at different bit rates.
• Understand the importance of wavelength division multiplexing (WDM) and de-multiplexing, types of WDM techniques.
• Understand the Working principle of optical communication components are amplifiers, filters and isolators.
• Understand the network performance, coherent systems, and heterodyne/homodyne systems.

SYLLABUS:
Unit –I
Overview of optical fiber communications: Elements of an optical fiber transmission link.
Optical Fibers: structures, wave guiding, Nature of light, Basic optical laws and definitions, optical fiber modes and configurations (Fiber types, Rays and modes, step index and graded index fibers) mode theory of circular waveguides. (Qualitative Treatment) **Fabrication, cabling and installation**: Fabrication, fiber optic cables, Installation- placing the cable.
Unit – II
Optical sources: LEDs, structures, quantum efficiency, modulation capability, Laser diodes: Laser diodes and threshold conditions, external quantum efficiency resonant frequencies,
Optical Detectors: Physical principles of photodiodes (pin Photodiode, avalanche, photo diode) comparison of photo detectors, noise in detectors.
Unit – III
Optical Communication Systems: Block diagrams of optical communication systems, direct intensity modulation, digital communication systems, Laser semiconductor transmitter, Generations of optical fiber link, description of 8 Mb/s optical fiber communication link, description of 2.5 Gb/s optical fiber communication link.
Unit – IV
Components of fiber optic Networks: Overview of fiber optic networks, Trans receiver, semiconductors optical amplifiers, couplers/splicer's, wavelength division multiplexers and demultiplexers,
filters, isolators and optical switches.
Fiber Optic Networks: Basic networks, SONET/SDIT, Broad cast and select WDM Networks, wavelength routed networks, optical CDMA Non linear effects on network performance.

Unit – V

Coherent Systems :Coherent receiver, Homodyne and heterodyne detection, noise in coherent receiver, polarization control, Homodyne receiver , Reusability and laser line-width, heterodyne receiver , synchronous, Asynchronous and self synchronous demodulation, phase diversity receivers.

Text Books:

1. Optical fiber communications – Gerd Keiser, 3 rd Ed. MGH.
2. Fiber Optic Communication Technology – Djafar K. Mynbaev and Lowell L. Scheiner,
3. Optoelectronic devices and systems – S.C. Gupta, PHI, 2005.
4. John Gowar, "Optical Communication Systems", PHI,2001.

References:

1. Fiber Optics Communications – Harold Kolimbiris (Pearson Education Asia)
2. Optical Fiber Communications and its applications – S.C. Gupta (PHI) 2004.
3. WDM Optical Networks – C. Siva Ram Murthy and Mohan Guru Swamy, PHI.
4. Fiber Optic communications – D.C. Agarwal, S.Chand Publications, 2004.

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ADVANCED OPERATING SYSTEMS

OUTCOMES:
- On completion of this course the student should be able to understand and evaluate operating
- System implementations.
- Develop system software modules
- Write and debug concurrent programs
- Debug complex systems and low-level software and Work with distributed and real time OS.

UNIT-I: Introduction to Operating Systems:
Overview of computer system hardware, Instruction execution, I/O function, Interrupts, Memory hierarchy, I/O Communication techniques, Operating system objectives and functions, Evaluation of operating System

UNIT-II:
Introduction to UNIX and LINUX:
Basic Commands & Command Arguments, Standard Input, Output, Input / Output Redirection, Filters and Editors, Shells and Operations

UNIT-III:
System Calls:
System calls and related file structures, Input / Output, Process creation & termination.
Inter Process Communication:
Introduction, File and record locking, Client – Server example, Pipes, FIFOs, Streams & Messages, Name Spaces, Systems V IPC, Message queues, Semaphores, Shared Memory, Sockets & TLI

UNIT-IV:
Introduction to Distributed Systems:
Goals of distributed system, Hardware and software concepts, Design issues
Communication in Distributed Systems:
Layered protocols, ATM networks, Client - Server model, Remote procedure call and Group Communication

UNIT-V:
Synchronization in Distributed Systems:
Clock synchronization, Mutual exclusion, E-tech algorithms, Bully algorithm, Ring algorithm, Atomic transactions
Deadlocks:
Dead lock in distributed systems, Distributed dead locks prevention and distributed dead lock Detection

TEXT BOOKS:
1. The Design of the UNIX Operating Systems – Maurice J. Bach, 1986, PHI.
2. Distributed Operating System - Andrew. S. Tanenbaum, 1994, PHI.
3. The Complete Reference LINUX – Richard Peterson, 4thEd., McGraw – Hill.

