List of Ph.D. course work subjects that can be offered under Electrical Science Group from 2024

GROUP 1		GROUP 2		GROUP 3		GROUP 4	
Subject Code	Name of the subject	Subject Code	Name of the subject	Subject Code	Name of the subject	Subject Code	Name of the subject
PHES101	Dynamics of analog & Discrete Time Systems	PHES201	Computer modelling of Electrical Power Systems	PHES301	Power System Instrumentation	PHES401	Dynamics of Linear Systems
PHES102	VLSI Design	PHES202	Switched Mode Power Conversion	PHES302	Alternate Energy Sources	PHES402	Energy Management Systems
PHES103	Advanced Network Analysis and synthesis	PHES203	Bio-Mass Energy Resources	PHES303	Digital Power System Protection	PHES403	Digital Signal Processing
PHES104	Protection techniques for Electrical Machines	PHES204	Engineering Economics and Management	-	-	-	-
PHES105	Design of analog and Discrete Time Control Systems	PHES205	AI Applications to energy Management	PHES305	HVDC/EHVAC Transmission and FACTS	PHES405	Nonlinear Automatic Control Theory
PHES106	Non Linear Systems	PHES206	Environmental Engineering and Pollution Control	-	-	PHES406	AI Applications in Power Systems

PHES107	Discrete Control Systems & Multi Variable Control	PHES207	Computer Aided power system operation and Analysis	PHES307	Parallel Processing in Power Systems	PHES407	Power System Reliability Engineering
PHES108	Computer Based Industrial Drive Control	PHES208	HVDC Transmission	PHES308	Environmental Aspects of Power Generation and Transmission	PHES408	Computer based industrial control
PHES109	Analysis of Linear Systems	-	-	PHES309	Optical Communications & Fiber Optic Networks	PHES409	Multimedia Networks
-	-	PHES210	Computer Graphics	PHES310	Digital Image Processing & Computer Vision	PHES410	Computer Architecture
PHES111	Client Server Programming & Application	PHES211	Database Management Systems	PHES311	Object Oriented Analysis & Design	PHES411	Pattern Classification
PHES112	Data Structure & Algorithms	PHES212	Operating Systems & Linux Internals	PHES312	Product Engineering	PHES412	Embedded & Real Time Systems
-	-	PHES213	Theoretical Foundations of Computer Science	PHES313	Artificial Intelligence & Expert Systems	PHES413	Data Warehousing & Mining
PHES114	Complier Design Tools & Techniques	PHES214	System Simulation & Modeling	PHES314	Advanced Algorithms	PHES414	Multimedia Information Systems

PHES115	Computer Networks	PHES215	Software Architecture	PHES315	Software Quality Assurance & Testing	PHES415	Systems Performance & Evaluation
PHES116	Software Engineering	-	-	PHES316	Multimedia Communication	PHES416	High Performance Computing
PHES117	Wireless & Mobile Networks	PHES217	Network Programming	PHES317	Power Semi-conductor devices	PHES417	Electrical machine dynamics
PHES118	Cryptography and Network Security	PHES218	Design of Power Converters	PHES318	Microcomputer control of electrical Drives	PHES418	VLSI Technology
PHES119	Electromagnetic Compatibility	PHES219	Testing and verification of VLSI Circuits	PHES319	Modeling and Simulation of Data networks	PHES419	Power electronics system Design with ICS
PHES120	Advanced Bio-medical Instrumentation	PHES220	HV- DC Power Transmission.	PHES320	CMOS RF Circuit Design	PHES420	Digital Switching Systems
PHES121	Advanced control systems	PHES221	Error Control Coding	PHES321	Radar Systems	PHES421	Design of Analog & Mixed mode VLSI Circuits
PHES122	Advanced Digital Communications	PHES222	ASIC Design	PHES322	Internet of Things	PHES422	Wireless Communications

PHES123	Algorithms for VLSI Design Automation	PHES223	Detection and Estimation	PHES323	Hardware - Software Co-design	PHES423	Theory & Design of Bio-Medical Instruments
PHES124	Antenna Theory & Design	PHES224	Ergonomics	PHES324	Real Time Embedded Systems	PHES424	Low power VLSI Design
PHES125	Bio- medical Signal Processing	PHES225	Embedded System Design	PHES325	Pattern Recognition	PHES425	Synthesis and Optimization of Digital Circuits
PHES126	Design of VLSI Systems	PHES226	Digital System Design Using VHDL	PHES326	Mobile Computing	PHES426	Speech and Audio Processing
PHES127	Digital Circuits and Logic Design	PHES227	Image and Video Processing	PHES327	Statistical Signal Processing	PHES427	NET Technology
PHES128	Digital Signal Compression	PHES228	Ethernet Technology	PHES328	Web Services	PHES428	Parallel Systems
PHES129	Distributed Computing	PHES229	VLSI System and Architecture	PHES329	High Speed VLSI Design	PHES429	Advanced Data Networks
PHES130	Linear Algebra	PHES230	Protocol engineering	PHES330	RF & MMIC Design and Technology	PHES430	Optical communication & Networking

PHES131	Network Protocol Design	PHES231	Soft Computing	PHES332	Suggested Subject relevant to the chosen area Thin Film Instrumentation Technology	-	-
PHES132	Wireless & ATM Networks	PHES232	Vacuum and Thin film science and technology	PHES333	Internet of Things	-	-
PHES133	Nano electronics	PHES233	Suggested Subject relevant to the chosen area Senors & application	-	-	-	-
PHES134	GaAs and Related devices and Technology	PHES234	Numerical Techniques in Electromagnetic	-	-	-	-

Group I

PHES101 DYNAMICS OF ANALOG AND DISCRETE TIME SIGNALS

State variable description of linear systems:

State space representation of electrical, mechanical and electromechanical systems. Computation of state transition matrix by I) series expansion method, ii) Laplace transform approach and iii) Cayley Hamilton theorem; state space equations in canonical forms; solution of linear time invariant and time variant state equations. Transfer functions (Text book 1- ch.9, Text book 2-ch.12)

Controllability and observability:

State variable equations of composite systems, effect of pole zero cancellation subsystems of composite systems, controllability and observability, transformation to the phase variable canonical form (Text Book3-ch4, Text Book 1-ch 9)

Design of control system by state space methods;

Control system design via pole placement techniques, Design of state observer (full order and minimum order observer); Effects of addition of observer on a closed loop system (Text Book 1 –Ch 10, Text Book 2-ch12)

Linear, discrete, dynamic systems analysis;

The Z –transfer –Introduction, linear difference equations, the discrete transfer function, discrete models of sampled data systems, signal analysis and dynamic response, properties of the Z transform (Ref. Book 4 –Ch 2)

Sampled Data systems:

Introduction, analysis of the sample and hold, spectrum of sampled signal and aliasing. (Ref. Book 4 – Ch 3 & 4)

State space analysis and design of discrete of discrete time systems:

State space representation of discrete –time systems solving discrete time state space equations, the pulse transfer function matrix, discretisation of continuous time state space equations, controllability, observability, design via pole placement, design of state observer, effect of observers on stability (ref book 5 Ch 5&6)

BOOKS:

1. Modern Control Engineering –K. Ogata
2. Control system engineering –Nagrath and Gopal
3. An introduction to control of dynamic systems –M. K. Chidambara et.al
4. Digital Control of Dynamic Systems –Gene. F. Franklin
5. Discrete –time control Systems-K. Ogata

PHES102 VLSI DESIGN

Introduction -VLSI technology trends, Moore's law

Difference between MOS and BJT's , MOS transistor characteristics, types of MOS transistors, NMOS & CMOS inverters, and transmission gated, structure. Operation of inverter circuits.

NMOS & CMOS circuits for combinational and sequential logic's, stick notation, Shannon's expansion theorem, realization of Boolean functions. PLA generators, Pseudo NMOS circuits, Clocked logic, Simple flip flop realization, Shift registers, dynamic shift registers, super buffers, RAMs and ROMs,

VLSI fabrication techniques, Lithographic process, Twin-tub and SOS process,
Design rules, specification of layers.

Delay and timing calculation, power estimation

System design: VLSI Design level system, design examples

CAD tools for VLSI Design, Design steps CIF representation, Design Styles, placement, routing, and simulation. Circuit extraction, design rule, checking algorithms. Testability and fault tolerances, silicon compilers (in brief)

BOOKS:

1. Mead, Conway, Introduction to VLSI Systems, Addison Wesley
2. Mukherjee Amar, Introduction to NMOS and CMOS VLSI System Design, Prentice Hall India.
3. Pucknell, Eshtangina, Basic VLSI Design systems & circuits, Prentice Hall India
4. Niel H E Weste, Kamran Eshranghian, Principles of VLSI design, Pearson Edu Asia.1993.

Network Topology, open circuit and short circuit, operations, indefinite admittance matrix; Tellegen and Minky Theorem, application

Implicit duality, multiport decomposition, adjoint network, decomposition through altering topology.Formulation of state equations through graph theoretic methods, equivalent source methods.Approximation, Response of filters, butterworth, Chebyshev, Inverse Chebyshev, Bessel –Thomson filters, frequency transformation.Active Networks: Element nullator norator models, higher order networks.Network Synthesis: Review of pr function, two –element kind network synthesis, RL, RC and LC networks.Realization of driving point impedance, Brune, darlington and Bott –Duffin methods, Driving point impedance without mutual inductance.Realization of Transfer function, ladder and lattice networks, Quadri poles terminated with resistances.

BOOKS:

1. Seshu.S.red M. B Linear Graph and electric Networks, Addison Wesley, 1961
2. Seshu S. Balbanian N. Linear Network Analysis, John Wiley, 1959
3. Narayanan, H. Sub-Modular functions and electric Networks, annals of Discrete Math. Vol. 54 North Holland 1997
4. Norma Balbanian, Bickart Theodore A, Electrical Network Theory, John Wiley
5. Aatre, V.K. Network Theory and Filter Design New Age Int.P.1980
6. Swamy, M.N.S. Thulasiraman K. Graphs, Networks And algorithms, John Wiley, 1981.

PHES104 PROTECTION TECHNIQUES FOR ELELCTRICAL MACHINES

Part A: Fundamentals of protection Engineering. Introduction, the principal faults on electrical Power Systems and System components.

Part B: Analog Protection. Analog Protection for

Machines. Part C: Digital Protection

BOOKS:

1. Protection Techniques in Electrical Energy systems. By Helmut Ungrad, Wili Bald Winkler, and Anorzej Wiszni Ewski New York, Basel, Hong Kong, Marcel dekkar Inc., Sub sec 1.1, 1.2, 1.3, from chapter1, sub sec 2.1, 2.2 to 2.7 from chapter 2, sub sec 8.1, 8.2, 8.3 from chapter 8, chapter 9,10, 11, 12 & 13

PHES105 DESIGN OF ANALOG AND DISCRETE TIME CONTROL SYSTEMS

Design of Analog systems: Time response of second - order systems, design specifications, Performance indices, concept of stability, stability analysis- from bode plots and root - locus. Design with PID controllers. design with phase lag, lead and lag-lead componsators**,**

Design of discrete time control systems via transform methods: Stability analysis of closed loop systems in z- domain --the jury stability test

Introduction, obtaining discrete time equivalent of continuous time filters, design principles based on a discrete time equivalent 'of an analog controller, transient and steady state response analysis, design based on the root locus method, design based on the frequency response method, analytical design method.

REFERNCE BOOKS:

1. Nagrath and Gopal "Control System Engineering"
2. K Ogata "Modem Control Engineering"
3. K Ogata "Discrete Time Control Systems"
4. BC kuo "Automatic Control Systems", PHI
5. Gene F Franklin. J David Powell "Digital Control of Dynamic Systems'[1]

PHES106	NON-LINEAR SYSTEMS

Non-linear phenomena, pieces wise linear approximation, Harmonic, Linearization

Describing functions

Phase plane method, phase plane plots, trajectories , singular points, limit cycle

Stability, Testing , Nyquist method Dual input describing function, sub harmonic and jump phenomena Lyapunov methods, generation of functions for linear and non-linear systems, analysts of stability.

Lure's criteria, popov's method, circle criteria and its application, BIBO stability

Relay control analysis, Hamel Tsypkin Loci

REFERENCE BOOKS

1. Hsu, J C Mayer, A U-, Modern Control Principles & Applications, Mc-Graw Hill, 1968
2. Atherton DP Non liner control systems Van Nostrand 1975
3. Vidyasagar M., Nonlinear Systems, Prentice Hall, 1995, Ed 2
4. HoltzmanJM, Nonlinear System Theory, functional Analysis Approach, Prentice Hall, 1970
5. Gibson. J E. Nonlinear Automatic Control. Mc Graw Hill, 1963
6. Graham, *D.*, McRuer M., Analysis of Nonlinear Systems, John Wiley, 1961

Design of discrete lime systems using Transform methods; Stability analysis of closed loop systems in the *Z* - domain- the jury .stability lest.

Introduction, obtaining discrete time equivalent of continuous time fillers, design principles based on a discrete time equivalent of analog controller, transient find steady state response analysis, design based on the root locus method,, design based on the frequency response method, Analytical design method.

Multi variable System models, state equations, canonical forms, polynomial matrices, (Transmission zeroes, Multi variable system analysis, solution of state equations, controllability, stabilize ability.

Observer theory, Realization of transfer matrices, minimal realization, Multi variable system design, pole placement, decoupling model matching, Inverse nequist array, characteristic locus methods.

BOOKS:

1. Discrete time control systems by Ogata.
2. Automatic control system by B.C Kuo.
3. Digital control of dynamics systems by Gene F, Franklin, J. David Powell, Michael L.
4. Warkman, II edition
5. 4 Owens, D. H, Feed back and multi variable systems Peter Peregrines, 1978
6. 5.Wonhans .W.M. Multi variable control, springer Verlag , ed 21997,

PHES108 COMPUTER BASED INDUSTRIAL DRIVE CONTROL

Concept of Continuous and discrete time process control, single loop and multiloop control Brief outline of Multi variable control, brief out line of adaptive control.

Schematic representation of inter connected systems, supervisory control and data acquisition Direct Digital Control, PID control, interfacing process with digital control, position algorithm,Velocity algorithm, Z Transform Based control algorithm. Velocity algorithm, Programmable controllers, diagrammatic representation, functional blocks, architecture, interfacing, software (basic concepts),'

Real time programming -units- tasking, state transition diagram, inter state communication, development of algorithm,

Outline of real time operating Systems. Modeling, simulation, intelligent Controllers, AI based control, Fuzzy based control. neural control. Computer inter facing, methodology, computer control of process, case study.

BOOKS;

1. Krishna Kant: Computer based Industrial Control, Prentice Hall (1), 1997.
2. Hirota,K: Industrial Applications of Fuzzy Technology, Springer, 1993
3. Hertz, John Krogh, Anders, rainier, Richard, Introduction to theory of Neural Computation, Atldisfln-Weslfiy 1991
4. Eggebrecht L,C. Interfacing to [he IBMPC, Howard Samson & Co
5. Ahsons Microprocessors wish application innprocess control TMH 1984

PHES109 ANALYSIS OF LINER SYSTEMS

Linear Control systems: Review, Analytic & experimental modeling. Review of Transfer function- Representation-Analysis-Time & harmonic response.
Frequency response Specifications, random inputs.
State Space Analysis: SISO, MIMO system Analysis-Solution-Impulse response matrix, Controllability-Observability, Observers, Observer based feedback
Composite System-Parallel, Feedback & Tandem-Concept of State Feedback, State Estimators-pole placement methods.

Stability Analysis-Lyapunov's Stability Criteria, generating Lyapunov function, testing for stability

Introduction to phase lag, lag-lead, lead, PID controllers.
Digital Control Systems, Sampling & data reconstruction, Sampling theorem, hold operation.
Z-transform-roperties, inverse, solution of difference equation, System function, Pole- Zero location, frequency consideration.
State Variable methods of analysis of Digital Control Systems, PID controller brief introduction.
Stability Analysis of Digital Control Systems by Jury's Criteria and Bilinear transformation

REFERENCE BOOKS:

1 .Chen C.T., Linear System Theory and Design, Holt, Rinehart, Winston, 1984 Blackman, P.E., Introduction to State Variable Analysis, Macmillan Press, 1977 Kuo, B.C., Digital Control Systems
2. Franklin, Powell., Digital Control Systems
3. Ogata.K., Discrete Time Control Systems, Addison Wesley Longman, Ed. 2, 2000 Power, H.M., Introduction to Dynamics and control, Mcgraw Hill, 1978
4. Nisse, Control Systems Engineering, John water ED. 4 2005 Phillips- Digital Control Systems Analysis Design
5. Gopal. M., Digital Control and State Variable methods.

The Client Server Model and Software Design – Introduction, Motivation, Terminology and Concepts. Concurrent Processing in Client-Server software – Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. Program Interface to Protocols – Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.

The Socket Interface – Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters.Algorithms and Issues in Client Software Design – Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

Example Client Software – Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

Algorithms and Issues in Server Software Design – Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm,Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

Iterative, Connectionless Servers (UDP) – Introduction, Creating a Passive Socket, Process Structure, An example TIME Server.

Iterative, Connection-Oriented Servers (TCP) – Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP) – Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

TEXT BOOK

Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, Douglas E.Comer & David L. Stevens, Second Edition, Pearson Education Asia.

PHES112 DATA STRUCTURES & ALGORITHMS

Introduction to Data Structures:
Information and Meaning, Arrays and Structures in C , Classes in C++, Recursion

Linear Data Structures:
The Stack and its representations, Applications, The Queue and its Representation, Priority Queue and its implementation.
Linked Lists, Lists in C, Other List Structures and its applications.

Non-Linear Data Structures:
Trees, Binary Trees and its representations, Applications.

Hashing:
Hash Tables, Hash Functions, HashMap, ChainingSets, HashSet, Open Address Hashing, Binary tree Hashing

Algorithms:
Introduction, Analysis of algorithms, Time and space complexity issues and Trade.

Techniques for Algorithm Design:
Divide and Conquer method and applications (Binary search, Max-Min), Greedy strategy method and applications (Storage on tapes, Knapsack, Job sequencing, Optimal merge patterns), Dynamic Programming method and applications (Multistage graphs, optimal binary search trees, travelling sales problem), Backtracking method and applications (8-Queens problems, Sum of sets) Branch and Bound method and applications (Knapsack, Travelling Sales problem)

Sorting Algorithms & its Complexities:
Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort and Heap Sort.

TEXT BOOKS

1. Yedidyah, Augenstein and Tenenbaum, "Data Structures Using C and C++" - Second Edition, PHI- India.
2. Sartaj Sahni, "Data Structures, Algorithms and Application in C++", University Press, Second Edition 2005.

REFERENCE BOOKS

1. Thomas H Coreman, Charles E Leiserson & Ronald L Rivest, "Introduction to Algorithms", Prentice Hall of India, Second Printing, August 2000.
2. Adam Drozdek, "Data Structures & Algorithms in C++", Vikas Publishing House, Second Edition 2004.