REFERENCE BOOKS:
1. Operating Systems: Internal and Design Principles - Stallings, 6thEd., PE.
2. Modern Operating Systems - Andrew S Tanenbaum, 3rdEd., PE.

3. Operating System Principles - Abraham Silberchatz, Peter B. Galvin, GregGagne, 7th Ed., John Wiley
4. UNIX User Guide – Ritchie & Yates.
5. UNIX Network Programming - W.Richard Stevens, 1998, PHI.

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ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE II)

OUTCOMES:
At the end of this course the student can able to:
- Know the concept of multi rate signal processing and derive the Expression for sampling rate conversion by a rational factor I/D.
- Design the single and two stage multi rate structures from the given specifications.
- Know the conditions for perfect reconstruction of 2 channels QMF.
- Know the classifications of non-parametric methods and compare the performance of non-parametric methods.
- Derive the statistical properties (i.e. mean, variance) of non-parametric power spectrum estimations.
- Know the advantages and disadvantages of non-parametric methods.
- Derive the reflection coefficients of Lattice realization.
- Know the forward prediction error and back ward prediction error and advantages of Lattice structures,
- Derive the properties of Auto-correlation and Cross correlation.
- Know the different methods of parametric power spectrum estimation methods.
- Understand the Non-parametric and Parametric power spectrum estimation methods.

SYLLABUS:
UNIT –I:
Review of DFT, FFT, IIR Filters and FIR Filters:
Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion.

UNIT –II:
Applications of Multi Rate Signal Processing:
Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Subband
Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

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

UNIT –IV:
Implementation of Digital Filters:
Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for

lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT –V:

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

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis& D. G.Manolakis, 4thEd., PHI.
2. Discrete Time Signal Processing - Alan V Oppenheim & R. W Schaffer, PHI.
3. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2 Ed., PearsonEducation.

REFERENCE BOOKS:

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

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SOFT COMPUTING TECHNIQUES
(ELECTIVE -III)

OUTCOMES:

At the end of this course the student can able to:
- Understand the basic concepts of Artificial neural network systems.
- Understand the McCulloch-Pitts neuron model, simple and multilayer Perception, Adeline and Madeline concepts.
- Data processing, Hopfield and self-organizing network.
- Difference between crisp sets to fuzzy sets, fuzzy models, fuzzification, inference,
- membership functions, rule based approaches and defuzzification.
- Self – organizing fuzzy logic control, non linear time delay systems.
- Understand the concept of Genetic Algorithm steps. Tabu, anD-colony search techniques for solving optimization problems.
- GA applications to power system optimization problems, identification and control of linear and nonlinear dynamic systems using MATLAB-Neural network toolbox.
- Know the application and importance stability analysis.

SYLLABUS:

UNIT –I:

Introduction:

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

UNIT –II:

Artificial Neural Networks:

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

UNIT –III:

Fuzzy Logic System:

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

UNIT –IV:

Genetic Algorithm:

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

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

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

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

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ARTIFICIAL INTELLIGENCE
(ELECTIVE-III)

Course Outcomes:

At the end of this course, students will be able to

- Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues
- Understanding reasoning and fuzzy logic for artificial intelligence
- Understanding game playing and natural language processing.

Syllabus Contents:

Unit I

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate- And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means- Ends Analysis.

Unit II

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Unit III

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Model Curriculum of Engineering & Technology PG Courses [Volume -II]
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Factors And Rule-Base Systems, Bayesian Networks, DempsterShafer Theory

Unit IV

Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

Unit V

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive

Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

References:
1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd
3. Edition, Prentice Hall, 2009.

INTERNET OF THINGS
(ELECTIVE III)

OUTCOMES:
- Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
- Conceptually identify vulnerabilities, including recent attacks, involving the Internet of Things Develop critical thinking skills
- Compare and contrast the threat environment based on industry and/or device type

Unit – I
Introduction to Embedded Systems and Internet of Things (IOT) :
Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Applications of Embedded Systems and IoT, Design Methodology for IOT Products

Unit –II
ARM Microcontrollers Architecture and Programming Architecture, Instruction set, Programming ports, Timer/Counter, Serial communication, Interrupts in C, Introduction ARM mBed platform

UNIT- III
Overview of Open Source Hardware and Its relevance to IOT
Introduction and Programming Arduino Development Board, Working with Sensor Integration, Interfacing Input/Output devices (LCD, Key Pad, LED Matrix etc)

UNIT IV
Fundamentals of Python Programming & Raspeberry PI
Introduction to python programming, Working with functions, classes, RESTfull Web Services, Client Libraries, Introduction & programming Raspberry Pi3, Integrating Input Output devices with Raspberry Pi3

UNIT V
IOT: Technologies, Standards and Tools
Fundamental characteristics and high level requirements of IoT, IoT Reference models,
Introduction to Communication Technologies & Protocols of IoT: BLE, Wi-Fi, LoRA, 3G/4G Technologies and HTTP, MQTT, CoAP protocols, Relevant Practical's on above technologies
IOT Platform: Cloud Computing Platforms for IOT Development (IBM CLOUD – Register in IBM
Blue mix website)
IOT Platform Architecture (IBM Internet of Things & Watson Platforms), API Endpoints for Platform Services, Devices Creation and Data Transmission, Introduction to NODE-RED and Application deployment

Text Books
1. Internet of Things: A Hands-On Approach by by Arsheep Bahga, Vijay Madisetti
2. Embedded Real Time Systems: Concepts, Design and Programming‖ by

Dr.K.V.K.K.Prasad, Dream Tech Publication, 2003.

3. Embedded Systems: Real-Time Interfacing to Arm(r) Cortex -M Microcontrollers: Volume-1 & 2 by Jonathan W Valvano

4. Designing the Internet of Things‖ by Adrian McEwen, Hakim Cassimally, Wiley Publications, 2012

5. The Internet of Things: Key applications and Protocols‖ Wiley Publications 2nd Edition

References

1. http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx

2. http://electronicdesign.com/embedded/understanding-protocolsbehind-internet-things

3. http://eclipse.org/community/eclipse_newsletter/2014/february/articl e2.php

4. http://iot.eclipse.org/protocols.html

5. http://www.slideshare.net/paolopat/internet-ofthingsprotocolswar

6. http://www.slideshare.net/RealTimeInnovations/io-34485340

7. http://www.networkworld.com/article/2456421/internet-of-things/aguide-to-theconfusing-internet-of-things-standards-world.html

8. http://internetofthings.electronicsforu.com

9. http://www.embedded.com/electronics-news/4410270/Thingsquareopens-up-sourcecode-for-its-IoT-Mist

10. http://www.cio.com/article/2843814/developer/how-to-developapplications-for-theinternet-of-things.html

11. http://www.cio.com/article/2602467/consumer-technology/10-hotinternet-of-thingsstartups.html

ADVANCED COMPUTER NETWORKS
(ELECTIVE IV)

OUTCOMES:
At the end of this course the student can able to:
- Analyze a communication system by separating out the different functions provided by the network; and some example networks
- Understand various network topologies required for communication
- Understand that there are fundamental limits to any communications system
- Understand the general principles behind , addressing, routing, reliable transmission and other state full protocols as well as specific examples of each
- Have an informed view of both the internal workings of the Internet and of a number of common Internet applications and protocols

SYLLABUS:
UNIT -I:
Congestion and Quality of Service (QoS):
Data traffic, Congestion, Congestion Control, Two examples, Quality of Service, Techniques to improve QOS, Integrated Services and Differential services.**Queue Management:**Passive-Drop trial, Drop front, Random drop, Active- early Random drop, Random Early detection.
UNIT -II:
X.25 Standards: X.25 Layers, X.21 Protocol ,**Frame Relay:** Introduction, Frame relay operation, Frame relay layers, Congestion control, Leaky Bucket algorithms, **ATM:** Design goals, ATM architecture, Switching, Switch Fabric, ATM layers, Service classes, ATM applications.
UNIT -III:
Interconnection Networks: Introduction, Banyan Networks, Properties, Crossbar switch, Three stage Class networks, Rearrangeble Networks, Folding algorithm, Benes Networks, Lopping algorithm, Bit allocation algorithm. **SONET/SDH**: Synchronous Transport signals, Physical configuration, SONET layers, SONET Frame.
UNIT -IV:
Spread Spectrum: Introduction, Basic concept, Protection against Jamming, Spreading codes (PN sequence), Generation, Properties, Types of Spread Spectrum Modulation, Application of Spread Spectrum. **Private Networks:** Virtual Private Networks, Network Address Translation **Next Generation:** IPV6 Transition from IPV4 to IPV6 ,**Mobile IP:** Addressing, Agents, Three phases, Inefficiency in Mobile IP.