PHES114	COMPILER DESIGN - TOOLS & TECHNIQUES

1. **Introduction to Compilers, Overview of Compilers:** Why Compilers? A Brief History, Program Related to Compilers, The Translation Process, Major data structures in a Compiler, Other issues in compiler structure, Bootstraping & Porting, Compiler Construction Tools

2. **Lexical Analysis :** The role of the Lexical analyzer, The scanning process, Regular expressions, finite Automata, From Regular expressions to DFA's , Design of a Lexical Analyzer generator, Use of Lex to generate a Scanner Automatically [2.1 to 2.4, 2.6 of Text Book 1]

3. **Syntax Analysis :** The role of the parser, The parsing process, Context- free grammars, Parse Tree & Abstract Syntax Trees, Ambiguity, External Notations, EBNF & Syntax diagrams, Formal properties of Context-free Languages, The Parser Generator [3.1 to 3.6 of Text Book 1]

4. **Top- Down Parsing :** Top –Down parsing by Recursive – Descent, LL(1) parsing, First & Follow sets, Error – Recovery in Top-Down Parsers[4.1 to 4.3, 4.5 of Text Book 1]

5. **Bottom – Up Parsing :**

Overview of Bottom – Up parsing, Finite Automata of LR(0) Items & LR(0) Parsing, SLR(1) Parsing, General LR(1) and LALR(1) Parsing YACC: An LALR(1) Parser Generator, Error Recovery in Bottom-Up Parser[5.1 to 5.5, 5.7 of Text Book 1]

6. **Semantic Analysis:** Attributes and Attribute Grammars, Algorithms for Attribute Computation, The Symbol Table, Data Types checking [6.1 to 6.4 of Text Book 1]

7. **Intermediate Code Generation:** Intermediate Languages, Intermediate Code & Data Structures for code generation, Basic code generation techniques, code generation of data structure references, code generation of control statements & logical expressions, code generation of procedures & function calls [8.1 to 8.5 of Text Book 1]

8. Run Time Environment: Memory organization During Program Execution, Fully Static Run Time Environments, Stack-Based Runtime Environments, Dynamic memory, Parameter Passing Mechanisms [7.1 to 7.5 of Text Book 1]

9. Code Optimization: Introduction, The Principal sources of optimization, Optimization of basic blocks, code improving Transformations [10.1 to 10.3, 10.4, 10.5 of Text Book 2]

TEXT BOOKS

1. Compiler Construction Principles & Practice By Kenneth C. Louden, International Student Edition, 2003, Vikas Publishing.

2. Compilers Principles Techniques & Tools By A. V. Aho, Ravi Sethi & J. D. Ullman Addison Wesley 4th Edition, 2000.

REFERENCE BOOKS

1. Engineering a compiler by Keith, D. Cooper & Linda Torezon, Margan Kafmann publishers, first Indian reprint 2004.

2. The essence of compilers by Robin Hunter, Pearson education, First Indian reprint 2004.

PHES115 Computer Networks

Introduction: Computer network design requirements, Network architecture, Implementing network software, Performance

Direct Link Networks: Hardware building blocks, Encoding, Framing, Error detection, Reliable transmission, Ethernet (802.3), Token Rings (802.5, FDDI), Wireless (802.11).

Packet Switching: Switching and Forwarding, Bridges and LAN switches, Cell switching (ATM), Implementation and performance.

Internetworking: Simple internetworking (IP), Routing, Global Internet, Multicast, Multiprotocol Label Switching (MPLS).
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream (TCP).

Congestion Control and Resource Allocation: Issues in resource allocation, Queuing disciplines, TCP congestion control, Congestion-avoidance mechanisms, Quality of Service.

Applications: Name Service (DNS), Electronic Mail, World Wide Web, Real-time Transport Protocol, Session control and call control, Overlay networks.

Network Management: Network monitoring and control, SNMP –V1, V2 & V3, RMON and RMONV2.

TEXT BOOKS

1. Larry L. Peterson & Bruce S. Davie, Computer Networks – A Systems Approach, Morgan Kaufmann Publishers ,3rd Edition, 2003.

2. William Stallings, SNMP, SNMPV2, SNMPV3, RMON1 and 2, Addison Wesley, 3rd Edition, 1999.

REFERENCE BOOKS

1. Mani Subramanian, Network Management: Principles and Practice, Addison Wesley, 2000.
2. James F. Kurose and Keith W. Ross, Computer Networking – A Top-down approach featuring the Internet, Addison Wesley, 3rd Edition, 2004.
3. S. Keshav, An Engineering approach to Computer Networks, Addison Wesley, 1997.
4. R. Perlman, Interconnections – Bridges, Routers, Switches, and Internetworking
5. Proprotocols, 2nd Edition, Addison Wesley, 2000.

Introduction - FAQs about software engineering - professional and ethical responsibility - system modeling - system engineering process - *the software process* - life cycle models - iteration - specification - design and implementation - validation - evolution - automated process support - *software requirements* - functional and non-functional requirements - user requirements - system requirements - SRS - *requirements engineering processes* - feasibility studies - elicitation and analysis - validation - management - *system models* - context models - behavior models - data models - object models - CASE workbenches

Software prototyping - prototyping in the software process - rapid prototyping techniques - *formal specification* - formal specification in the software process - interface specification - behavior specification - *architectural design* - system structuring - control models - modular decomposition - domain-specific architectures - distributed systems architecture - *object-oriented design* - objects and classes - an object oriented design process case study - design evolution - *real-time software design* - system design - real time executives - *design with reuse* - component-based development - application families - design patterns - *user interface design* - design principles - user interaction - information presentation - user support - interface evaluation

Dependability - critical systems - availability and reliability - safety - security - critical systems specifications - critical system development - verification and validation - planning - software inspection - automated static analysis - clean room software development - software testing - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation - software evolution - legacy systems - software change - software maintenance - architectural evolution - software re-engineering - data re-engineering

Software project management - project planning - scheduling - risk management - *managing people* - group working - choosing and keeping people - the people capability maturity model - *software cost estimation* - productivity estimationtechniques - algorithmic cost modeling, project duration and staffing *quality management* - quality assurance and standards - quality planning - quality control - software measurement and metrics - *process improvement* - process and product quality - process analysis and modeling - process measurement - process CMM - *configuration management* - planning - change management - version and release management - system building - CASE tools for configuration management

TEXT BOOK

1. Ian Sommerville, Software Engineering, Pearson Education Asia

REFERENCE BOOKS

1. Pressman R.S., Software Engineering, McGraw Hill
2. Mall R., Fundamentals of Software Engineering, Prentice Hall of India
3. Behferooz A. & Hudson F.J., Software Engineering Fundamentals, Oxford University Press Jalote P., An Integrated Approach to Software Engineering, Narosa
4. Pressman R.S., A Manager's Guide to Software Engineering, Tata McGraw-Hill.

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems.

Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

The Cellular Concept – System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference,power control for reducing interference.

Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.

Modulation Techniques for mobile Radio: Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).

Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols, Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems.

Wireless Networking: Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

TEXT BOOK

1. Wireless Communications, Principles and Practice, second edition, Theodore S Rappaport, Pearson Education Asia, 2002.

REFERENCE BOOKS

1. Mobile Communications Engineering Theory and Applications, Second Edition by William C Y Lee McGraw Hill Telecommunications 1998.
2. Wireless Communications and Networks by William Stallings, Pearson Education Asia, 2002.

PHES118 CRYPTOGRAPHY AND NETWORK SECURITY

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

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.

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.

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

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

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

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 pay load), Security associations, Key management, Problems.)

Firewalls: Firewall design principles; trusted systems, Problems.

TEXT BOOKS:

1) William Stallings, "Cryptography and Network Security," 3rd edition, Pearson Education (Asia) Pte. Ltd./ Prentice Hall of India, 2003.
2) C. Kaufman, R. Perlman, and M. Speciner, "Network Security: Private Communication in a Public World," 2nd edition, Pearson Education (Asia) Pte. Ltd., 2002.
3) Atul Kahate, "Cryptography and Network Security," Tata McGraw-Hill, 2003.

REFERENCE BOOKS:

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

PHES119 ELECTROMAGNETIC COMPATIBILITY

Review of EMI Theory, Sources of EMI, Noise pick up modes and reduction techniques for analog circuits; Use of co-axial cables and shielding of signal lines; Conducted and radiated noise emission in power electronic equipment and reduction techniques; EMI induced failure mechanisms for power electronic equipment; EMC in design of digital circuits; ESD and switching interference reduction; Susceptibility. aspects of power electronic and digital equipment; Shielding of electronic equipment; EMC standards and test equipment.

TEXT BOOKS:

1. Otto H. W., Noise Reduction Techniques in Electronic Systems, 2nd Edition, 1985.
2. William B. Greason, Electrostatic Damage in Electronics: Devices and Systems, John Wiley and Sons, 1986.
3. Joseph Di Giacomo, Digital Bus Hand Book, McGraw Hill Publishing Company, 1990.
4. White, R. J. “Handbook series of Electromagnetic Interference and Compatibility”, Don White consultants Inc. 1980.

PHES120 ADVANCED BIO-MEDICAL INSTRUMENTATION

Patient monitoring system: system concept, bedside patient monitors, central monitors, average reading heart monitor, intensive are monitoring, ambulatory monitoring. Biotelemetry: single channel & Multichannel telemetry, telephone & computer based telemetry.

Magnetic resonance imaging system: principles of NMR imaging system, image reconstruction techniques, basic NMR components, applications, advantages & disadvantages of NMR, imaging techniques, Biological effects of NMR imaging.

Computer applications in medical field: biomedical computer applications, computerized patient monitoring system, computer aided ECG analysis, computerized catheterization laboratory, basics of Computer Axial Tomography (CAT).

Laser applications in biomedical field: principle of operation of Laser, types of Lasers, applications of lasers in endoscopy, angiography, ophthalmology & removal of kidney stone. Regulation of water & electrolyte balance, kidney structure, filtration & re-absorption, renal acid base control, artificial kidney, dialysis system

Biosignal conversions & averaging: sampling basics, simple conversion systems, conversion requirements for biomedical signals, signal conversion ckts, basics of signal averaging, signal averaging as a digital filter, software for signal averaging, limitations of signal averaging.

TEXT BOOKS:

1. R.S.Khandpur: Handbook of Biomedical Instrumentation (TMH)
2. L.Cromwell & F. Weibell: Biomedical Instrumentation & Measurements (PHI)
3. W.J.Tmpkins: Biomedical Digital Signal Processing (Eastern Economy Education)

REFERENCE BS:

1. Cass & Brown: Introduction to Biomedical Equipment Technology.
2. J.G.Webster: Medical Instrumentation, 3rd edition, John Wiley.

PHES121 ADVANCE CONTROL STSTEM

Digital Control Systems: Review of difference equations and Z — transforms, Z-transfer function (Pulse transfer function), Z.-. Transforms analysis sampled data systems, Stability analysis (Jury's Stability Test and Bilinear Transformation), Pulse transfer functions and different configurations for closed loop Discrete-time control systems

Modern Control Theory: I, State model for continuous time and discrete time systems, Solutions of state equations (for both continuous and discrete systems), Concepts of controllability and observability (For both continuous and discrete systems), Pole Placement by state feedback (for both continuous and discrete systems), Full order and reduced order observes (for both continuous and discrete systems), Dead beat control by state feedback, Optimal control problems using state variable approach, State Regulator and output regulator, Concepts of Model reference control systems, Adaptive Control systems and design

Non Linear Control Systems: Common nonlinearities, Singular Points, Stability of nonlinear systems - Phase plane analysis and describing function analysis, Liapunoy's stability criterion, Popov's criterion

TEXT BOOKS

1. Ogata. K. "Modern Control Engineering", PHI, 2004

2. Ogata K "Discrete time Control Systems", Pearson Education, 2004

3. Nagarath and Gopal" Control Systems Engineering", Wiley Eastern Ltd, 1998

REFERENCE BOOKS:

1. M Gopal "Modem control system Theory"; Wiley Eastern Ltd., 1998

2. M. Gopal, "Digital Control & State Variable Methods", TMH, 2003

PHES122	ADVANCED DIGITAL COMMUNICATIONS

Digital Modulation Techniques: QPSK, DPSK, FQPSK, QAM, M-QAM, OFDM, Optimum Receiver for Signals Corrupted by AWGN, Performance of the Optimum Receiver for Memory-less Modulation, Optimum Receiver for CPM Signals, Optimum Receiver for Signals with Random Phase in AWGN Channel.

Coding Techniques: Convolutional Codes, Hamming Distance Measures for Convolutional Codes; Various Good Codes, Maximum Likelihood Decoding of Convolutional codes, Error Probability with Maximum Likelihood Decoding of Convolutional Codes, Sequential Decoding and Feedback Decoding, Trellis Coding with Expanded Signal Sets for Band-limited Channels, Viterbi decoding.

Communication through band limited linear filter channels: Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization.

Adaptive equalization: Adaptive linear equalizer, adaptive decision feedback equalizer, adaptive equalization of Trellis- coded signals, Recursive least squares algorithms for adaptive equalization, self recovering (blind) equalization.

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals, CDMA, time-hopping SS, Synchronization of SS systems.

Digital Communication through fading multi-path channels: Characterization of fading multi-path channels, the effect of signal characteristics on the choice of a channel model, frequency-Nonselective, slowly fading channel, diversity techniques for fading multi-path channels, Digital signal over a frequency-selective, slowly fading channel, coded wave forms for fading channels, multiple antenna systems.

TEXT BOOKS:

1. **John G. Proakis**, "Digital Communications," 4th edition, McGraw Hill, 2001.
2. **Stephen G. Wilson**, "Digital Modulation and Coding," Pearson Education (Asia) Pte. Ltd, 2003.
3. **Kamilo Feher**," Wireless Digital Communications: Modulation and Spread Spectrum Applications," Prentice-Hall of India, 2004.
4. **Andrew J. Viterbi**, "CDMA: Principles of Spread Spectrum Communications," Prentice Hall, USA, 1995.

PHES123	ALGORITHMS FOR VLSI DESIGN AUTOMATION

Logic synthesis & verification: Introduction to combinational logic synthesis, Binary Decision Diagram, Hardware models for High-level synthesis.

Partitioning: problem formulation, classification of partitioning algorithms, Group migration algorithms, simulated annealing & evolution, other partitioning algorithms

Placement, floor planning & pin assignment: problem formulation, simulation base placement algorithms, other placement algorithms, constraint based floor planning, floor planning algorithms for mixed block & cell design. General & channel pin assignment

Global Routing: Problem formulation, classification of global routing algorithms, Maze routing algorithm, line probe algorithm, Steiner Tree based algorithms, ILP based approaches

Detailed routing: problem formulation, classification of routing algorithms, single layer routing algorithms, two layer channel routing algorithms, three layer channel routing algorithms, and switchbox routing algorithms

Over the cell routing & via minimization: two layers over the cell routers, constrained & unconstrained via minimization

Compaction: problem formulation, one-dimensional compaction, two dimension based compaction, hierarchical compaction

TEXT BOOKS:

1. Naveed Shervani, "Algorithms for VLSI physical design Automation", Kluwer Academic Publisher, Second edition, 1995
2. Christophn Meinel & Thorsten Theobold, "Algorithm and Data Structures for VLSI Design", KAP, 2002.
3. Rolf Drechsler : "Evolutionary Algorithm for VLSI - CAD", Second edition KAP, 1998
4. Trimburger," Introduction to CAD for VLSI", Kluwer Academic publisher, 2002

PHES124	ANTENNA THEORY & DESIGN

Antenna Fundamentals and Definitions: Radiation mechanism - over view, Electromagnetic Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization

Resonant Antennas: Wires and Patches, Dipole antennas, Yagi - Uda Antennas, Micro strip Antenna.

Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, non- uniformly excited - equally spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays.

Broad band Antennas: Traveling - wave antennas, helical antennas, Biconical antennas, sleave antennas, and Principles of frequency - independent Antennas, spiral antennas, and Log - Periodic Antennas.

Aperture Antennas: Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, Axi -symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice.

Antenna Synthesis: Formulation of the synthesis problem, synthesis principles, line sources shaped beam synthesis, linear array shaped beam synthesis — Fourier Series, Woodward — Lawson sampling method, comparison of shaped beam synthesis methods, low side lobe narrow main beam synthesis methods Dolph Chebyshev linear array, Taylor line source method.

Method of Moments : Introduction to method of Moments, Pocklington's integral equation, integral equations and Kirchoff's Networking Equations, Source Modeling Weighted residuals formulations and computational consideration, calculation of antenna and scatter characteristics.

CEM for Antennas Finite Difference Time Domain Method Geometrical Optics Wedge diffraction theory, ray fixed coordinate system, uniform theory of wedge diffraction, E - Plane analysis of Horn antennas. Cylindrical parabolic antenna, radiation by a slot on a finite ground plane, radiation by a monopole on a finite ground plane, equivalent current concepts, multiple diffraction formulation, by curved surfaces, physical optics, method of stationary phase, physical theory of diffraction, cylindrical parabolic reflector antennas.

Assignments/Tutorials:

1. MATLAB / C Implementation to obtain radiation pattern of an antenna
2. Experimental study of radiation pattern of antenna.
3. Significance of Pocklington's integral equation
4. Measurement techniques of radiation characteristics of antenna.
5. Survey on frequency independent antennas
6. Analysis of E plane and H- plane Horns.

TEXT BOOKS:

1. Stutzman and Thiele, "Antenna Theory and Design", 2nd Ed, John Wiley and Sons Inc., 1997
2. C. A. Balanis: Antenna Theory Analysis and Design, John Wiley, 2nd Edition, 1997
3. Kraus: Antennas, McGraw Hill, TMH, 3" Edition, 2003
4. Kraus and R.J. Marhefka: Antennas, McGraw Hill, 2nd Edition, 1998

PHES125	BIO-MEDICAL SIGNAL PROCESSING

Genesis and significance of bioelectric potentials, ECG, EOG, EMG and their monitoring and measurement, spectral analysis, digital and analog filtering, correlation and estimation techniques, AR / ARMA models, Adaptive Filters, ECG: Pre-processing, Measurements of amplitude and time intervals, Classification, QRS detection, ST segment analysis, Baseline wander removal, wave form recognition, morphological studies and rhythm analysis, automated diagnosis based on decision theory ECT compression, Evoked potential estimation. EEG: evoked responses, Epilepsy detection, Spike detection, Hjorth parameters, averaging techniques, removal of Artifacts by averaging and adaptive algorithms, pattern recognition of alpha, beta, theta and delta waves in EEG waves, sleep stages, EMG: wave pattern studies, biofeedback, Zero crossings, Integrated EMG. Time frequency methods and Wavelets in Biomedical Signal Processing

TEXT BOOKS:

1. Willis J Tompkins, ED. "Biomedical Digital Signal Processing", Prentice-Hall of India, 1996.
2. R E Chellis and R I Kitney, "Biomedical Signal Processing", in IV parts, Medical and Biological Engg. And current computing, 1990-91.
3. Special issue on Biological Signal Processing, Proc. IEEE 1972

REFERENCE BOOKS:

1. Arnon Kohen, "Biomedical Signal Processing", Volumes I & II, CRC Press.
2. Metin Aray, "Time frequency and Wavelets in Biomedical Signal Processing", IEEE Press, 1999.
3. Current Published literature.

PHES126 DESIGN OF VLSI SYSTEMS

VLSI System Design methodology: Structure Design, Strategy, Hierarchy, Regularity, Modularity, and Locality. System on Chip Design options: Programmable logic and structures, Programmable interconnect, programmable gate arrays, Sea of gate and gate array design, standard cell design, full custom mask design.

Chip Design Methods: Behavioral synthesis, RTL synthesis, Logic optimization and structural tools layout synthesis, layout synthesis, EDA Tools for System

Design capture tools: HDL Design, Schematic Design, Layout Design, Floor planning and Chip Composition. Design Verification Tools: Simulation Timing Verifiers, Net List Comparison Layout Extraction, Design Rule Verification.

Data Path Sub System Design: Introduction, Addition, Subtraction, Comparators, Counters, Boolean logical operations, coding, shifters, Multiplication, Parallel Prefix computations

Array Subsystem Design: SRAM, Special purpose RAMs, DRAM, Read only memory, Content Addressable memory, Programmable logic arrays.

Control Unit Design: Finite State Machine (FSM) Design, Control Logic Implementation: PLA control implementation, ROM control implementation.

Special purpose Subsystems: Packaging, power distribution, I/O, Clock, Transconductance amplifier, follower integrated circuits, etc

Design Economics: Nonrecurring and recurring engineering Costs, Fixed Costs, Schedule, Person power, example

VLSI System Testing & Verification: Introduction, A walk through the Test Process, Reliability, Logic Verification Principles, Silicon Debug Principles, Manufacturing Test Principles, Design for Testability, Boundary Scan

VLSI Applications
Case Study: RISC microcontroller, ATM Switch, etc.

TEXT BOOKS:

1. Neil H.E. Weste, Davir Harris, "CMOS VLSI Design: A Circuits and system perspectives" Addison Wesley - Pearson Education, 3rd Edition, 2004.
2. Wayne, Wolf, "Modern VLSI design: System on Silicon" Prentice Hall PTR/Pearson Education, Second Edition, 1998
3. Douglas A Pucknell & Kamran Eshragian , "Basic VLSI Design" PHI 3rd Edition (original Edition – 1994)

Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks.

Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits, Fault-Location Experiments, Boolean Differences, Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic

Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities and Limitations of Finite – StateMachines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.

Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, Decompositions, Synthesis of Multiple Machines.

State—Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault-Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection Experiments for Machines which have no Distinguishing Sequences.

TEXT BOOKS:

1. Zvi Kohavi, “Switching and Finite Automata Theory”, 2nd Edition. Tata McGraw Hill Edition, 2004
2. Charles Roth Jr., “Digital Circuits Fundamentals of Logic Design”, Thomson Learning Asia, 2004
3. Parag K Lala, “ Fault Tolerant and fault testable hardware design”, Prentice Hall Inc. 1985

REFERENCE BOOKS:

1. E. V. Krishnamurthy, “Introductory theory of computers”, Macmillan Press Ltd, 1983
2. Mishra & Chandrasekaran, “Theory of computer science – Automata, Languages and Computation”, 2nd Edition, PHI,2004

PHES128 DIGITAL SIGNAL COMPRESSION

Introduction: Compression techniques, Modeling & coding, Distortion criteria, Differential Entropy, Rate Distortion Theory, Vector Spaces, Information theory, Models for sources, Coding – uniquely decodable codes, Prefix codes, Kraft McMillan Inequality

Quantization: Quantization problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization; Entropy coded Quantization, Vector Quantization, LBG algorithm, Tree structured VQ, Structured VQ, Variations of VQ – Gain shape VQ, Mean removed VQ, Classified VQ, Multistage VQ, Adaptive VQ, Trellis coded quantization

Differential Encoding: Basic algorithm, Prediction in DPCM, Adaptive DPCM, Delta Modulation, Speech coding – G.726, Image coding.

Transform Coding: Transforms – KLT, DCT, DST, DWHT; Quantization and coding of transform coefficients, Application to Image compression – JPEG, Application to audio compression.

Sub-band Coding: Filters, Sub-band coding algorithm, Design of filter banks, Perfect reconstruction using two channel filter banks, M-band QMF filter banks, Poly-phase decomposition, Bit allocation, Speech coding – G.722, Audio coding – MPEG audio, Image compression.

Wavelet Based Compression: Wavelets, Multiresolution analysis & scaling function, Implementation using filters, Image compression – EZW, SPIHT, JPEG 2000.

Analysis/Synthesis Schemes: Speech compression – LPC-10, CELP, MELP, Image Compression – Fractal compression.

Video Compression: Motion compensation, Video signal representation, Algorithms for video conferencing & videophones – H.261, H. 263, Asymmetric applications – MPEG 1, MPEG 2, MPEG 4, MPEG 7, Packet video.

Lossless Coding: Huffman coding, Adaptive Huffman coding, Golomb codes, Rice codes, Tunstall codes, Applications of Huffman coding, Arithmetic coding, Algorithm implementation, Applications of Arithmetic coding, Dictionary techniques – LZ77, LZ78, Applications of LZ78 – JBIG, JBIG2, Predictive coding – Prediction with partial match, Burrows Wheeler Transform, Applications – CALIC, JPEG-LS, Facsimile coding – T.4, T.6.

TEXT BOOKS:

1. K. Sayood**,** "Introduction to Data Compression," Harcourt India Pvt. Ltd. & Morgan Kaufmann Publishers, 1996.

2. N. Jayant and P. Noll, "Digital Coding of Waveforms: Principles and Applications to Speech and Video," Prentice Hall, USA, 1984.

3. D. Salomon," Data Compression: The Complete Reference," Springer, 2000.

4. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

PHES129	DISTRIBUTED COMPUTING

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.

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.

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

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

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)

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

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", 2nd Ed. Addison, Wesley 1994.

REFERENCE BOOKS:

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

PHES130	LINEAR ALGEBRA

Linear equations: Fields; system of linear equations, and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-factorization.

Vector spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces.

Linear Transformations: Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functionals; transpose of a linear transformation.

Canonical Forms: Characteristic values; annihilating polynomials; invariant subspaces; direct-sum decompositions; invariant direct sums; primary decomposition theorem; cyclic bases; Jordan canonical form. Iterative estimates of characteristic values.

Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization; least-squares problems; unitary operators.

Symmetric Matrices and Quadratic Forms: Digitalization; quadratic forms; constrained optimization; singular value decomposition.

TEXT BOOKS:

1. Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd/ Prentice Hall of India, 2004.

2. David C. Lay, “Linear Algebra and its Applications,” 3rd edition, Pearson Education (Asia) Pte. Ltd, 2005.

3. Gilbert Strang, "Linear Algebra and its Applications," 3rd edition, Thomson Learning Asia, 2003.

4. Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications," Pearson Education (Asia) Pte. Ltd, 7th edition, 2003.

Introduction: how to specify network protocols semantics of traditional protocol specifications syntax of traditional protocol specifications new protocol specifications first protocol examples a vending machine protocol a request/reply protocol a Manchester encoding protocol the current internet network processes constants, inputs, and variables actions protocol execution processes in the internet more on processes messages with fields nondeterministic assignment process arrays parameters a resource allocation protocol process communication in the internet

Transmission And Error: types of transmission errors protocol execution under error occurrence protocols that tolerate error occurrence normal timeout actions implementing normal timeout actions transmission errors in the internet connections using timeouts connections using identifiers full-duplex and half-duplex connections, connections in the internet data transfer and multiplexing data with idleness multiplexing data with control multiplexing data with data, data transfer and multiplexing in the internet error detection, detection of message corruption detection of message loss detection of message reorder error detection in the internet error recovery forward error recovery backward error recovery cumulative acknowledgment individual acknowledgment block acknowledgment error recovery in the internet flow control window size control rate control circular buffer control flow control in the internet maintaining topology information local and global topology information maintaining local topology information maintaining hierarchical topology information maintaining topology information in the internet the abstraction of perfect channel using the abstraction of perfect channel the abstraction of perfect channel in the internet

Routing And Switching: hierarchical routing random routing detection of message reorder error detection in the internet circuit switching datagram switching , switching in networks with changing topologies switching in the internet congestion control congestion control in circuit networks congestion control in datagram networks deadlock prevention in datagram networks congestion control in the internet the abstraction of virtual neighborhood the abstraction of virtual neighborhood in the internet using the abstraction of virtual neighborhood naming and name resolution hierarchical names name resolution name caches naming and name resolution in the internet

Security And Applications: asymmetric and symmetric keys authentication using asymmetric keys authentication using symmetric keys privacy and integrity non-repudiation authorization message digest security in the internet data compression Huffman coding static Huffman compression dynamic Huffman compression context-sensitive compression lossy compression data compression in the internet broadcast and multicast maintaining spanning trees low-level broadcast high -level broadcast ordered precedence, and recall broadcasts hierarchy of broadcast primitives broadcast and multicast in the internet application structures sockets clients and servers using sockets clients and servers using remote procedures application structures in the internet applications echo file transfer remote login applications in the internet ring networks types of ring networks slotted ring networks token ring networks ring networks in the internet broadcast

networks broadcast processes collision prevention collision resolution broadcast networks in the internet protocol layers and hierarchies protocols versus protocol layers a connection protocol layer an error recovery protocol layer a protocol hierarchy example protocol hierarchies in computer networks the next internet

TEXT BOOKS:

1. Mohamed G. Gouda: Elements of Network Protocol Design, John Wiley & Sons 2004

2. Douglas E Comer: Computer Networks and Internet with Internet applications, Fourth Edition, Pearson 2004

3. Pallapa Venkataram and Sunil Kumar Manvi, "Communication protocol Engineering", Prentice Hall India, First Edition, 2004.

REFERENCE BOOKS:

1. G.J. Holtzmann, "Design and Validation of Computer Protocols", Prentice Hall, New York, 1991.
2. F.Belina, Hogrefe D., Sarma A, "SDL with applications from protocol specifications", Prentice Hall, Boston, 1991

PHES132 WIRELESS & ATM NETWORKS

PCS Architecture, Cellular telephony, Cordless telephony and low tier PCS, Third and Fourth generation wireless systems ; Mobility management, handoff, roaming management for SS& and CT2, handoff Detection, strategies for handoff detection, channel assignment, link transfer types, hard Handoff soft handoff; IS-41 signaling, IS-41 handoff and authentication, CDPD architecture, CDPD air Interface, radio resource allocation.; GSM architecture, location tracking, data services, HSCPD, GPRS, OSM network signaling, GSM mobility management, GSM short message service, International Roaming for GSM, VoIP for GSM networks.; GPRS functional groups, architecture, network nodes, interfaces, procedures, billing, evolving from GSM to GPRS,WAP protocols, W-CDMA and cdma 2000, QOS in 3G, paging network architectures, wireless local loop architectures, Bluetooth core Protocols; Introduction to wireless LANS, 802.11 WLANs, physical and MAC layers, Wireless ATM and HIPERLAN, 802.15 WPAN, Bluetooth, interference between Bluetooth and 802.11, wireless geolocation system architecture, standards, performance measures, introduction other wireless LAN standards 802.lle, 802.16, 802.17, 802.19, 802.20

Assignments can be given on simulation of mobility management, handoff schemes, wireless MAC protocols and application development over wireless LANs. GlomoSim tool can be used for simulation, which is free software on Linux. Also, student can collect recent articles from magazines/Journals and prepare survey paper or a technical report.

TEXT BOOKS:

1. Yi-Bing Lin, Imrich Chlamtac, Wireless and mobile network architectures, John Wiley, 2001
2. Kaveh Pablavan, P. Krishnamurthy, Principles of wireless networks, Pearson education, 2002
3. P. Venkataram, S. S. Manvi, B. P. Vijaykumar, WLANs: Architectures, Protocols and Applications, Pearson education (In Press), 2005
4. Marlyn Mallick, Mobile and wireless design essentials, Wiley, 2003

GROUP I

NANOELECTRONICS

Lecture hours/Week : 04 **Exam hours : 03**
Total Lecture Hours : 60 **Exam Marks :100**
Practical/Field work /Assignment- hours/week : 02

INTRODUCTION - Overview of nanoscience and engineering – Development milestones in micro-fabrication and electronics industry – Moore's Law and continued miniaturization – Scaling Laws and effects of scaling - Classification of nanostructures – Fabrication Processes: engineer's top-down, chemist's bottom-up, and biologist's (nature's) self-assembly processes – Synergy of sciences and engineering towards nanotechnology – Applications of nanotechnology - Societal implications of nanotechnology

PHYSICO-CHEMICAL BASICS - The isolated atom – Quantization of energy - Schrödinger's wave equation and its importance - Physical significance of wave function - Eigen values and Eigen functions – Heisenberg's Uncertainty Principle - Free electrons in 1-, 2-, and 3-dimensional confinement – The quantum mechanical tunneling - Atoms coming together – Valence and free electrons - Electronic bonding, orbitals, and hybridization – Energy bands, quantization, and electron bonds in aggregates of 3-, 2-, and 1-dimensional matter (semiconductors and carbon nano-tubes as examples) – Quantum dots – Quantum dot cellular automata – Magnetism at nanometer scale – Giant mangetoresistance (GMR) - Effects of nanometer length scale on electrical, mechanical, thermal, and chemical properties

ELECTRONIC AND ATOMIC PROCESSES IN NANOSCALE DIMENSIONS - Electronic transport at the nano-scale – Quantum wells, quantum wires, band gap engineering (superlattices), and carbon nano-tubes – Ballistic conductance and quantization of conductance – Principles of operations of Atomic Force and Scanning Tunneling Microscopes – Coulomb blockade – Spintronics - Atomic processes: surface and interface phenomena at nano-scale – Nanotriboloy - Catalysis – Example of C60 (fullerenes) – Drift, diffusion, glide, and osmosis - Colloid systems – Homogeneous and heterogeneous nucleation and monolayer crystal growth – Basis of *bottom-up* processes

FABRICATION TECHNIQUES FOR NANO-MATERIALS - Physics, chemistry and material science of nano-fabrication - Top-down processes – Milling and micromachining – MEMS and NEMS - Elements of silicon CMOS technology – High resolution lithographic patterning concepts and materials - Lithography and etching technologies, including photon, electron, ion and atom, scanning probe - "Soft lithography" and nano-imprinting - Pattern transfer – Ion implantation - Bottom-up processes – Chemical vapor deposition (CVD) – Epitaxy (MBE, OMVPE) – Self-organization – Self-assembly - Process integration – Characterization and applications – Capabilities and limits

FABRICATION TECHNIQUES FOR NANO-DEVICES/COMPONENTS (Examples) - Silicon CMOS chip manufacturing – Problems in CMOS technology - CVD of carbon

nano-tubes – Carbon nano-tube FETs – Quantum dot lasers – QWIPs – Photonic crystals – Liquid phase methods – Colloidal methods – Sol-gel methods

CHARACTERIZATION TECHNIQUES AND EVALUATIONS - Optical microscope – Profilometry - Atomic scale characterization – X-ray absorption and photon emission – TEM/SEM, AFM, STM - Atomic manipulation – Photoluminescence – Optical spectroscopy – Electrical characterization methods

NANOELECTRONICS APPLICATIONS - Sensors (MEMS, NEMS) - Micro-motors - Better Computing & communications – QWIPs – Defense - Health and biological applications – Water purification – Micro-/nano-fluidic and drug delivery systems - Nano-particles for a variety of applications – Fuel cells, renewable energy, and energy storage – Bioelectronics materials

REFERENCES and SUGGESTED READING MATERIALS FOR THE COURSE

1. *Nanoscale Science and Technology*, Ed. by Robert Kelsall, Iam Hamley and Mark Geoghegan, John Wiley & Sons (2005).
2. *Handbook of Nanoscience Engineering and Technology*, Ed. William A.Goddard III, Donald W.Brenner, Sergey Edwart Lyschevski and Gerald J.Iafrate, CRC Press, New York (2003).
3. *Introduction to Nanotechnology*, by C.P. Poole Jr., F.J. Owens, Wiley (2003).
4. *Microlithography Fundamentals in Semiconductor Devices and Fabrication Technology*, by Ueno T., Ito T. and Nonogaki S., Marcel Dekker (1998).
5. *Semiconductor Lithography: Principles, Practices and Materials*, by William Moreau, Plenum Press (1988).
6. *Sub-Half Micron Lithography for ULSI*, Ed. by Matsui S., Ochiai Y., and Suzuki, K., Cambridge University Press (1999).
7. *Nanolithography: A Borderland Between STM, EB, IB and X-ray Lithographies*, Ed. by Gentili M., Giovannella C., and Selci S., NATO Asi Series E: Applied Sciences, vol. 264, Kluwer Academic Publishers (1994).
8. *Solid State Physics*, by G.I. Epifanov, Mir Publishers (1979).
9. *Semiconductor Devices - Physics and Technology*, by S.M. Sze, John Wiley & Sons (2003).
10. *Introduction to Semiconductor Devices*, by Kevin F. Brennan, Cambridge University Press (2005).
11. *VLSI Fabrication Principles*, by Sorab K. Ghandhi, John Wiley & Sons (1983).
12. *Basic Principles of Colloid Science*, D.H. Everett, Royal Society of Chemistry, Cambridge, 1994
13. *Explorations in Quantum Computing*, by Colin P. Williams and Scott H. Clearwater, Springer-Verlag, New York (1998).

GROUP I

GaAs AND RELATED DEVICES AND TECHNOLOGY

Lecture hours/Week	**: 04**	**Exam hours**	**: 03**
Total Lecture Hours	**: 60**	**Exam Marks**	**:100**

Practical/Field work/Assignment- hours/week : 02

Introduction to GaAs and related technology. Properties of III-V compounds – Density of States in 2-, 1-, and 0-dimensions – Conduction processes – Optical processes – recombination, absorption, and radiation in semiconductors.

Bulk single crystal growth (Bridgman and LEC) – Wafer fabrication and specification – Epitaxy (MBE and OMVPE) of single crystal layers, heterostructures and dissimilar materials – Quantum wells, superlattices, quantum wires and quantum dots – Doping techniques – Material characterization techniques – Emerging III-V materials (GaN).

Metal (Schottky) and ohmic contact techniques. GaAs metal-semiconductor field effect transistor (GaAs MESFET): introduction, structure, equivalent circuits, current saturation, effect of source and drain resistances, gate resistance and application of GaAs MESFET. Physics, operation and technology of RF and microwave solid state devices – Schottky, IMPATT, TRAPATT, PIN, tunnel and GUNN diodes.

Physics and technology of heterostructure materials, and devices and ICs. Quantum wells, superlattices, quantum wires and quantum dots - High electron mobility transistor (HEMT): practical HEMT structure, energy band line-up, equivalent circuit, HEMT noise, pseudomorphic HEMT and applications. Resonant tunneling diodes, Heterojunction bipolar transistors (HBTs), light emitting diodes (LEDs), Solar cells, Photo-detectors and Lasers. Opto-electronic integration of compound semiconductor devices: heterojunction phototransistor (HPT) and light amplifying optical switch (LAOS). Design consideration of MMICs and power MMICs using compound semiconductor devices. Reliability and degradation of GaAs and related devices – FETs, HBTs, LEDs, and lasers.