UNIT -V:
Wireless Networks: Wireless LAN: IEEE802.11, Architecture, MAC Sub Layer, Addressing Mechanism, Physical Layer. **Bluetooth:** Architecture, Bluetooth layers, Radio layer, Base band layer, L2CAP, **Wireless WAN:** The Cellular Concept, Cell, Frequency reuse, Principle, Channel Assignment Strategies, Interference and system capacity, Types of interference, Improving

capacity in cellular system, Handoff, AMPS, D-AMPS, GSM, CDMA, GPRS, 3G & 4G technologies.

TEXT BOOKS:
1. Data Communication and Networking - B. A.Forouzan, 4thEd,TMH
2.TCP/IP Protocol Suit – B. A. Forouzen, 4thEd, TMH

REFERENCE BOOKS:
1. Wireless Communication System- AbhishekYadav, University Sciences Press
2. Wireless Digital Communications – KamiloFeher, 1999, PHI
3. High Performance TCP-IP Networking- Mahaboob Hassan, Jain Raj, PHI
4. ATM Fundamentals- N. N. Biswas, Adventure Book Publishers, 1998
5. Wireless Communication – T. L. Singhal, McGraw Hill, 2010
6. Wireless Communication and Networking- Vijay K. Garg, Elsevier, 2009

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EMBEDDED SYSTEM DESIGN
(ELECTIVE-IV)

OUTCOMES:
At the end of this course the student can able to:
- Understand the basic concepts of Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, and software development.
- Understand the Processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts with examples.
- Know the Embedded Hardware building blocks, Embedded Processors – ISA architecture models, internal processor design, and processor performance.
- Know the introduction to Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.
- Know the importance and requirement of real time operating system to perform the task by an embedded system on real time environment.
- Understand the Input-Output component interfacing in embedded board Input / output –
- Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance.
- Know the Embedded Operating Systems RTOS basics, multitasking and process Management, Memory Management, I/O and file system management.
- Performing the Testing and Implementing in the design-The main software utility tool, CAD and the hardware, Translation tools, Debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

SYLLABUS:
UNIT-I:
Introduction
An Embedded System-Definition, Examples, Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, software development, processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts.
UNIT-II: Embedded Hardware
Embedded hardware building blocks, Embedded Processors – ISA architecture models, Internal processor design, processor performance, Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.
Embedded board Input / output – Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses – Bus arbitration and timing, Integrating the Bus with other board components, Bus performance.
UNIT-III: Embedded Software
Device drivers, Device Drivers for interrupt-Handling, Memory device drivers, On-board bus device drivers, Board I/O drivers, Explanation about above drivers with suitable examples.

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

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

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

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

UNIT-V: Embedded System Design-Case Studies

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

RADAR SIGNAL PROCESSING
(ELECTIVE -IV)

OUTCOMES:
At the end of this course the student can able to:
- Understand the operation of Radar and derive the radar range equation.
- Know the characteristics of Matched filter for non-white noise.
- Understand the various detection criterion and types of detectors that can be used to detect the Radar signals in noise.
- Understand the waveform design requirements and optimum waveforms for the detection of signals in clutter.
- Know the significance and types of pulse compression techniques in radar signals.
- Know the concepts of digital compression SAW pulse compression in Radar signals.
- Understand the requirements of phase coding in Radar and various poly phase codes used for phase coding.