Applications and emerging technologies: RF and wireless transreceivers. Solid state high power microwave sources. Solar cells. Fiber optics communication. Quantum Well Infrared Photodetectors (QWIPs). White light and super bright LEDs. Edge emitting, surface emitting, and high power lasers. Opto-electronic integrated circuits (OEICs).

Course Text Books:

1. Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Prentice-Hall of India Private Limited, New Delhi (1995).
2. V Swaminathan and A. T. Macrander, Material Aspects of GaAs and InP Based Structures, Printice Hall, Englewood Cliffs, NJ (1991).
3. David K. Ferry, Ed., Gallium Arsenide Technology, Howard W. Sams Co., Inc., Indianapolis, IN (1985).
4. Joseph Mun, GaAs Integrated Circuits, Macmillan Publishing Company, New York (1988).
5. Sitesh Kumar Roy and Monojit Mitra, Microwave Semiconductor Devices, Prentice-Hall of India Private Limited, New Delhi (2003).
6. M. J. Howes and D. V. Morgan, Ed., Reliability and Degradation – Semiconductor Devices and Circuits, John Wiley & Sons, New York (1981).

References:

1. S. M. Sze, Physics of Semiconductor Devices, 2nd edition, John Wiley & Sons, New York (1981).
2. S. M. Sze, Semiconductor Physics and Technology, John Wiley & Sons, New York (2003).
3. Michael Shur, Physics of Semiconductor Devices, Printice Hall, Englewood Cliffs, NJ (1990).
4. Sorab K. Ghandhi, VLSI Fabrication Principles – Silicon and Gallium Arsenide, John Wiley & Sons, New York (1983).
5. James V. DeLorenzo and Deen D. Khandelwal, Ed., GaAs FET Principles and Technology, Artech House, Inc. (1982).
6. David J. Elliot, "Integrated Circuit Fabrication Technology", McGraw-Hill Book Company, New Delhi (1982).
7. Current review and research papers.

Group II

PHES201	COMPUTER MODELING OF ELECTRICAL POWER SYSTEMS

Basic single phase modeling. Three phase system analysis. Three phase models of transmission lines. Three phase models of transformers. Formation of the system admittance matrix.Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission.

Load Flow: Introduction, Basic nodal-method. Conditioning of Y matrix. The case where one voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Method competitive in load flow. Characteristics of the Newton-Raphson load flow method. Decoupled Newton load flow method. Fast Decoupled load flow. Convergence criteria and tests. Numerical examples.

AC-DC Load Flow: Introduction. Formulation of the problem. DC system model. Solution techniques. Control of converter AC terminal voltage. Extension to multiple and or multi-terminal DC systems. DC convergence tolerance. Test system and results Numerical examples.

REFERENCE BOOKS:

1. J.Arrillaga and C.P.Arnold and B.J.harker – Computer Modeling of Electrical Power Systems, Wiley Inter-science Publications, John Wiley & Sons(Text Book).

2. E.Clarke-Circuit Analysis of AC Power Systems, Vol.I John Wiley & Sons Ltd, New York.

3.1. Introduction to Modeling of Power Transmission Plant: Introduction. Linear transformation techniques. Glenn W.Stagg and E.L.Abiad-Computer Methods in Power System Analysis, McGraw Hill Publishers.

4. E.W.Kimbark – Direct Current Transmission, Vol.1, Wiley Inter-Science, London

PHES202 SWITCHED MODE POWER CONVERSION

Introduction to Power Supplies: Overview: Series regulator, steady state and dynamics, Examples.
Primitive Switched Mode Converter Characteristics: Diode as a real switch.Transistor as a Switch: Thermal Design of Power Devices Transistors as a switch. Protection. Design of snubbers. Steady state analysis. Power flow in converters.

Basics of DC-DC Converters: Steady state Analysis. Realization of switches. Non-idealities. Bi-directional power flow. Discontinuous conduction. Steady state analysis. Converter Topologies: Practical DC-DC converter topologies. Popular Circuit realizations. Dynamic equations of converters. Comparison.

Interference and Noise due to DC-DC converters: Conducted and radiated EMI. Basic principles. Spikes at output and input. Simulation of Converter Circuits: Simulation methods. Review of dynamic system. Dynamic modeling of converter in continuous and discontinuous mode of operation. Parallel resonant converter designs.

REFERENCE BOOKS:

1. Ramanarayana- Lecture Notes on switched Mode Power Conversion, Indian Institute of Science, Bangalore.

2. Ned Mohan, Tore M.Undeland and William.P.Robbins-Power Electronics: Converters, Applications and Design, john Wiley & Sons Ltd., ISBN 9971-51-177-0

3. George Chrysis – High Frequency switching Power Supplies: Theory and Design , McGraw Hill Publishers, ISBN 0-07-0109-49-4

4. Middle Brook R.D.and Cuk- Advances in Switched Mode Power Conversioin, Vols.I, II and III Teslaco, pasadena, Caltech, US A

5. P.N.K. Chetty – Switched Mode Power Supply Design, B.P.B. Publication, New Delhi.

PHES203 BIOMASS ENERGY RESOURCES

Introduction: Bio-energy- why it is worth while? Photo-synthesis and fuel production in a nutshell. Solar Energy and Photo-Synthesis: Solar energy-down to earth. The mechanisms of photo

Synthesis. Energy from Bio-masses: Bio-gas generation. Factors affecting bio-digestion or generation of gas. Types of bio-gas plants. Constructional details of some main digesters. Bio-gas from plant wastes. Digester design considerations. Methods for maintaining bio-gas production. Problems related to bio-gas plant

The Bio-energy Conversion Technology: An overview. Anaerobic digestion. Alcoholic fermentation. Chemical reduction. Gasification. Pyrolysis. Direct combustion.

The Economics of Bio-mass Systems: General considerations. Net present value. Energy payback time. Some conventional economic costing. Costs of bio-mass fuels Relative prices of

biological and other fuels

Present Developments and Future Prospects: The state of the art – an over view. Hydrogen and electricity via bio-photolysis – hope for the future. Petrol pump plants. Improving plant productivity I and II. Conservation through integration – a system approach. Bio-mass potential for national

energy autonomy. The biological path to self reliance

REFERENCE BOOKS:

1. Malcolm Slesser and Chris Lewis – Biological Energy Resource(Text Book)
2. G.D.Roy – Renewable Energy Sources (Text Book)
3. K.R.Datye – Banking on Bio-mass
4. Edward A Hiler and Bill A Stout – Bio-mass Energy: A Monograph

Interest and Time Value of Money: Simple interest. Compound interest. Single payments. Uniform series payments. Interest factors and tables. Nominal and effective interest rates. Continuous compounding. Uniform continuous payments.

Methods for Evaluation of Tangible Alternatives: Present worth comparison. Equal, unequal lived assts. Study period Capitalized cost. Bond valuation. Equivalent uniforms annual costcomparison. Rate of return comparison

Replacement Analysis: Review of conventional approach. Analysis with time value accounting. Current salvage value of the defender. Defender and challenger with different lives. Additional one year assessment. Review of project management – PERT and CPM Crashing cost system.

Project Feasibility Analysis: Case study: Report preparation. Deprecations – reasons. Depreciation accounts. Causes of declining value. Depreciation methods. Costs volume profit analysis. Review of conventional approach. Analysis with time value, linear, nonlinear multi product

Marketing Feasibility: Types of market identification of investment opportunities. Market and demand analysis. Forecasting demand(review). Forecast control. Secondary sources of information.

Technical Feasibility: Product design and development. Concept of concurrent engineering. Plant design and capacity planning. Equipment selection. Process planning. Line balancing. Purchasing, Make versus buy decisions. Productivity analysis.Financial feasibility: Means of financing. Financial institutions – all India and state level.Profitability. Cash flows of a project. Financial leverage of a business. Tax factors in investment analysis. Direct, indirect, advance tax. Tax rates. Incentives for new industries in backward areas.Risk Analysis and Decision Trees: Recognizing risk, including risk in economic analysis. Expected value. Payoff table. Decision trees, Discounted decision trees. Present economic policy. Liberalization, Privatization, Globalization, Scope for industrial growth.

REFERENCE BOOKS:

1. James.L.Riggs – Essentials of Engineering Economics, Mcgraw Hill Book Company, 1982
2. Prasanna Chandra – Project Preparation, Appraisal and Implementation, Tata McGraw Hill, New Delhi, 1992(Text book)
3. Norman.N.Barish- Economics Analysis for Engineering and Managerial Decision Making, McGraw hill Book Company, 1983
4. Leland.T.Blank, Anthony.J.Jarquin – Engineering Economy, McGraw Hill Company, 1983.

PHES205 AI APPLICATIONS TO ENERGYMANAGMENT

Overview of Artificial Intelligence: Problem solving. State space Representation

Searching Techniques : Breadth first search. Depth first search. Heuristics search A and AO algorithms.

Knowledge Representation Schemes: Predicate logic. Resolution. Proof by refutation. Semantic nets. Scripts and frames. Reasoning and planning.

AI Applications to Energy Forecasting: Short term and long term prediction using neural networks. Genetic algorithms and their application to economic load dispatch. Security analysis using neural computing techniques.

REFERENCE BOOKS:

1. Alien Riche & Kerningham - Artificial Intelligence, Tata McGraw-Hill
2. Wood and Woolen Berg - Power System Operation and Control
3. IEEE Transactions on Power Systems.

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PHES206	ENVIRONMENTAL ENGINEERING AND POLLUTION CONTROL

Introduction: Over view of environmental system. Environmental legislation and regulation. Environmental ethics. Material balance approach to problem solving.

Water Quality Management: Water pollution and their sources Water quality management in rivers, lakes and ocean

Waste Water Treatment: Waste water micro-biology. Characteristics of waste water. On site disposal systems. Municipal waste water treatment systems unit. Operations of pre-treatment-primary treatment unit. Process of secondary treatment. Disinfection. Land and sludge treatment. Sludge disposal.

Air Pollution: Physical and chemical fundamentals. Air pollutants and standards. effects of air pollution. Fate of air pollution. Micro and micro air pollution. Air pollution metrology. Atmospheric dispersion. Air pollution control of stationary and mobile sources. Waste disposal

Noise Pollution: effects of noise, sources and criteria. Transmission of sound outdoors. Traffic noise.Protection. noise control

Solid Waste Management: Perspective. Collection. Inter-route transfer. Disposal by sanitary

landfill. Incineration. Resource conservation. Noise control. Hazardous Waste: Definition and classification of hazardous waste. Hazardous waste management. Treatment technologies. Land disposal. Ground water contamination and remedy.

Ionizing Radiation: Fundamentals. biological effects of ionizing. Radiation. Radiation standards. Radiation exposure. Radiation protection. Radioactive waste disposal.

REFERENCE BOOKS:

1. Mackenzie.L.Davis and David.A.Cornwell - Introduction to Environmental Engineering, McGraw Hill, 1991(Text book)

2. Noel De Nevers - Air Pollution Control Engineering, Mc Graw Hill, 1995

PHES207	COMPUTER AIDED POWER SYSTEM OPERATIONAND ANALYSIS

Interchange Evaluation and Power Tools: Introduction. Economy interchange. Economy interchange evaluation> Interchange evaluation with unit commitment. Multiple interchange contracts. After the fact production costing. Transmission losses in transaction evaluation. Other types of interchange. Capacity interchange. Diversity interchange. Energy banking. Emergency power interchange. inadvertent power exchange. Power tools - The energy broker system. Centralized economic dispatch of a power pool. Allocating pool saving. Problems and further readings

Power System Security: Introduction. Factors affecting power system security. Contingency analysis. Detection of network problems - Network sensitivity factors. AC load flow methods. Correcting the generation dispatch. Correcting the generation dispatch by sensitivity methods. Compensated factors. Correcting the generation dispatch using linear programming.

State Estimation in Power Systems: Introduction. Power system state estimation. Maximum likelihood Weighted Least Squares estimation - Introduction. Maximum Likelihood Concepts. Matrix Formulation. An example of Weighted Least squares State estimation. State estimation in AC networks-Development of method. Typical results of state estimation on an AC network. Introduction to Advanced Topics in State Estimation - Detection and identification of bad measurements. Estimation of quantities not being measured. Network observability and pseudo-measurements. Applications ofPower System State Estimation - Derivation of Least squares equations. Problems and further reading.

REFERENCE BOOKS:

1. Allen.J Wood Brue and F.Wollenberg - Power Generation Operation and Control(Text book)
2. George L Kusic - Computer Aided Power System Analysis, Prentice Hall of India pvt. ltd.

DC Power Transmission Technology: Introduction. Comparison of AC and DC transmission. Application of DC transmission. Description of DC transmission. Planning for HVDC transmission. Modern trends in DC transmission. Thyristor Valve : Introduction. Thyristor device. Thyristor valve. Valve tests. Recent trends.

Analysis of HVDC Converters: Pulse number. Choice of converter configuration. Simplified analysis of Greaetz circuits. Converters bridge characteristics. Characteristics of twelve pulse converter. Detailed analysis of converters. Converters and HVDC System Control: General. Principles of DC link control. Converter control characteristics. System control hierarchy. Firing angle control. Current and excitation angle control. Starting and stopping of DC link. Power control. Higher level controllers. Telecommunication requirements.

Converter Faults and Protection: Introduction. Converter faults. Protection against over-currents. Overvoltages in a converter station. Surge arrestors. Protection against over-voltages. Smoothing Reactor and Line: Introduction. Smoothing reactors. DC line. Transient over-voltage currents in DC line. Protection of a DC line. DC breakers. Monopolar operation. Effects of proximity of
AC and DC transmission lines.

REFERENCE BOOKS

1. Dr.K.R.Padiyar - HVDC Transmission System(Text book)

2. Arrilaga.J. - High Voltage Direct Current Transmission, Peter Peregrinus Ltd., 1983.

3. Uhlmann, E - Power Transmission by Direct current, springer verlag. 1975.

PHES210 | **COMPUTER GRAPHICS**

Introduction: Applications of computer graphics, Elements of pictures created in computer graphics, Graphics display devices, Device-independent programming and OpenGL. Basic raster graphics algorithms for drawing 2D primitives: Midpoint line & circle algorithm, Scan- line polygon filling algorithm. Antialiasing.

2D geometric transformations and 2D viewing: Basic transformations, Matrix representations and homogeneous coordinates, Composite transformations, The viewing pipeline, window-to-viewport coordinate transformation, clipping operations – Cohen-Sutherland line clipping, Liang-Barsky line clipping & Sutherland-Hodgeman polygon clipping**.** 3D concepts & 3D object representations: Polygon surfaces, Curved lines and surfaces, Quadric surfaces, Spline representations, Bezier curves and surfaces, B-spline curves and surfaces. 3D geometric transformations and 3D viewing: Translation, Rotation,
Scaling, Viewing pipeline,
Viewing coordinates, Parallel projections & Perspective projections.
Solid Modeling, Achromatic and Coloured light: Representing solids, Regularized Boolean set operations, Primitive instancing, Sweep representations, Boundary representations, Spatial-partitioning representations, Constructive solid geometry, Comparison of representations, User
Interfaces for solid modeling. Achromatic light, Chromatic colour, Colour models for raster
graphics, Reproducing colour, Using colour in computer graphics.

Visible-surface detection methods: Classification, Back-face detection, method Depth-buffer ,
Scan-line method, Depth-sorting method, BSP-tree method & Area-subdivision method, Visible-
surface ray tracing.
Illumination and shading: Illumination models, Shading models for polygons , Surface details,
Shadows, Transparency.

TEXT BOOKS

Computer Graphics, C Version, Second Edition, Donald Hearn & M. Pauline Baker, Pearson Education.

Computer Graphics Principles & Practice, Second Edition in C, James D. Foley, Andries van Dam, Steven K. Feiner & John F. Hughes, Pearson Education.

REFERENCE BOOKS

Schaum's Outline of Computer Graphics, Second Edition, Roy A. Plastock & Zhigang Xiang, Tata McGraw-Hill.

Computer Graphics using OpenGL, Second Edition, F.S.Hill, Jr., Pearson Education.

PHES211	DATABASE MANAGEMENT SYSTEMS

Overview of Relational Model, ER and EER Mapping. DBMS Internals.Normalization: Functional dependencies, Properties of FDs, Definition of 1st, 2nd, 3rd, and Boyce-Codd Normal forms. Lossless decomposition and Dependency preservation, Definition and techniques for testing, Algorithms for conversion to 3 NF and BCNF, Multi-valued dependencies,

Axioms for FDs and MVDs, Dependency basis, Fourth Normal Form, Generalized dependencies, PJ/NF and DKNF.

Query Optimization: Translating SQL Queries into Relational algebra, Basic algorithms for executing Query operations using Heuristics in Query optimization using selectivity and cost estimates in Query optimization. Overview of Query optimization in ORACLE semantic Query optimization. Object Oriented Data Bases: Overview of Object-Oriented Concepts, Object model of ODMG, Object Definition Languages, Object Relational features of ORACLE.

Transaction & Processing Concurrency Control: Transaction Schedules and Recoverability, Serializability of schedules, Concurrent transactions in a database and need for synchronization, Concurrency control based on 2-phase locking, Concurrency control in distributed databases.

Database Recovery Techniques & Security issues

Integrity, Multimedia, Temporal & Spatial databases.

Distributed Databases: Architecture of a Distributed DBMS, Design methodology for distributed databases, Query processing in distributed databases.

TEXT BOOKS

Elmasree Navathe, Fundamentals of Database Systems, 3rd Edition, Pearson Education.

C. Ceri & S. Pelgatti, Distributed Databases, McGraw Hill

REFERENCE BOOKS:

Sisberschatz Korth & Sudarshan, Databases – System Concepts, 4th Edition, TMH. Raghu Ramakrishna, Database Management Systems, TMH.

1. INTRODUCTION

computers and Software, Operating System Strategies.

2. USING THE OPERATING SYSTEM

The Programmer's Abstract Machine, Resources, Processes and Threads, Writing Concurrent Programs, Objects.

3. OPERATING SYSTEM ORGANIZATION

Basic Functions, General Implementation Considerations, Contemporary OS Kernels.

4. DEVICE MANAGEMENT

The I/O System, I/O Strategies, Device Manager Design, Buffering, Device Class Characteristics.

5. IMPLEMENTING PROCESSES, THREADS, AND RESOURCES

The Task at Hand, The Hardware Process, The Abstract Machine Interface, The Process Abstraction, Thread Abstraction, State Diagrams, Resource Managers, Generalizing Process the Management Policies.

6. SCHEDULING

Overview, Scheduling Mechanisms, Strategy Selection, Non-preemptive Strategies, Preemptive Strategies, Implementing the Scheduler.

7. BASIC SYNCHRONIZATION PRINCIPLES:

Cooperating Processes, Evolving from the Classic Solution,

Semaphores, Synchronization in Shared Memory Multiprocessors.

8. HIGH-LEVEL SYNCHRONIZATION AND INTERPROCESS COMMUNICATION

Alternative Synchronization Primitives, Monitors, Interprocess communication.

9. DEADLOCK

Background, Prevention, Avoidance, Detection and Recovery.

10. MEMORY MANAGEMENT

The Basics, The Address Space Abstraction, Memory Allocation,

Dynamic Address Space Binding,Modern Memory Manager Strategies.

11. VIRTUAL MEMORY

The Task at Hand, Address Translation, Paging, Static Paging Algorithms,

Dynamic Paging. Algorithms, Segmentation, Memory-mapped Files.

12. FILE MANAGEMENT

The Task at Hand, Files, Low-level File Implementations, Supporting High-

level File Abstractions,

Directories, Implementing Directories, File Systems

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PART B

1. INTRODUCTION

LINUX: The Operating System; Compiling the kernel; Introduction to the kernel: Important Data Structures, Main algorithms, Implementing System Calls; Memory Management: Architecture-independent memory model, Virtual Address Space of a Process, Block Device Caching, Pages under Linux.

2. INTERPROCESS COMMUNICATION, FILE SYSTEM, DEVICE DRIVERS

IPC: Synchronization in the Kernel, Communication via Files, Pipes, Debugging using ptrace, System V IPC, IPS with sockets; File system: Basic Principles, Representation of File System in the Kernel, The Proc File System, The Ext2 File System; Device Drivers: Character and Block Devices, Polling, Interrupts and Waiting Queues, Implementing a Driver, Dynamic and Static Drivers.

TEXT BOOKS

1. Operating Systems: Gary Nutt, 3rd Edition, Pearson Education, 2005.
2. LINUX Kernel Programming: M Beck etal, 3rd Edition, Pearson Education, 2002.

REFERENCE BOOKS

1. Operating Systems: Deitel, Deitel and Choffnes, 3rd Edition, Pearson Education, 2004.
2. Operating System Concepts: Silberschatz, 6th Edition, John Wiley and Sons, 2003.
3. The LINUX Kernel Book: Remy Card etal, John Wiley, 1998.

PHES213 THEORETICAL FOUNDATIONS OF COMPUTER SCIENC

Regular expressions and finite Automata: Regular languages, Finite automata, Union, Intersections & complements. Non deterministic Finite automata, Kleene's theorem Regular & Non regular languages Criterion for regularity, minimal Finite Automata, Pumping lemma, Decision problems, languages & computers

Context-free grammars

Derivation Trees & Ambiguity, An Unambiguous CFG for algebraic expressions, simplified forms and normal forms Pushdown Automata

Definition, Deterministic pushdown automata, A PDA corresponding to a given context-free grammar, context-free grammar corresponding to a given PDA, parsing

Context-free and Non-Context-free languages The pumping lemma for context-free languages, Intersections & complements of context-free languages, decision problems involving context-free languageS

languages, decision problems involving context-free languages

Turing Machins, Definitions, computing partial functions, combining Turing machine, variation of Turing machines, Non-Deterministic Turing Machines, Universal Turing Machine, Church-Turing Thesis

Graph Theory: Introduction, Isomorphism, Sub-graphs, walks, paths and circuits, connected graphs disconnected graphs and components, Euler graphs, Operations on graphs, more on Euler Graphs, Hamiltonian paths and circuits, The traveling salesman problem, Chromatic number, Chromatic partitioning, Chromatic polynomial, Matchings

Continuous-Parameter Markov chains and Queuing Theory: Introduction, The Birth and death process, other special cases of the Birth-Death Model, Non Birth-Death processes

TEXT BOOKS

1. Introduction to languages & the theory of computation by John C Martin, Tata McGraw Hill publication Co. Ltd., 3rd edition, 2004.
2. Narsingh Deo – Graph Theory with Applications to Engineering & Computer Science – Prentice Hall of India.
3. K.S. Trivedi - Probability and Statistics with Reliability and Queuing and Computer Science Applications, Prentice Hall of India.

REFERENCE BOOKS

1. John E Hopcroft and Jefrey D Ullman – Introduction to Automata theory, Languages and Computation – Narosa Publication House, 2004.

PHES2 14	SYSTEM SIMULATION & MODELING

Introduction To Simulation: When Simulation is the Appropriate Tool; When Simulation Is Not Appropriate; Advantages and Disadvantages of Simulation; Areas of Application; Systems and System Environment; Components of a System; Discrete and Continuous Systems; Model of a System; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

Simulation Examples: Characteristics of Queueing Systems; Queueing Notation; Simulation of Queueing Systems; Simulation of Inventory Systems.

General Principles: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling.

Random-Number Generation: Properties of Random Numbers; Generation of Pseudo-Random

Numbers; Techniques for Generating Random Numbers; Tests for Random Numbers.

Random-Variate Generation: Inverse Transform technique: Exponential Distribution, Uniform Distribution, Discrete Distributions; Acceptance-Rejection Technique: Poisson Distribution.

Input Modeling: Data Collection; Identifying the distribution with Data; Parameter Estimation; Goodness of Fit Tests; Selecting Input Models without Data; Multivariate and Time-Series Input Models.

Verification and Validation of Simulation Models: Model Building, Verification and Validation; Verification of Simulation Models; Calibration and Validation of Models.

Output Analysis for a Single Model: Types of Simulations with Respect to Output Analysis; Stochastic Nature of Output Data; Measures of Performance and Their Estimation; Output Analysis for Terminating Simulations; Output Analysis for Steady-State Simulations.

Simulation of Computer Systems: Introduction; Simulation Tools; Model Input; High-Level Computer- System Simulation; CPU Simulation; Memory Simulation.

TEXT BOOK:

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation”, Third Edition, Prentice-Hall India

REFERENCE BOOKS:

1. Averill M. Law, W. David Kelton, “Simulation Modeling and Analysis”, Third Edition, McGraw Hill.

2. Geoffrey Gordon, “System Simulation”, Second Edition, Prentice-Hall India.

PHES215	SOFTWARE ARCHITECTURE

Introduction:

Definition of Software Architecture, Software design levels engineering discipline for Software, the current state of Software Engineering and Architecture

Architecture Styles:

Use of Patterns and styles I Software design, Common architectural styles (Pipes and filters, Data abstraction and object orientation, Event based implicit invocation, Layered systems, Repositories, interpreters) with an example case study

Shared Information Systems:

Detailed study of shared information systems with features like Database integration, Integration of software development environments, Architectural structures of shared information systems

Architectural Design:

Guidelines for Architectural design, Design space and rules, Applying design space with an example, study of Quantified design space

Formal models and specifications:

Architectural formalism and its applications, Study of formalizing various architectural styles like filters, pipes, etc. Formalizing Architectural design Space

Architectural Description Languages:

Requirements of an Architectural Description Language, First-Class Connectors, Adding implicit invocation to traditional programming Languages

Architectural Design Tools:

UniCon – A Universal Connecting Language, Exploiting styles in Architectural design, Architectural interconnection

REFERENCE BOOKS:

1. Mary Shaw & David Garlan, “Software Architecture”, Prentice Hall India Private Limited.
2. Len Bass, Paul Clements, & Rick Kazman, “Software Architecture in Practice”, Second Edition, Pearson Education.

PHES217	NETWORK PROGRAMMING

Perl: As scripting language, programming in Perl

Introduction and Elementary Socket: Introduction Transport Layer Sockets Introduction Elementary TCP Sockets TCP Client/Server Example Elementary SCTP Sockets SCTP Client/Server Example Name and Address Conversions

Advanced Sockets: IPv4 and IPv6 Interoperability Daemon Processes and the inetd Superserver Advanced I/O Functions Unix Domain Protocols Nonblocking I/O ioctl Operations Routing Sockets Key Management Sockets Broadcasting Multicasting Advanced UDP Sockets Advanced SCTP Sockets Out-at-Band Data Signal-Driven I/O Threads IP Options Raw Sockets Data link Access Client/Server Design Alternatives.

Implementation: SMTP, HTTP, FTP

TEXT BOOKS:

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004

2. Barry Nance: "Network Programming in C", PHI 2002

3. Bob Quinn, Dave Shute: "Windows Socket Network Programming", Pearson 2003

4. W. Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition, Pearson, 2004

PHES218 DESIGN OF POWER CONVERTER

Introduction to power electronic applications like UPS, SMPS, power factor converters, motor control, lighting; AC to DC converters; DC to DC converters; Inverters; Drive circuits for power devices; Magnetics for switched mode converters; Thermal design for switched mode converters; current mode control; controller designs; switched mode power supply circuits; regulation in isolated SMPS; magnetic amplifiers; application case studies.

TEXT BOOKS:

1. Ned Mohan Tore. M. Undeland and William. P. Robbins; "Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons, 2003

2. G.C. Chryssis, "High frequency switching power supplies", McGraw Hill, 1989 (2nd Edn.)

3. Umanand. L. & Bhat. S.R. "Design of Magnetic Components for Switched Mode Power Converters", Wiley Eastern Publication, 1992.

PHES219	TESTING AND VERIFICATION OF VLSI CIRCUITS

Scope of testing and verification in VLSI design process; Issues in test and verification of complex chips; embedded cores and SOCs. Fundamentals of VLSI testing, Fault models. Automatic test pattern generation, Design for testability, Scan design, Test interface and boundary scan, System testing and test for SOCs, Iddq testing, Delay fault testing, BIST for testing of logic and memories, Test automation. Design verification techniques based on simulation, analytical and formal approaches, Functional verification, Timing verification, Formal verification, Basics of equivalence checking and model checking, Hardware emulation.

TEXT BOOKS:

1. M. Abramovici, M. A. Breuer and A. D. Friedman, "Digital Systems Testing and Testable Design", IEEE Press, 1990.(Available as JAICO Publication)

2. M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2000 T.Kropf, "Introduction to Formal Hardware Verification", Springer Verlag, 2000.

REFERENCE BOOK

1. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers, 2001.

2. M. Abramovici, M. A. Breuer, A. D. Friedman, “Digital Systems Testing and Testable Design” Piscataway, New Jersey: IEEE Press, 1994,
3. J.DiGiacomo, editor, “VLSI Handbook”, McGraw-Hill, 1989.
4. Samiha Mourad and Yervant Zorian, “Principles of Testing Electronic Systems”, Wiley (2000).
5. D. K. Pradhan (Editor). Fault-Tolerant Computing: Theory and Techniques, Prentice Hall, NJ, 1986. Miczo. Digital Logic Testing and Simulation , John Wiley & Sons, 1987

6. Barry Johnson. Design and Analysis of Fault-Tolerant Digital Systems, Addison Wesley, 1989.

PHES220	HV – DC POWER TRANSMISSION

Review of Power Transmission: Advantages and disadvantages, Problems of stability, corona, power loss. Insulation and co-ordination, economic consideration.

Development of HVDC Technology: Historical development, Technical details of existing system in operation in India and abroad, Advantages and limitations. Principle components, different types of HDVC system, Types of converter circuits and their comparison.

Analysis of 6 - pulse and 12 - pulse converters: Effects of source inductance, equivalent circuits and characteristics.

Control Strategies: Analogue and digital controllers, HVDC link, operation, compounding and regulation. Fault development and protection schemes, DC reactor and its design Consideration.

Harmonics: Design of filter circuits for AC and DC sides, corona, DC cables over voltages and insulation coordination Multi terminal HVDC system.

Simulation of HVDC Systems: FACTS. Stability analyses of AC-DC inter- connected systems, static VAR compensation.

TEXT BOOKS:

1. Adamson C, Hingorani N G "High voltage direct current power transmission"
1. Grraway Ltd. London 1960 .
2. Kimbark E. W "Direct current transmission Vol 1 ", Wiley 1971 .
3. Arrillaga "High voltage direct current transmission", Peter Pregrinus, London 1983 .
4. Padiyar K R "High voltage direct current transmission" .
5. Padiyar K R "HVDC Power transmission systems : Technology and System Interactions", New Age, 2003 .

PHES221 ERROR CONTROL CODING

Introduction to Algebra: Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2^m) and its basic properties, Computation using Galois Field GF (2^m) Arithmetic, Vector spaces and Matrices.

Linear Block Codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes, Reed – Muller codes, The (24, 12) Golay code, Product codes and Interleaved codes.

Cyclic Codes: Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes – Encoding using Feed back shift register circuits, Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder, Error trapping decoding, Cyclic Hamming codes, The (23, 12) Golay code, Shortened cyclic codes.

BCH Codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non – binary BCH codes: q – ary Linear Block Codes, Primitive BCH codes over GF (q), Reed – Solomon Codes, Decoding of Non – Binary BCH and RS codes: The Berlekamp - Massey Algorithm.

Majority Logic Decodable Codes: One – Step Majority logic decoding, one – step Majority logic decodable Codes, Two – step Majority logic decoding, Multiple – step Majority logic decoding. **Convolutional Codes:** Encoding of Convolutional codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding

Concatenated Codes & Turbo Codes: Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes

Burst – Error – Correcting Codes: Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes, Convolutional codes for Burst Error correction.

TEXT BOOKS:

1. Shu Lin & Daniel J. Costello, Jr. "Error Control Coding" Pearson / Prentice Hall, Second Edition, 2004. (Major Reference)

2. Blahut, R.E. "Theory and Practice of Error Control Codes" Addison Wesley, 1984

3. F. J. Mac Williams and N.J.A. Slone, "The theory of error correcting codes" North Holland, 1977

REFERENCE BOOKS:

1. Peterson, W.W. & Weldon, E.J. "Error-Correcting Codes" MIT Press, Cambridge. Massachusetts, 1972

2. Das, J; Mullick, S.K. & Chaterjee.P.K, "Principles of Digital Communications" Wiley Eastern Ltd. New Delhi, 1986.

3. satyanarayana p.s., "concepts of information theory & coding Bangalore, 2005

PHES222 ASIC DESIGN

Note All Designs Will Be Based On VHDL

Introduction: Full Custom with ASIC, Semi custom ASICS, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, structured get array, Programmable logic device, FPGA design flow, ASIC cell libraries

Data logic cells: Data Path Elements, Adders, Multiplier, Arithmetic Operator, I/O cell, Cell Compilers

ASIC library Design: Logical effort: practicing delay, logical area and logical efficiency logical paths, multi stage cells, optimum delay, optimum no. of stages, library cell design.

Low-level design entry: Schematic Entry: Hierarchical design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances and buses, Edit in place attributes, Netlist, screener, Back annotation

Programmable ASIC: programmable ASIC logic cell, ASIC I/O cell

A brief introduction to low level design language: an introduction to EDIF, PLA Tools, and an introduction to CFI designs representation. Half gate ASIC. Introduction to Synthesis and Simulation;

ASIC Construction Floor planning and placement and routing: Physical Design, CAD Tools, System Partitioning, Estimating ASIC size, partitioning methods. Floor planning tools, I/O and power planning, clock planning, placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow global Routing, Local Routing, Detail Routing, Special Routing, Circuit Extraction and DRC.

TEXT BOOKS:

1. Mohammed Ismail, Terri Fiez, "Analog VLSI signal and Information Processing", McGraw-Hill International Editions, 1994.
2. M. J. S. Smith, - "Application - Specific Integrated Circuits" – Pearson Education, 2003
3. Malcolm R.Haskard; Lan. C. May, "Analog VLSI Design - NMOS and CMOS" Prentice Hall, 1998.
4. Randall L Geiger, Phillip E. Allen, "Noel K.Strader, VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Company, 1990.

REFERENCE BOOKS:

1. Jose E.France, Yannis Tsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and signal processing", Prentice Hall, 1994.
2. Andrew Brown, - "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991.
3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, "Field Programmable Gate Arrays"- Kluwer Academic Publishers, 1992.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, 1994.
5. S. Y. Kung, H. J. Whilo House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.
6. Jose E. France, Yannis Tsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

PHES223	DETECTION AND ESTIMATION

Classical Detection and Estimation Theory: Introduction, simple binary hypothesis tests, M Hypotheses, estimation theory, composite hypotheses, general Gaussian problem, performance bounds and approximations.

Representations of Random Processes: Introduction, orthogonal representations, random process characterization, homogenous integral equations and eigen-functions, periodic processes, spectral decomposition, vector random processes.

Detection of Signals – Estimation of Signal Parameters: Introduction, detection and estimation in white Gaussian noise, detection and estimation in nonwhite Gaussian noise, signals with unwanted parameters, multiple channels and multiple parameter estimation.

Estimation of Continuous Waveforms: Introduction, derivation of estimator equations, a lower bound on the mean-square estimation error, multidimensional waveform estimation, nonrandom waveform estimation.

Linear Estimation: Properties of optimum processors, realizable linear filters, Kalman-Bucy filters, fundamental role of optimum linear filters.

TEXT BOOKS:

1. Harry L. Van Trees, “Detection, Estimation, and Modulation Theory,” Part I, John Wiley & Sons, USA, 2001.
2. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan, "Introduction to Statistical Signal Processing with Applications,” Pearson Education (Asia) Pte. Ltd. /Prentice Hall of India, 2003.
3. Steven M. Kay, "Fundamentals of Statistical Signal Processing," Volume I: "Estimation Theory", Prentice Hall, USA, 1998;
4. Steven M. Kay, "Fundamentals of Statistical Signal Processing, "Volume II: "Detection Theory," Prentice Hall, USA, 1998.

REFERENCE BOOKS:

1. Louis L Scharf, “Statistical Signal Processing: Detection, Estimation and Time series Analysis”, Addison Wesley, 1991

K Sam Shanmugam, Arthur M Breipohl, “Random Signals: Detection, Estimation and Data Analysis”, John Wiley & Sons, 1998

PHES224	ERGONOMICS

Introduction: Principles, Scope and Application of Ergonomics **Anthropometry:** Basic definitions, Body dimensions and importance.

Musculo Skeletal disorders: Muscular energy, Dynamic and static effort, postures, Types of disorders their courses and remedies, fatigue, Boredom.

Workstation Design: Design of furniture and lighting computer and office workstations, Operations theatre equipments and their arrangement, Dental chair, Wheel chair.

Environmental Factors: Effect of noise and vibration on the human body, Remedies — Measurements of vibration and noise levels, Effect of temperature and humidity on human body.

TEXT BOOKS:

1. Grandjaen, "Fitting the task to Man", Taylor Pub, 1982.
2. Sanders, Human factors in Engg. & Design, MGH, 1993
3. D. Majumdar and W. Selvamurthy (eds), "Advances in Ergonomics, Occupational Health and Safety", New Age International (P) Ltd, 4835/24, Ansari Road, Daryaganj, New Delhi 110 002. 2000.
4. Stanton, Neville et al. "Handbook of human factors and ergonomics methods", New York: CRC Press, 2005.

REFERENCE BOOKS:

1. Bridger, "Introduction of Ergonomics", Tata McGraw Hill-1995.
2. Shah, H.S, "Work study and Ergonomics", Dhanpat Rai & Sons-1992 .
3. KROEMER, K. E. and E. GRANDJEAN, "Fitting the Task to the Human: A Textbook of Occupational Ergonomics" 5th ed.Taylor & Francis - ACGIH Publ. #9810, 1997 .
4. KONZ, S, "Work Design: Industrial Ergonomics", 5th ed. Holcomb Hathaway Publishers - ACGIH Publ. #9145, 2000

Introduction to embedded system: An embedded system, processor, hardware unit, soft ware embedded into a system, Example of an embedded system, OS services, I/O, N/W, O/S, Real time and embedded OS.

Processor and memory organization: Structural unit in as processor, processor selection for an embedded systems. Memory devices, memory selection for an embedded system, allocation of memory to program statements and blocks and memory map of a system. Direct memory accesses.