SYLLABUS:
UNIT -I:
Introduction:
Radar Block Diagram, Biostatic Radar, Monostatic Radar, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, MTI and Pulse Doppler Radar. Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.
UNIT -II:
Detection of Radar Signals in Noise:
Detection Criteria – Nyman -Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors–Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection-CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management–Schematics, Component Parts, Resources and Constraints.
UNIT -III:
Waveform Selection [3, 2]:
Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noise Like Waveforms, Waveform Design Requirements, Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.
UNIT -IV:
Pulse Compression in Radar Signals:
Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram,

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

UNIT V:

Phase Coding Techniques:

Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar. Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant

PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Sidelobe Reduction for Phase Coded PC Signals.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

NETWORK SECURITY AND CRYPTOGRAPHY
(ELECTIVE IV)

OUTCOMES:
At the end of this course the student can able to:
- Understands the basics of network security and cryptography, models and classical and modern techniques of security.
- Students understand and practice the encryption algorithms with computers.
- Students learn key managements techniques and number theory.
- Students learn message authentication and hash functions, digital signatures electronic mail security.
- Students learn IP security, web security, Secure electronic transactions, intruders, viruses and worms and fire walls.

SYLLABUS:
UNIT -I:
Introduction:
Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
Modern Techniques:
Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.
UNIT -II:
Encryption Algorithms:
Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. **Conventional Encryption :**Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.
UNIT -III:
Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. **Number Theory:** Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.
UNIT -IV:
Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms.
MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
Authentication Applications : Kerberos, X.509 directory Authentication service. Electronic Mail
Security: Pretty Good Privacy, S/MIME.

UNIT –V:
IP Security:
Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.
Intruders, Viruses and Worms
Intruders, Viruses and Related threats.
Fire Walls: Fire wall Design Principles, Trusted systems.

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

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

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ADVANCED COMMUNICATIONS LAB

Note: The students are required to design the communication system using Simulink and they have to perform the simulation using MATLAB/CC Studio (programming) simulation software tool. Further they are required to compare the results. All Experiments may be Simulated using MATLAB and to be verified using related training kits

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

PART B: Equipment required for Laboratory
Software:
1. MATLAB along with Simulink Licensed simulation software tool with communication and Signal processing toolbox.
2. Computer Systems with required specifications
Hardware:
1. Hard ware kits for verification of BER
2. Hard ware kits of Convolution encoders ,Hamming encoders.
3. Frequency spectrum
4. Mobile Phone Trainer
5. DSP Trainer Kit
6. CDMA-DSS-BER Trainer
7. ISDN Training System with Protocol Analyzer
8. Optical fiber Transmitter and receiver kit along with different lengths of cables.

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ERTOS LAB

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

List of Experiments:

Part-I: Experiments using ARM-926 with PERFECT RTOS

1. Register a new command in CLI.
2. Create a new Task.
3. Interrupt handling.
4. Allocate resource using semaphores.
5. Share resource using MUTEX.
6. Avoid deadlock using BANKER'S algorithm.
7. Synchronize two identical threads using MONITOR.
8. Reader's Writer's Problem for concurrent Tasks.

Part-II   Experiments on ARM-CORTEX processor using any open source RTOS.

(Coo-Cox-Software-Platform)

1. Implement the interfacing of display with the ARM- CORTEX processor.
2. Interface ADC and DAC ports with the Input and Output sensitive devices.
3. Simulate the temperature DATA Logger with the SERIAL communication with PC.
4. Implement the developer board as a modem for data communication using serial port communication between two PC's.

Lab Requirements:

Software:

- Eclipse IDE for C and C++ (YAGARTO Eclipse IDE), Perfect RTOS Library, COO-COX Software Platform, YAGARTO TOOLS, and TFTP SERVER.
- LINUX Environment for the compilation using Eclipse IDE & Java with latest
  version.

Hardware:

- The development kits of ARM-926 Developer Kits and ARM-Cortex Boards.

- Serial Cables, Network Cables and recommended power supply for the board.

SEMESTER III

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DATA ACQUISITION SYSTEMS
(ELECTIVE-V)

UNIT-I

INTRODUCTION: Objective of a DAS, single channel DAS, Multi-channel DAS,Components used in DAS– Converter Characteristics-Resolution-Non-linearity,settling time, Monotonicity.

UNIT-II

ANALOG TO DIGITAL CONVERTERS (ADCS): Classification of A/D converters.Parallelfeed back – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

NON-LINEAR DATA CONVERTERS (NDC): Basic NDC configurations – Some common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM – High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems – PCM voice communication systems – Test and measurement instruments – Electronic weighing machines.