Devices and buses for device networks: I/O devices, serial communication using FC, CAN devices, device drivers, parallel port device driver in a system, serial port device driver in a system, device driver for internal programmable timing devices, interrupt servicing mechanism, V context and periodsfor switching networked I/O devices using ISA, PCI deadline and interrupt latency and advanced buses.

Programming concepts and embedded programming in C: Microchip PlC microcontroller/Motorola MC68HC1I: Introduction, CPU architecture registers instruction sets, addressing modes, timers. Interrupts, ITC bus operation, serial EEPROM, ADC, UART, serial programming /parallel slave port

Program modeling concepts in single and multiprocessor systems: software development process, modeling process for software analysis before software implementation, programming model for the event controlled or response time constrained real time programs, modeling of multiprocessor system.

Intel-process communication and synchronization of processors tasks: and threads; multiple process in an application, problems of sharing data by multiple tasks and routines, inter process communications. RTOS task scheduling models interrupt literacy and response times, performance metric in scheduling models, standardization of RTOS, list of basic functions, fifteen point strategy for synchronization.

TEXT BOOKS:

1. Raj Kamal, "Embedded systems Architecture, Programming and design", TMH., 2004
2. I B Peatman, "Design with PlC microcontroller", Pearson Education Asia, 2004
3. J. W. Valvano, "Embedded Microcomputer system – Real time interfacing", Thomson Learning Publishing, 2000
4. Jane W. S., Liu, "Real time systems", Pearson Education Asia Pub, 2004

PHES226	DIGITAL SYSTEM DESIGN USING VHDL

Specification of combinational systems using VHDL, Introduction to VHDL, Basic language element of VHDL, Behavioral Modeling, Data flow modeling, Structural modeling, Subprograms and overloading, VHDL description of gates. Description and design of sequential circuits using VHDL, Standard combinational modules, Design of a Serial Adder with Accumulator, State Graph for Control Network, design of a Binary Multiplier, Multiplication of a Signed Binary Number, Design of a Binary Divider. Register- transfer level systems, Execution Graph, Organization of System, Implementation of RTL Systems, Analysis of RTL Systems, and Design of RTL Systems. Data Subsystems, Storage Modules, Functional Modules, Data paths, Control Subsystems, Micro programmed Controller, Structure of a micro programmed controller, Micro instruction Format, Micro instruction sequencing, Micro instruction Timing, Basic component of a micro system, memory subsystem. I/O subsystem, Processors, Operation of the computer and cycle time, Binary Decoder, Binary Encoder, Multiplexers and Demultiplexers, Floating Point Arithmetic-Representation of Floating Point Number, Floating Point Multiplication

TEXT BOOKS:

1. J. Bhaskar, “A VHDL Primer”, Addison Wesley, 1999.
2. M. Ercegovac, T. Lang and L.J. Moreno, ”Introduction to Digital Systems”, Wiley,2000
3. C. H. Roth, “Digital System Design using VHDL”, Thomson Learning,2001

REFERENCE BOOKS:

1. John. F. Wakerly, “Digital Design-Principles and Practices”, PHI, 3rd Edition updated, 2005
2. Douglas Perry, “VHDL: Programming by Example”, TMH, 2002
3. Michae John Sebastian Smith, “Application-Specific Integrated Circuits”, Addison-Wesley, 1997
4. Navabi, “VHDL-Analysis and Modeling of Digital Systems”, MGH, 1998
5. Pedroni, “Circuit Design with VHDL”, PHI, 2005

PHES227	IMAGE AND VIDEO PROCESSING

Introduction: 2D systems, Mathematical preliminaries – Fourier Transform, Z Transform, Optical & Modulation transfer function, Matrix theory, Random signals, Discrete Random fields, Spectral density function.

Image Perception: Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome vision models, Fidelity criteria, Color representation, Chromaticity diagram, Color coordinate systems, Color difference measures, Color vision model, Temporal properties of vision.

Image Sampling and Quantization: Introduction, 2D sampling theory, Limitations in sampling & reconstruction, Quantization, Optimal quantizer, Compander, Visual quantization.

Image Transforms: Introduction, 2D orthogonal & unitary transforms, Properties of unitary transforms, DFT, DCT, DST, Hadamard, Haar, Slant, KLT, SVD transform.

Image Representation by Stochastic Models: Introduction, one-dimensional Causal models, AR models, Non-causal representations, linear prediction in two dimensions.

Image Enhancement: Point operations, Histogram modeling, spatial operations, Transform operations, Multi-spectral image enhancement, false color and Pseudo-color, Color Image enhancement.

Image Filtering & Restoration: Image observation models, Inverse & Wiener filtering, Fourier Domain filters, Smoothing splines and interpolation, Least squares filters, generalized inverse, SVD and Iterative methods, Maximum entropy restoration, Bayesian methods, Coordinate transformation & geometric correction, Blind de-convolution.

Image Analysis & Computer Vision: Spatial feature extraction, Transform features, Edge detection, Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation, Classification Techniques.

Image Reconstruction from Projections: Introduction, Radon Transform, Back projection operator, Projection theorem, Inverse Radon transform, Fourier reconstruction, Fan beam reconstruction, 3D tomography.

Image Data Compression: Introduction, Pixel coding, Predictive techniques, Transform coding, Inter-frame coding, coding of two tone images, Image compression standards.

Video Processing: Fundamental Concepts in Video – Types of video signals, Analog video, Digital video, Color models in video, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, Content based video indexing.

TEXT BOOKS:

1. A. K. Jain**,** "Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.

2. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

3. R. C. Gonzalez and R. E. Woods, "Digital Image Processing," 2nd edition, Pearson Education (Asia) Pte. Ltd/Prentice Hall of India, 2004.

4. M. Tekalp, "Digital Video Processing," Prentice Hall, USA, 1995.

	PHES228 ETHERNET TECHNOLOGY

Introduction: Introduction to Ethernet, The Evolution of Ethernet, The Ethernet System, The Media Access Control Protocol The media Access Control Protocol Full Duplex Ethernet Auto-Negotiation

Ethernet Media Systems: Ethernet Media Fundamentals Twisted-Pair Media System (10Base-T) Fiber Optic Media System (10Base-F) Fast Ethernet Twisted-Pair Media System (100Base-TX) Fast Ethernet Fiber Optic Media System (100Base-FX) Gigabit Ethernet Twisted-Pair Media System (1000Base-T) Gigabit Ethernet Fiber Optic Media System (1000Base-X) Multi-Segment Configuration Guidelines

Building Your Ethernet System: Structured Cabling Twisted-Pair Cables and Connectors Fiber Optic Cables and Connectors Ethernet Repeater Hubs Ethernet Switching Hubs

Performance and Troubleshooting: Ethernet Performance Troubleshooting

TEXT BOOKS:

1. Charles E. Spurgeon: “Ethernet – The Definitive Guide”, O’Reilly 2004

2. Rich Seifert: “Gigabit Ethernet”, Addison-Wesley 1998

PHES229 VLSI SYSTEM AND ARCHITECTURE

Behavior and Architecture: Dedicated and Programmable VLSI architectures, Instruction sets and through enhancement techniques (Parallelism. pipelining. cache, etc.)

CISC Architecture Concepts: Typical CISC instruction set and its VLSI implementation, RT-level optimization through hardware flow charting, Design of the execution unit, Design of the control part (micro programmed and hardwired), handling exceptions: Instruction boundary interrupts, immediate interrupts and traps.

RISC Architecture concepts: Typical RISC instruction set and its VLSI implementation, Execution pipeline, Benefits and problems of pipelined execution, Hazards of various types of pipeline stalling, concepts of scheduling (Static and dynamic) and forwarding to reduce / minimize pipeline stalls Exceptions in pipelined processors

DSP architecture concepts: Typical DSP instruction set and its VLSI implementation

Dedicated Hardware Architecture Concepts: Example and Case studies

Dedicated DSP architecture Concepts: Synthesis, Scheduling and Resource allocation, Conventional Residue number, distributed arithmetic architecture

Future Trends

TEXT BOOKS:

1. GABlaauw and F P Brooks, "Computer Architecture: Concepts and Evolution" Addison Wesley, 1997
2. D A Patterson and J L Hennessy, "Computer organization and Design: Hardware/Software interface" Second Edition, Margan Kaufmann, 1998
3. D A Patterson and I L Hennessy, "Computer Architecture: A Quantitative approach", Second edition, Margon Kaufmann, 1996
4. W. Stallings, "Computer Organization and architecture: Designing for Performance", Fourth Edition, PH, 1996

PHES230	PROTOCOL ENGINEERING

Communication model, software, subsystems, protocol development methods, protocol engineering process ; Network reference model: services and interfaces, protocol functions, OSI and TCP/IP model, Host to network interface protocols, network protocols transport protocols, application protocols; Protocol specifications: Components of protocol, service specifications, entity specifications, interface and interactions, multimedia protocol specifications, HDLC, ABP and RSVP specifications; SDL: features, communication system using SDL, examples of SDL based protocol specifications, other specification languages; Protocol verification, FSM based verification, validation, design errors,
validation approaches, verification and validation of ABP using SDL; Conformance testing, framework, conformance test architectures, test sequence generation methods, TTCN, multimedia testing, MPLS testing; Performance testing methods, testing of TCP and OSPF, interoperability testing, scalability testing; Protocol synthesis algorithms, resynthesis, protocol implementation requirements, methods of implementation, protocol compilers, tools for protocol engineering

Assignments / practical can be chosen from the Appendix of the mentioned reference books, particularly –book 1.

TEXT BOOKS:

1. Pallapa Venkataram, Sunil Kumar Manvi, “Communication Protocol Engineering”, PHI, 2004.

2. G. J. Holtzmann, “Design and validation of Computer protocols”, Prentice hall, 1991 (available on web)

3. K. Tarnay, “Protocol specification and testing”, Plenum press, 1991

PHES231	SOFT COMPUTING

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

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

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

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

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

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.

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.

REFERENCE BOOKS:

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.

GROUP II

VACUUM AND THIN FILM SCIENCE AND TECHNOLOGY

Lecture hours /Week : 04 **Exam hours : 03**
Total Lecture Hours : 60 **Exam Marks :100**
Practical/Field work /Assignment- hours/week : 02

Vacuum Science and Technology: Introduction and vacuum requirements. Pumps, Gauges, Pressure control. Gas Kinetics - Kinetic theory of gases – Low-vacuum pumps – High-vacuum pumps – Gauging and measurement – Pressure control – Composition control

Thermodynamics and Kinetics of Thin Film Formation: a) Clean Surfaces i) Thermodynamics ii) Crystal structure iii) Electronic structure
b) Adsorption i) Physisorption ii) Chemisorption iii) Phase transitions and reconstructions
c) Nucleation and Growth i) Nucleation ii) Growth modes iii) Stability iv) Capillarity and surface energetics v) Coarsening and ripening vi) Coalescence vii) Kinetic processes in thin films
d) Single Crystals i) Homoepitaxy ii) Heteroepitaxy - Misfit strain - Defect formation
e) Polycrystals i) Zone Models ii) Grain Growth, Size evolution iii) Surface morphology iv) Texture v) Multilayers
f) Amorphous films g) Stresses in thin Films h) Microstructure

Science and Technology of Thin Film Growth: Growth Techniques: i) Liquid Phase Epitaxy ii) Physical Vapor Deposition (PVD) Introduction, overview, and history – Evaporation (Thermal; e-Beam; Pulsed Laser Deposition (PLD); Molecular Beam Epitaxy (MBE) – Sputter deposition (DC; RF; Pulsed-DC; Magnetron; Reactive; Ion beam); Introduction to plasmas - Collision cascade (target and substrate) - Deposition Rate; Composition; Uniformity - Reactive sputtering and process control. iii) Chemical Vapor Deposition – Atmospheric. Pressure; Low Pressure; Plasma-enhanced; Epitxy – VPE and Organometallic VPE – Atomic Layer Deposition (ALD) – Introduction, overview, and history – Thermodynamics and reaction kinetics – Gas and component transport – Adatom transport and surface effects; Reactor geometry - uniformity - step coverage; Safety; Growth processes; structural zone models – Epitaxial, polycrystalline, and amorphous films – Crystal texture; surface morphology; Structure and Properties of Films – Mechanical; Electronic; Optical; iv) Electrochemical – plating methods.

Thin Film Characterization: Characterization Techniques - Structure and Properties of Films – Mechanical – Wafer bow or beam deflection test – Tape test – Nanoindentation – Tribology and scratch testing; Film and surface structure – Profilometry - Optical microscopy - electron microscopy (SEM or TEM) - X-ray diffraction (XRD) - scanning probe microscopy (SPM)/atomic force microscopy (AFM)/ scanning tunneling microscopy (STM); Film composition - Energy dispersive X-ray analysis (EDX) - X-ray photoelectron spectroscopy (XPS)/Auger electron spectroscopy (AES) - Secondary ion mass spectrometry (SIMS) - Rutherford backscattering spectroscopy (RBS); Electronic – Four-point probe – Hall measurements (van der Pauw geometry) – Transmission line measurements (TLM) – Current-voltage (I-V) / Capacitance-Voltage (C-V); Optical - Spectrophotometry

(transmission/reflection) – Ellipsometry – Fourier transform infrared spectroscopy (FT-IR) – Photoluminescence/Cathodoluminescence.

Applications: Electronics - Conductors; Semiconductors; Micro and Optoelectronic Devices; insulators; piezoelectrics; Optoelectronics - (Anti)reflective coatings; filters, organic semiconductor LEDs; decorative, data storage, waveguides, optical band gaps, digital optics; Magnetic - Data storage layers; magneto-resistive heads; Mechanical - Tribological (wear-resistant) coatings - Micro-electro-mechanical systems (MEMS) – Smart Sensors.

Course Text Books:

1. John A. Venables, Introduction to Surface and Thin Films Processes, Cambridge University Press, 2000.
2. M. Ohring, Materials Science of Thin Films: Deposition and Structure, 2002.
3. Joseph I. Goldstein and Harvey Yakowitz, Ed., Practical Scanning Electron Microscopy – Electron and Ion Microprobe Analysis, Plenum Press, New York (1975).
4. Leon I. Maissel and Reinhard Glang, Ed., Handbook of Thin Film Technology, McGraw-Hill Publishing Company, New Delhi (1970)

Reference Books:

1. Electronic Thin Film Science for Electrical Engineers and Materials Scientists, by K-N Tu, J. W. Mayer and L. C. Feldman, 1992.
2. John O'Hanlon, A User's Guide to Vacuum Technology
3. Elements of X-ray Diffraction, 2nd Edition, by B. D. Cullity, 1978.
4. Introduction to Dislocations, by D. Hull and D. J. Bacon, 4th Edition, 2001.
5. Jeffrey Tsao, Materials Fundamentals of Molecular Beam Epitaxy, Academic Press, 1993.
6. Andrew Zangwill, Physics at Surfaces, Cambridge University Press, 1992.
7. Zbigniew D. Jastrzebski, The Nature and Proprties of Engineering Materials, John Wiley & Sons Inc., New York (1976).
8. Additional and current papers from the literature where appropriate.

Suggested Subject relevant to the chosen area : Group :2

Sensors & Applications

Chapter 1. Measurement, Instrumentation and Calibration

Introduction, classification of transducers, Performance Characteristics-Static & Dynamic characteristics. Errors in Measurement - Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Calibration and Standards - Process of Calibration, Classification for standards, Standards for Calibration.

Chapter2. Mechanical Transducers

Temperature Measurement : Introduction, Basics of temperature Measurement: Absolute thermodynamics or Kelvin scale, Bimetallic Element.

Pressure, Force and Torque

Basics of Pressure measurement - Manometers, Ring-balance Manometer, Bell-type Manometer, Thin Plate Diaphragms ,Membranes, Corrugated Diaphragms and Capsules, Bellows Element, Bourdon tube Elements. Basics of Force Measurements- Helical spiral springs, Cantilever beams, Beams held at both ends, Diaphragm elements, Column – type load cells, Proving ring type load cells.

Basics of Torque measurement - Torsion bar, Flat Spiral Spring.

Basics of flow measurement - Pitot-static tube, Flow obstruction elements, Centrifugal force element, Static vane-systems, Rotating vane systems, Rota meter-float system. Displacement –to- pressure transducer, Seismic displacement transducers.

Chapter3 Passive electrical transducer

Introduction, Resistive transducers - Resistance thermometers, Hot wire resistance transducers, Resistive displacement transducer, Resistive strain transducer, Resistive pressure transducer, Resistive optical radiation transducers.

Inductive transducers -Inductive thickness transducers, Inductive displacement transducers, Movable core-type Inductive transducers, Eddy current type Inductive transducers.

Capacitive transducers - Capacitive thickness transducers, Capacitive displacement transducer, Capacitive moisture transducers.

Chapter 4 Active Electrical Transducers

Introduction, Thermoelectric Transducers, Thermoelectric Phenomenon, Common Thermocouple systems, Piezoelectric Transducers: Piezoelectric Phenomenon, Piezoelectric Materials, Piezoelectric Force Transducers, Piezoelectric strain transducers, Piezoelectric Torque Transducers, Piezoelectric pressure Transducers, Piezoelectric Acceleration Transducers.

Magnetostrictive Transducers - Magnetostrictive Force transducers, Magnetostrictive Acceleration Transducers, Magnetostrictive Torsion Transducers. Hall Effect Transducers- Application of Hall Transducers.

Electromechanical transducers - Tachometers, Variable reluctance Tachometers, Electrodynamic vibration Transducers, Electromagnetic Pressure Transducers, electromagnetic Flowmeter.

Photoelectric transducers - Photoelectric phenomenon, Photoconductive transducers, photo voltaic transducers, photo emissive transducers.

Ionization transducers - Ionization vacuum Gauges, Ionization displacement transducers, nuclear radiation transducers, radioactive vacuum Gauge, radioactive thickness Gauge, radioactive level Gauges.

Digital Transducers - Digital Displacement transducers, Digital tachometers, Transducer oscillators.

Electrochemical transducers - Basics of electrode potentials, Reference Electrodes, Indicator electrodes, Measurement of pH, Measurement of Bioelectric signals.

Text Book :

1. Transducers and Instrumentation - DVS Murty, Prentice Hall of India Private Limited

Reference Books:

2. Measurement systems – Ernest O, Doebelin
3. Instrument transducers : an introduction to their performance & design – Neubert, Hermann K. P
4. Intelligent Instrumentation – George C. Barney

PHES301	POWER SYSTEM INSTRUMENTATION

Measurement of large currents and voltages, current and voltage transformers, design equations and operational characteristics, error compensation schemes.

Protective CTs and PTs, overload and transient performance, standard specification of instrument transformers. **15 Hrs.**

DC current transformers, measurement of power and energy, torque equation of induction type energy meter, parasitic torques and their minimization, IS specifications, analog and digital KVAr meters.

Tele-metering, remote terminal units, data acquisition systems, tri-vector meters, event and disturbance recorders.

REFERENCE BOOKS:

1. Cooper Helfrick, "Electrical Instrumentation and Measuring Techniques", Prentice Hall India, 1986

2. D. C. Nakra and K. K. Chowdhry, "Instrumentation, Measurement, and Analysis", Tata McGraw Hill Publishing Co., 1984.

3. Selected topics from IEEE, AIEE and CIGRE Journals.

PHES302 ALTERNATE ENERGY SOURCES

Introduction to energy sources, need for non-conventional energy sources. Geothermal Energy: Introduction, origin and types of geothermal energy, operational and environmental problems, vapor dominated systems, liquid dominated systems, (flashed steam, binary cycle, total flow concept), petro-thermal systems, hybrid geothermal - fossil systems.

Solar Energy: Introduction, extra terrestrial and terrestrial solar radiation, solar-electric conversion systems, solar thermal central receiver systems, the Heliostats, the receiver, the heat transport system, the thermal storage system, distributed solar thermal systems, other solar thermal power systems, solar ponds, photo voltaic energy conversion, solid state principles, semiconductors, the solar cell, photo-voltaic energy storage, satellite solar power systems.

Wind Energy: Introduction, principles of wind power, wind turbine operation, site characteristics, new developments: small machines, large machines.The magnetic effect, Madras rotor wind machine, The darrius machine, other wind turbine designs .Energy From the Oceans: Introduction, ocean temperature differences, the open or Claude cycle, modification of the open OTEC cycle, the closed or Anderson cycle, OTEC cycle, recent OTEC .cycle developments, ocean waves, wave motion, energy and power from waves, wave-energy conversion by floats, high pressure accumulation wave machines, other wave machines, the tides, the simple single-pool tidal system, the modified single-pool tidal system, the two-pool tidal system .
Energy Storage: Energy storage systems, pumped hydro, compressed air storage, energy storage by (i) flywheels (ii) electrical battery (iii) super conducting magnet, (iv) latent heat (v) chemical reaction (vi) thermal sensing.

REFERENCE BOOKS:

1. M. M. El-Wakil, “Power Plant Technology”, McGraw Hill International edition, 1984.
2. B. G. A. Skrotzki and W. A. Vopat, “Power station engineering and Economy”, TMH, 1990.
3. Selected topics from IEEE, AIEE and CIGRE Journals.

DISCUSSION TOPICS

General layout and characteristics of hydel, thermal and nuclear power plants, introduction to non-conventional power generation, load forecasting, load curves, load duration curves, selection of generating units.

Simulation methodologies of complex power systems and transducers

Transient behavior of transducers

Signal conditioning and sampling for on-line relay applications

Algorithms for protective relaying

Digital protection schemes for transmission lines, generators and transformers

Substation control

Microprocessor based testing of relays, hardware considerations.

REFERENCE BOOKS:

1. C. Russell Mason, "The Art and Science of Protective Relaying", Wiley Eastern Ltd., 1991.

2. Ravindranath and Chander, "Power System Protection and Switchgear", Wiley Eastern Ltd., 1990.

3. T. S. Madhava Rao, "Power System Protection - Static Relays", TMH, 1979.

4. A. R. Van. C. Warrington, "Protective Relays - their Theory and Practice", Vol. 1 and 2, Chapman and Hall Limited, 1969.

5. Arun G. Phadke and James Thorpe, "Computer Relaying for Power Systems", John Wiley Inc., 1988.

6. IEEE Tutorial course on "Computer Relaying", 1979.

7. IEEE Tutorial course on "Microprocessor Relays and Protection Systems", 1987.

Modern trends in power transmission - computer aided calculation of line parameters - HV cables, Voltage Control - series and shunt compensation using capacitors - tuning of transmission lines and its effect on SIL and V,I profiles.

HVDC transmission - applications, control of converters, converter and line fault protection, multi-terminal DC transmission, introduction to AC-DC system interaction.

Concepts of FACTS, SVC, methods of analysis of SVC and FACTS controllers, static condensers, harmonics and filters.

REFERENCE BOOKS:

1 K. R. Padiyar, "HVDC Power Transmission", Wiley Eastern Ltd., 1990.

2 R. D. Begamudre, "Extra-High Voltage AC transmission engineering", Wiley Eastern Ltd., 1990.

3 E. W. Kimbark, "Direct Current Transmission", Vol1, John Wiley, 1971.

4 N. G. Hingorani, "HV Power Electronics and Flexible AC Transmission Systems", IEEE Power Engineering Review, July 1988.

5 J. Arrillaga, "High Voltage DC Transmission" Peter Peregrinus, 1983.

6 Selected topics from IEEE, AIEE and CIGRE Journals.

PHES307 Parallel Processing in Power Systems

Parallel computing vs distributed computing, scope and issues in parallel computing, performance matrices and the scalability of parallel systems, Taxonomy of parallel architectures: dynamic and static interconnection networks, architectural models for parallel algorithm design, Simple message transfer schemes: one-to-all and all-to-all broadcast, prefix sums, one-to-all and all-to-all personalized communication.

Dense Matrix Algorithms: Mapping of matrices onto processors, matrix transposition and multiplication, matrix-vector multiplication, solution of linear equations, Solving Sparse Systems of Linear Equations: Storage schemes for sparse matrices, direct and iterative methods for sparse linear systems, multi-grid methods, Parallel programming paradigms.

Pimitives for the message passing programming paradigm, data parallel languages, primitives for shared address space programming paradigm, Study of parallelism in power system algorithms: parallel algorithms for load flow analysis, fault analysis, contingency evaluation and transient stability studies.

REFERENCE BOOKS:

1. Vipin Kumar, Ananth Grama, Anshul Gupta, and George Karypis - Introduction to Parallel Computing - Design and Analysis of Algorithms, The Benjamin/Cummings Publishing Company, 1994.

3. M.J.Quinn - Parallel Computing - Theory and Practice, McGraw-Hill Publishing Company, 1994.

4. Kai Hwang - Advanced Computer Architecture - Parallelism, Scalability, Programmability, McGraw-Hill Publishing Company, 1993.

5. S. Lakshmivarahan and Sudarshan K.Dhall - Analysis and Design of Parallel Algorithms - Arithmetic and Matrix Problems , McGraw-Hill Publishing Company, 1990.

6. Selected topics from IEEE, AIEE and CIGRE Journals.

Constituents of the atmosphere, oxides of sulphur, nitrogen, and Carbon, Green house effect, acid precipitation, particulate matter, flue-gas desulfurization systems, electrostatic precipitators, fabric filters and bag houses, thermal pollution, natural and artificial radio activity, nuclear power and the environment, radiations from nuclear power plant effluents, high level wastes. Ecological considerations, power transmission lines - right of way

Socio economical impacts of different types of power plants, policies to promote environmentally viable technologies for power generation, environmental implications of bio-mass, restructuring of power sector for environmental benefits

REFERENCE BOOKS:

1. M. M. El-Wakil, “Power Plant Technology”, McGraw Hill International edition, 1984.

2. B. G. A. Skrotzki and W. A. Vopat, “Power station engineering and Economy”, TMH, 1990.

3. B. R. Gupta, “Generation of Electrical Energy”, Eurasia publishing house private limited, New Delhi, 1983.

4. Standard hand books on plant engineering.

5. Selected topics from Journals.

PHES309 OPTICAL COMMUNICATIONS &FIBER OPTIC NETWORKS

Introduction to Fiber Optics: A Personal View, The Roots of Fiber Optics, Fibers in Communications, Basic Fiber Concepts, The Emerging Optical Network, Fiber Terms and Terminology. Fundamentals of Fiber Optic components: Basics of Optics, Light Guiding, Fiber Transmission, Other Optical Components .

Fundamentals of Communications: Communication Concepts, System Functions, Signal Formats, Analog and Digital Communications, Communications Services, Fiber-Optic communication Equipment.

Properties of Optical Fibers : Fiber Attenuation, Light Collection and Propagation, Dispersion, Nonlinear Effects, Mechanical Properties. Couplers and other passive components : Coupler Concepts and Applications, Coupler Characteristics, Coupler Types and Technologies, Attenuators, Optical Isolators, Optical Circulators.

Wavelength-division multiplexing optics : WDM Requirements, Optical Filters and WDM, WDM Technologies, building Multiplexers and Demultiplexers. Fiber-optic sensors : Fiber-Sensing Concepts, Fiber Optic Probes, Fiber-Sensing Mechanisms, Some Fiber Sensor Examples, Fiber Optic Gyroscopes, Smart Skins and Structures. Fiber Optic Measurements : Basics of Optical Power Measurement, Wavelength and Frequency Measurements, Phase and Interference Measurements, Polarization Measurements, Time and Bandwidth Measurements, Signal Quality Measurements, Fiber Specific Measurements. Fiber System Standards: Why Standards Are Needed, Families of Standards, Layers of Standards, Transmission Fort Concepts, Interchange Standards, Fiber-Transmission Standards, Video Standards, Optical Networking Standards.

Global Telecommunications Applications: Defining Telecommunications, The Global Telecommunications Network, Putting Networks Together, Submarine Cables, Long-Haul Terrestrial Systems, Types of long-distance Services.

Video Transmission: Video Basics, Transmission Media, Cable Television Networks, Digital Television and Cable Systems, Other Video Applications.

Mobile Fiber-Optic Communications: Mobile Systems, Remotely Controlled Robotic Vehicles, Fibers in Aircraft, Shipboard Fiber-Optic Networks, Automotive Fiber Optics.

TEXT BOOKS

Understanding Fiber Optics, 4th Edition by JeffHecht, PHI 1999.
Optical Networks - Uyless Black, Pearson Education Asia, 2002.

REFERENCE BOOKS

Rajiv Ramaswami and Kumar N.Sivaranjan, Optical Networks - A Practical Perspective Morgan Kaufuann, 2000.
Paul E.Green Jr., Fiber Optic Network, Prentice Hall, 1993.

PHES310 DIGITAL IMAGE PROCESSING & COMPUTER VISION

Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

Digital Image Fundamentals :Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operation

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening spatial Filters, Combining Spatial Enhancement Methods

Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier. Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression, Wavelets Background and Multiresolution Expansions.

Image Compression: Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards.

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation

PHES311	OBJECT ORIENTED ANALYSIS & DESIGN

Introduction to Object Orientation: Real-world Domains, Object oriented approach and technology, Objects Instances and Concepts. Objects and Classes of Objects Generalized Object-Oriented Software Development Cycle, Object oriented Programming language. Object-Oriented Analysis of a Real-World Domain Object Model. The Notion of Encapsulation and Information Hiding, Object Identity: Entity and Attributes, Data and Knowledge: The Notion of Inheritance, Relationships between Objects: Association, Generalization / Specialization, Aggregation , Objects and States. Dynamic Behavior of Objects

Object oriented Analysis: Analysis an introduction, Techniques for information Gathering for RA, Use case - Driven OO Analysis, OO concepts and principles. Identifying the elements of an Object model. Management of OO software projects. Object oriented analysis, domain analysis, generic components of OO analysis model, object behavior model

Object-Oriented System Design: Design Introduction, System Design Concepts and the Object-Oriented Approach Conventional Vs OO approaches, Design issues, the generic components of the 00 design model, the system design process, the object design process, OOD landscape, Useful design Patterns, OO Design Process, Design patterns. UML and the System Design Introduction to the Unified Modeling Language (UML), The unified Approach, Unified Modeling Language, Static Class diagram, Use case Diagram, Behavior Diagram Relationships, Identifying Attributes and Methods

Object oriented testing: Testing OOA and OOD models, Object oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

Technical metrics for object oriented systems: The intent of OO metrics, the distinguishing characteristics, metrics for the OO design model, class oriented metrics, operation oriented metrics, metrics for object oriented testing, metrics for object oriented projects.

Object-Oriented Programming Paradigm: Object-Oriented Support of Software Qualities Data Abstraction and Encapsulation. Data Type and Abstract Data Type Object-Oriented Program Structure More about Inheritance Reusability and Support for Reuse Class Design Guidelines Morphism and Polymorphism. Binding, Overloading, Overriding Object-Life Cycle. Persistent Objects Introduction to Object-Oriented Databases Object-Oriented Programming Environments. Comparison between C++, Java and C#.

TEXT BOOKS

1. J. Rumbauch, M. Blaha, W. Premeriani, F. Eddy, W. Lorensen, "Object-Oriented Modeling and Design", Prentice-Hall, 1991.

2. Jacobson, M. Christerson, P. Jousson, G. Overgaard: " Object-Oriented Software Engineering ". A Use Case Driven Approach, Addison-Wesley, 1992.

REFERENCE BOOKS

1. Roger S Pressman, "Software Engineering - A Practitioner's Approach", The McGraw Hill Publications V Edition

2. Waman S Jawadekar, "Software Engineering Principles and Practice", TMH, 2004.

PHES312 PRODUCT ENGINEERING

Introduction:
Concepts of Product, Market Positioning, Product types and Competitive analysis, Product team functions, roles and responsibilities, Product Engineering, definitions and characteristics of product and environment. Challenges in product Engineering.

Requirements Management:
Techniques and methods, Customer feedback and ratification, requirements prioritization, Tradeoff's, Prototyping.

Design and Development:
Design for Changing requirements, Design Constraints and Customizability, Extensibility, Performance etc, re-factoring, Design Reviews, Development and change management, Coding standards and consistency guidelines, Code optimization and maintainability, Code reviews, testing and automation, Performance Analysis

Testing and Configuration Management:
Different types of testing, Test Automation and Challenges, Reviews, SCM – Issues and concerns, Major & Minor releases, Managing fixes (Normal & Hot), Document updation, Multi-platform releases, installer license managers, 3rd party components and, product bundling

Usability & Supportability:
Issues and concerns, Types of User documentation, Importance of UI and Instrumentation like Error messages, Logs, Installers, Profilers Performance measurement tools probes.

Security & Performance:
Performance – throughput, scalability, availability, response time, Performance requirements and goals, Appropriate engineering methodologies, Performance related risks, mitigations, Test tools, security models, - Users / Roles / Privileges, Security standards

Management issues in Product Engineering:
Managing different requirements, Estimating schedules and Change Management, Choosing life cycle, Priorities, Risk Management, Test planning, Quality measurement, defect of classification, Product health monitoring, Metrics definition and management.

People and Knowledge Management:
Importance of KM, Information sharing and redundancy planning, relevant tools, Team organization and bonding, inculcating ownership / passion Product evangelism.

Product Engineering Management Tools:
UML, MDA, etc as Product engineering tools, Planning tools for Hardware and Software, Outsourcing and Use of party for product development and outsourcing, Multi-site Product engineering

REFERENCE BOOKS:

1. Dan Conde, "Software Product Management: Managing Software Development from Idea to Product to Marketing to Sales (Execenablers)"

2. Dean Leffingwell , "Managing Software Requirements: A Unified Approach (The Addision – Wesley Object Technology Series)"

3. John R. Hauser, "The House of Quality"

4. Steve C McConnell, "Software Project Survival Guide"

5. Harvard Business Review, "Managing Product Life Cycles: From Start to Finish (Harvard Business Review Paperwork Series)'

6. Michael A Cusumano and Richard W Selby, "Microsoft Secrets", (The Free Press, 1995, ISBN 0-02-874048-3)

7. Steve Maguire, "Debugging the Development Process", (Microsoft Press, 1994, ISBN 1-55615-650-2)

8. Jan Bosch, "Design and Use of Software Architectures: Adopting and Evolving a Product – Line Approach", ISBN: 0201674947; Published 2000; Edition: 1st

RELATED WEBSITES

WWW Virtual Library on Software Engineering:

http://mingo.info-science.uiowa.edu/soft-eng/

www.pragmticmarketing.com

www.BambooWeb.com

http://www.npd-solutions.com/bok.html

PHES313	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

I Problems and Search

1. Introduction

   Concepts and definition of AI, AI Problems, The Underlying assumption, What is an AI technique?, AI characteristics, AI versus Natural Intelligence, Applications of AI, Etc. (Also refer articles 10.2 to 10.4 of Book 2)

2. Problems, Problem Spaces, and Search

   Defining the Problem as State Space Search, Production Systems, Problem Characteristics, Production Systems Characteristics, Issues in the Design of Search Programs, Advantages and Disadvantages of DFS & BFS Techniques.

3. Heuristic Search Techniques

   What is heuristic?, Heuristic Function, Importance of Heuristic Function, Examples, Search Techniques: Generate – and – Test, Hill Climbing, Best-First Search, Problem reduction, Constraint – Satisfaction, Means-Ends Analysis.

II Knowledge Representation

Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation. Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward reasoning, Matching. Approaches: Propositional Logic, Predicate Logic, Representing

Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution, Natural Deduction.

Structured Representation Approaches: Semantic Networks, Frames, Conceptual Dependency, Scripts, Etc.

Reasoning under Uncertainty

1. Introduction to Nonmonotonic Reasoning, Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem Solver, Statistical Reasoning, Probability and Bay's Theorem, Certainty Factors and Rule-based Systems, Bayesian Networks, Dempster-Shafer Theory.

IV Game Playing

Overview, The Minima Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements,

V Expert Systems

1. Basic Concepts of Expert System, Structure of Expert Systems, The Human Element in Expert Systems, How Expert Systems Work, Example of an Expert System Consultation, Problem Areas Addressed by Expert Systems, Benefits of Expert Systems, Problems and Limitations of Expert. Systems, Expert System Success Factors, Type of Expert Systems, Expert Systems and the Internet / Intranets / Web. (Chapter 10.6 to 10.16 of Book 2)

VI Learning

What is Learning?, Rote Learning, Learning by taking Advice, Learning in Problem Solving, Learning from Examples: Induction, Explanation-based Learning, Discovery Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning.

VI

I Planning

1. Overview, An Example Domain: The Blocks world, Components of a Planning System, Goal Stack Planning, Nonlinear Planning using Constraint Posting, Hierarchical Planning, Other Planning Techniques.

VIII Natural Languages Processing & Understanding

1. What is Understanding?, What makes Understanding Hard?, Understanding as Constraint satisfaction, Introduction to NLP, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

IX Advanced Topics

1. Parallel and Distributed AI: Psychological Modeling, Parallelism in Reasoning Systems, Distributed Reasoning Systems, Commonsense Ontologies, Memory Organization, Case-based Reasoning, Perception, Action, Robot Architecture.

TEXT BOOKS

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Second Edition, Tata McGraw Hill.
2. Decision Support Systems and Intelligent Systems, Efraim Turban and Jay E. Aronson, Sixth Edition 2002, Pearson Education Asia.

PHES314	ADVANCED ALGORITHMS

Analysis Techniques:

Growth Functions, Recurrences and Solution of Recurrence equation-, Amortized Analysis, Aggregate, Accounting and Potential Methods,String Matching: naïve string Matching, Rabin Karp, and String matching with finite Automata, KW and Boyer – Moore algorithm.

Number Theoretic Algorithms:

Elementary notions, GCD, Modular Arithmetic, Solving modular linear equations, The chines remainder theorem, Powers of an element, RSA cryptosystem, Primality testing, Integer factorization, Polynomials. Huffman Codes: Concepts, construction, correctness of Huffman's algorithms; Representation of polynomials, DFT, FFT, Efficient implementation of FFT, Graph Algorithm, Bellman Ford Algorithm, Single source shortest paths in a DAG Johnson's Algorithm for sparse graph, Flow networks & Ford fulkerson Algorithm, Maximum bipartite matching.