UNIT-III

DIGITAL TO ANALOG CONVERTERS (DACS): Principles and design of – Parallel R–2R, Weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

DATA CONVERTER APPLICATIONS: DAC applications – Digitally programmable V/I sources – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

UNIT-IV

Monolithic data converters: typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a μP.

UNIT-V

Error budget of DACS and ADCS: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

TEXT BOOKS:

1. Electronic data converters fundamentals and applications – Dinesh K. Anvekar, B.S. Sonde – Tata McGraw Hill.

REFERENCES:

1. Electronic Analog/ Digital conversions – Hermann Schmid – Tata McGraw Hill.

2. E.R. Hanateck, User's Handbook of D/A and A/D converters - Wiley

3. Electronic instrumentation by HS Kalsi- TMH 2 ndEdition, 2004.

4. Data converters by G.B. Clayton

Wireless Sensor Networks
(ELECTIVE V)

Course Outcomes:

At the end of this course, students will be able to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor
- for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor
- network based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance
- of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

Syllabus Contents:

Unit I: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Unit II: Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit III: Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit IV: Overview of sensor network protocols (details of atleast 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit V: Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Specialized features: Energy preservation and efficiency; security challenges; faulttolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

References:

1. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.
2. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks",

3. Springer Verlag, 1st Indian reprint, 2010.
4. F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing
5. Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
6. YingshuLi, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer
7. series on signals and communication technology, 2008.

Cyber security systems
(ELECTIVE V)

OUTCOMES:
- Cyber Security architecture principles
- Identifying System and application security threats and vulnerabilities
- Identifying different classes of attacks
- Cyber Security incidents to apply appropriate response
- Describing risk management processes and practices
- Evaluation of decision making outcomes of Cyber Security scenarios

UNIT- I:
Introduction to Cybercrime:
Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security ,Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

UNIT -II:
Cyber offenses:
How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

UNIT -III:
Cybercrime Mobile and Wireless Devices:
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT -IV:
Tools and Methods Used in Cybercrime:
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft)

UNIT -V:
Cybercrimes and Cyber security:
Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act,
Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

TEXT BOOKS:
1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

REFERENCES:
1. Information Security, Mark Rhodes, Ousley, MGH.

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WIRELESS LANS AND PANS
(ELECTIVE – V)

UNIT –I:
Wireless System & Random Access Protocols:
Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G systems, The Wireless Spectrum; Random Access Methods: Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

UNIT –II:
Wireless LANs:
Introduction, importance of Wireless LANs, WLAN Topologies, Transmission Techniques: Wired Networks, Wireless Networks, comparison of wired and Wireless LANs; WLAN Technologies: Infrared technology, UHF narrowband technology, Spread Spectrum technology

UNIT –III:
The IEEE 802.11 Standard for Wireless LANs:
Network Architecture, Physical layer, The Medium Access Control Layer; MAC Layer issues: Hidden Terminal Problem, Reliability, Collision avoidance, Congestion avoidance, Congestion control, Security, The IEEE 802.11e MAC protocol

UNIT –IV:
Wireless PANs:
Introduction, importance of Wireless PANs, The Bluetooth technology: history and applications, technical overview, the Bluetooth specifications, piconet synchronization and Bluetooth clocks, Master-Slave Switch; Bluetooth security; Enhancements to Bluetooth: Bluetooth interference issues, Intra and Inter Piconet scheduling, Bridge selection, Traffic Engineering, QoS and Dynamics Slot Assignment, Scatternet formation.

UNIT –V:
The IEEE 802.15 working Group for WPANs:
The IEEE 802.15.3, The IEEE 802.15.4, ZigBee Technology, ZigBee components and network topologies, The IEEE 802.15.4 LR-WPAN Device architecture: Physical Layer, Data Link Layer, The Network Layer, Applications; IEEE 802.15.3a Ultra wideband.

TEXT BOOKS:
1. Ad Hoc and Sensor Networks - Carlos de MoraisCordeiro and Dharma PrakashAgrawal, World Scientific, 2011.
2. Wireless Communications and Networking - Vijay K.Garg, Morgan Kaufmann Publishers, 2009.

REFERENCE BOOKS
1. Wireless Networks - KavehPahlaram, Prashant Krishnamurthy, PHI, 2002.
2. Wireless Communication- Marks Ciampor, JeorgeOlenewa, Cengage Learning, 2007.