Computational Geometry:

Geometric structures using C++: Vectors, points, Polygons, Edges: Geometric Objects in space: Finding the intersection of a line & triangle, Finding star shaped polygons and convex hull using incremental insertion, Point enclosure: Ray shooting and Signed angle methods: Clipping: Cyrus-Beck and Sutherland–Hodgman algorithms, Triangulating monotonic polygons: Convex hulls: Gift wrapping and Graham Scan: Removing hidden surfaces, Intersection of convex Polygons: Convex hulls, Contour of the union of rectangles, Decomposing polygons into monotone pieces.

REFERENCE BOOKS:

1. T. H Cormen, C E Leiserson. R L Rivest & C Stein, "Introduction to algorithms", 2nd Edition, PHI.

2. Michael J Laszio, "Computational Geometry and Computer Graphics in C++", PHI. India 1996.

PHES315	SOFTWARE QUALITY ASSURANCE & TESTING

Introduction: Software Quality: Perspective and Expectations, Historical perspective of Quality, Quality frameworks, Quality Assurance as dealing with defects, Defect prevention detection and Containment strategies.

QA Process and Quality Engineering:QA Activates in Software Processes, Verification and Validation Perspectives, Reconciling the Two Views Quality Engineering: Activities and Process Quality Planning: Goal Setting and Strategy Formation Quality Assessment and Improvement Quality Engineering in Software Processes

Testing Concepts, Issues and Planning: Purpose, Activities, Processes and Context Questions about Testing, Functional vs Structural Testing: Coverage –based vs Usage – based Testing: When to Stop Testing? – Test Planning and Preparation: Goals, Strategies, and techniques, Testing models and test cases. Test suite preparation and management, 4 Preparation of Test procedure, Test Execution, Result Checking, and Measurement, Analysis and Follow-up, Activates, People, and Management, Test Automation

Coverage based and Boundary Testing Techniques: Checklist-Based Testing and its Limitations, Testing for partition Coverage, Partition: Concepts and definitions, Testing decisions and predicates for partition coverage, Usage-Based Statistical Testing, a case study, Input Domain Partitioning and Testing, Input domain testing for partition and boundary problems, simple Domain Analysis and the Extreme point Combination Strategy, Other Boundary Test Strategies and Applications

Control Flow, Data Dependency, and Integration Testing: Basic Control Flow Testing, Model construction path selection & sensitization, Loop Testing, CFT Usage, and Other Issues, Different types of loops and corresponding CFGs, Loop testing: Difficulties and a heuristic strategy, CFT Usage and other Issues, Data Dependency and Data flow Testing: Basic concepts: Operations on data and data dependencies, DFT and DDG elements and characteristics DFT: Coverage and Applications, Achieving slice and other coverage

Testing Techniques: Adaptation, Specialization and Integration: Testing Sub-Phases and Applicable Testing Techniques, Specialized Test Tasks and Techniques, Test Integration case Study: Hierarchical Web Testing

Quality assurance beyond testing: Defect Prevention and Process Improvement: Basic concepts and Generic Approaches, Root cause Analysis for Defect Prevention Other Techniques for Defect Prevention, Analysis and modeling for defect prevention, Technologies, standards, and methodologies for defect prevention, Software tools to block defect injection, Focusing on Software Processes – Process selection , definition and conformance, Process maturity.

Software Inspection and Formal verification: Basic concepts and Generic Process, Fagan inspection, Other Inspections and Related Activities, Code reading, other formal reviews and static analyses, Defect Detection Techniques, Tool / Process Support, and Effectiveness Basic Concepts: Formal Verification and Formal Specification, Formal Verification: Axiomatic Approach

REFERENCE BOOKS:

1. Jeff Tian, "Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement", - John Wiley and Sons Inc., and IEEE Computer Society Press, February 2005

2. Edwar.Dkit. "Software testing in the Real World", Pearson Education 2003.

3. William E Perry. "Effective Methods for Software Testing", Second Edition, John Wiley and Sons

4. Stephan H. Kan, "Metrics and Models in Software Quality Engineering", Second Edition, Pearson Education.

5. Dustin, "Effective Software Testing: 50 Specific Ways to Improve Your Testing", Pearson Education.

PHES316 MULTIMEDIA COMMUNICATION

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

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, P1.323, MPEG 1, MPEG 2, Other coding formats for text, speech, image and video.

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.**Synchronization:** notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, and process management techniques.

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 can be given on 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. K. Sayood, "Introduction to Data Compression", 2nd Ed, Morgan Kauffman, Indian Edition, 2000.
2. V. Bhaskaran and K.Konstantinedes, "Image and Video Compression Standards, Algorithms and Architecture", 2nd 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

PHES317	POWER SEMI-CONDUCTOR DEVICES

Introduction: Fabrication - Characteristics of Power Semiconductor devices

Diodes: Static & Dynamic performance, junction structure, Reverse recovery Characteristics, Schottky diode, Snubber Circuit, Series — parallel operation.

BJT: Types, Safe Operation Area (S.O.A) Switching Time, Base Drives Snubber Circuits, Power Darlington's Protection Circuits.

MOSFETS: Types Principle of Operation, characteristics, SOA, Gate. Driver Circuits

IGBT: Structures, characteristics, SOA and Gate Driver Circuits, Comparison with MOSFETS and Power BJT, Junction Structure, Terminal Capacitance, Gate Driver Circuits, On-Off time

TIIYRISTOR & FAMTLY DEVICES (Triac, GTO, LASCR): Construction, Operation, Static, and, Dynamic characteristics, Gate Circuit consideration, Thyristor ratings and Protections, Snubber circuit, Heat sink design.
Emerging Devices – IGBT Spice modeling and simulation of the devices and circuits.

TEXT BOOKS:

1. Ned Mohan Tore. M. Undeland and William. P. Robbins; "Power Electronics: Converters, Applications and Design", 3rd edition, Wiley, 2003

2. B. Jayant Baliga, "Power semiconductor Devices", Pws Pub Co, 1995

3. Joseph Vithayathil, "Power Electronics - Principles and Applications", McGraw Hill, 1995

4. John Gowar, Duncan A. Grant, Vitezslav Benda, "Power semiconductor Devices - Theory and Applications (Illustrated)", John Wiley & Son Ltd, 1998

PHES318	MICRO COMPUTER CONTROL OF ELECTRICAL DRIVES

Introduction to Microcomputer control of electrical drives: Review of microprocessors in Industrial motor drive systems. Microprocessor control of converter fed Dc motor drives.

Performance analysis of microprocessor based control system applied to adjustable speed motor drives.

Microprocessor control of Induction motors: Microprocessor based vector control system for Induction motor drives. Microprocessor based optical efficiency drive of an induction motor.

Microprocessor control of current fed synchronous motor drive, microprocessor control for censor less brush less motor, Microprocessor control of switched reluctance motor

TEXT BOOKS:

1. B. K. Bose "Micro computer control of power electronics and Drives" IEEE Press 1987

2. Alok Jain, "Power Electronics and Its Applications", Penram International Publishing (India) Pvt Ltd, 2002

3. D.V. Hall, "Microprocessors and Interfacing", Tata McGraw Hill, 1991

4. W. Shepherd, "Power Electronics and Motor Control", Cambridge University Press, 1996

Delay Models in Data Networks: Queuing Models, M/M/1, M/M/m, M/M/∞, M/M/m/m and other Markov System, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.

Multi-access Communication: Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks.

Routing in Data Networks: Introduction, Network Algorithms and Shortest Path Routing, Broadcasting Routing Information: Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing, Routing in the Codex Network.

Flow Control: Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

TEXT BOOKS:

1. Dimitri Bertsekas and Robert Gallager, “Data Networks," 2nd edition, Prentice Hall of India, 2003.

2. William Stallings, “High-Speed Networks and Internets,” Pearson Education (Asia) Pte. Ltd, 2004.

3. J. Walrand and P. Varaya,”High Performance Communication Networks,” 2nd edition, Harcourt India Pte. Ltd. & Morgan Kaufman, 2000.

PHES320	CMOS RF CIRCUIT DESIGN

Introduction to RF design and Wireless Technology: Design and Applications, Complexity and Choice of Technology. Basic concepts in RF design: Nonlinearly and Time Variance, Intersymbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion

RF Modulation: Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, direct conversion and two-step transmitters

RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers**.**

BJT and MOSFET Behavior at RF Frequencies: BJT and MOSFET behavior at RF frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation.

RF Circuits Design: Overview of RF Filter design, Active RF components & modeling, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technologies, Design of Mixers at GHz frequency range, various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Resonator VCO designs, Quadrature and single sideband generators. Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers, Power Amplifier design, Liberalization techniques, Design issues in integrated RF filters.

TEXT BOOKS:

1. Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press 1998.
2. B. Razavi “RF Microelectronics” PHI 1998
3. R. Jacob Baker, H.W. Li, D.E. Boyce “ CMOS Circuit Design, layout and Simulation” PHI 1998
4. Y.P. Tsividis “Mixed Analog and Digital Devices and Technology” TMH 1996

PHES321 **RADAR SYSTEMS**

Introduction: Range equation, Transmitter and Receiver parameters and model, Types of Radars, Radar signal Transmission; Transmitted Waveforms (Time and Frequency Domains), Energy, Radar signal analysis using autocorrelation and Hilbert Transform., Pulse Compression, Clutter — Properties, reduction, Coding and Chirp.

Radar Antenna-Reflector types, side lobe control; -Arrays;- Array factor and Beam width, Synthetic Aperture, Adaptive Antennas;

Propagation effects- Multipath, Low Altitude, Ionosphere

Radar networks: Matched Filter Response and noise considerations

Data Processing: Fast Fourier transform, Digital MTI, tracking, Plot Track,

Applications: Secondary Surveillance, Multi static, Over the Horizon, Remote sensing and meteorological radars.

TEXT BOOKS:

1. M.LSkolnjk; "Radar handbook"TMH, 2003

2. M.J.B.Scanlan; "Modem radar techniques".

3 Peyton Z Peebles, "Radar Principles", Wiley-Inter science

PHES322 INTERNET OF THINGS

M2M to IoT - The Vision : Introduction, From M2M to IoT - A brief background, M2M communication, IoT, M2M towards IoT-the global context - Game changers, General technology and scientific trends, Trends in information and communications technologies, , A use case example, Differing Characteristics.

M2M to IoT - A Market Perspective: Introduction - Information marketplaces, Some Definitions - Global value chains, Ecosystems vs. value chains, Industrial structure, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT - The information-driven global value chain.

M2M and IoT Technology Fundamentals : Devices and gateways - Introduction, Basic devices, Gateways, Data management - Introduction, Managing M2M data, Considerations for M2M data, Business processes in IoT - Introduction, IoT integration with enterprise systems, Distributed business processes in IoT, Knowledge Management - Data, information, and knowledge, A knowledge management reference architecture.Retrival Layer

Architecture Reference Model: Introduction, Reference Model and architecture, IoT Reference Model - IoT domain model, Information model, Functional model, Communication model, Safety, privacy, trust, security model.

IoT Reference Architecture and Real-World Design Constraints: Introduction, Functional View - Device and Application functional group, Communication functional group, IoT Service functional group, Virtual Entity functional group, IoT process management functional group, Service Organization functional group, Security functional group, Management functional group

Real-World Design Constraints: Introduction, Technical Design constraints hardware is popular again - Devices and networks, Data representation and visualization, Interaction and remote control.

References

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle. “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence” 1st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846)

2. VijayMadisetti and Arshdeep Bahga. “Internet of Things (A Hands-on-Approach)” 1st Edition, VPT, 2014 (ISBN-13: 978-8173719547)

3. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, A press Publications, 2013 (ISBN-13: 978-1430257400)

PHES323	HARDWARE - SOFTWARE CO-DESIGN

Introduction: Motivation hardware & software co-design, system design consideration, research scope & overviews

Hardware Software back ground: Embedded systems, models of design representation, the virtual machine hierarchy, the performance3 modeling, Hardware Software development,

Hardware Software co-design research: An informal view of co-design, Hardware Software tradeoffs, crosses fertilization, typical co-design process, co-design environments, limitation of existing approaches, ADEPT modeling environment.

Co-design concepts: Functions, functional decomposition, virtual machines, Hardware Software partitioning, Hardware Software partitions, Hardware Software alterations, Hardware Software trade offs, co-design.

Methodology for co-design: Amount of unification, general consideration & basic philosophies, a framework for co-design

Unified representation for Hardware & Software: Benefits of unified representation, modeling concepts

An abstract Hardware & Software model: Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model

Performance evaluation: Application of t he abstract Hardware & Software model, examples of performance evaluation

Object oriented techniques in hardware design: Motivation for object oriented technique, data types, modeling hardware components as classes, designing specialized components, data decomposition, Processor example.

TEXT BOOKS:

1. Sanjaya Kumar, James H. Ayler "The Co-design of Embedded Systems: A Unified Hardware Software Representation", Kluwer Academic Publisher, 2002
2. Gomaa, Software Design Methods for Concurrent and Real-time Systems, Addison-Wesley, 1993.
3. H. Kopetz, Real-time Systems, Kluwer, 1997.
4. R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.

REFERENCE BOOKS:

1. S. Allworth, Introduction to Real-time Software Design, Springer-Verlag, 1984.
2. C. M. Krishna, K. Shin, Real-time Systems, Mc-Graw Hill, 1997.
3. Peter Marwedel, G. Goosens, Code Generation for Embedded Processors, Kluwer Academic Publishers, 1995.
4. Additional reading from selected journal papers.

PHES324	REAL TIME EMBEDDED SYSTEMS

Introduction: Real Time System, Types, Real Time Computing, Design Issue, Sample Systems, Hardware Requirements- Processor in a system, System Memories, System I/O, Other Hardware Devices (A/D, D/A, USART, Watchdog Timers, Interrupt Controllers).

Device Drivers, Interrupt Servicing Mechanism & Interrupt Latency.

Embedded Systems: Introduction, Various System Architecture for Embedded System, High Performance Processors - Strong ARM processors, Programming, Interrupt Structure, I/O architecture.

Real Time Operating System: Fundamental Requirements of RTOS, Real Time Kernel Types, Schedulers, Various Scheduling modules with examples, Latency (Interrupt Latency, Scheduling Latency and Context Switching Latency), Tasks, State Transition Diagram, Task Control Block. Inter-task communication and synchronization of tasks.

Memory and File management: Pipelining and Cache Memories, Paging and Segmentation, Fragmentation, Address Translation.

Case Study: Introduction to VX Works/Mucos/pSOS; Example systems.

Development and Verification of Real Time Software: Building Real Time applications; Considerations such as double buffing.

TEXT BOOKS:

1. David E. Simon, "An Embedded software primer", Pearson Education, 1999.
2. Philip. A. Laplante, "Real-Time Systems Design and Analysis- an Engineer's Handbook"- Second Edition, PHI Publications.
3. Jane W.S. Liu, "Real-Time Systems", Pearson Education Inc., 2000.
4. Rajkamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. Dr. K.V.K K Prasad, "Embedded Real Time Systems: Concepts Design and Programming", Dreamtech Press New Delhi, 2003.
2. David A. Evesham, "Developing real time systems – A practical introduction", Galgotia Publications, 1990
3. C. M. Krishna, "Real Time Systems" MGH, 1997

PHES325	PATTERN RECOGNITION

Introduction: Applications of pattern recognition, statistical decision theory, image processing and analysis.

Probability: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators **Statistical Decision Making:** Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving-one—out technique. Characteristic curves, estimating the composition of populations.

Nonparametric Decision Making: Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate Functions, minimum squared error discriminate functions, choosing a decision making technique.

Clustering: Introduction, hierarchical clustering, partitional clustering

Artificial Neural Networks: Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application

Processing of Waveforms and Images: Introduction, gray level sealing transfoniiations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching, logarithmic gray level sealing, the statistical significance of image features.

TEXT BOOKS:

1. Eart Gose, Richard Johnsonburg and Steve Joust, "Pattern Recognition and Image Analysis", Prentice-Hall of India-2003.
2. Duda and Hart, "Pattern recognition (Pattern recognition a scene analysis)"
3. Robert J Schalkoff,"Pattern recognition : Statistical ,Structural and neural approaches", John Wiley

PHES326 MOBILE COMPUTING

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.

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.

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.

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

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

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

REFERENCE BOOKS:

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

PHES327	STATISTICAL SIGNAL PROCESSING

Random processes: Random variables, random processes, white noise, filtering random processes, spectral factorization, ARMA, AR and MA processes.

Signal Modeling: Least squares method, Padé approximation, Prony's method, finite data records, stochastic models, Levinson-Durbin recursion; Schur recursion; Levinson recursion.

Spectrum Estimation: Nonparametric methods, minimum-variance spectrum estimation, maximum entropy method, parametric methods, frequency estimation, principal components spectrum estimation.

Optimal and Adaptive Filtering: FIR and IIR Wiener filters, Discrete Kalman filter, FIR Adaptive filters: Steepest descent, LMS, LMS-based algorithms, adaptive recursive filters, RLS algorithm.

Array Processing: Array fundamentals, beam-forming, optimum array processing, performance considerations, adaptive beam-forming, linearly constrained minimum-variance beam-formers, side-lobe cancellers, space-time adaptive processing.

TEXT BOOKS:

3. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling," John Wiley & Sons (Asia) Pte. Ltd., 2002.
4. Dimitris G. Manolakis, Vinay K. Ingle, and Stephen M. Kogon, "Statistical and Adaptive Signal Processing: Spectral Estimation, Signal Modeling, Adaptive Filtering and Array Processing," McGraw-Hill International Edition, 2000.
5. Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing," Pearson Education (Asia) Pte. Ltd., 2001.

REFERENCE BOOKS:

1. Simon Haykin, "Adaptive Filters," Pearson Education (Asia) Pte. Ltd, 4th edition, 2002.
2. J.G. Proakis, C.M. Rader, F. Ling, C.L. Nikias, M. Moonen and I.K. Proudler, "Algorithms for Statistical Signal Processing," Pearson Education (Asia) Pte. Ltd, 2002.

PHES328	WEB SERVICES

Introduction: Web Services Overview: What Are Web Services? History Web Services Technology, Other Concerns, Java and Web Services, Application Scenarios, Implementation Scenarios, Benefits of Web Services, A Word about Standards, Service-Oriented Architecture, SOA Entities, SOA Characteristics, Component-Based Service Development, Development Lifecycle, Design, Verification and Validation, Maintenance

Technologies: SOAP, The Case for SOAP, What Does SOAP Define? SOAP Message Structure, SOAP Message Elements, SOAP Processing Model, SOAP Encoding, WSDL, Describing a Web Service, Describing Functional Characteristics of Services of WSDL, 1.2 UDDI Discovering Web Services, Categorizing Services, Identifiers, Business Entity Relationships, UDDI's SOAP Interfaces, UDDI and SOAP/WSDL Relationships, Publishing WSDL Service Interfaces in UDDI, Internationalization and Multiple Languages, Extending a UDDI Registry, UDDI- Private UDDI Registries, ebXML, Architectural Overview of ebXML, Putting It All Together

Java Web Services: Java Web Service Developer, Pack JAXP, JAXP Architecture, SAX, DOM, When to Use SAX, When to Use DOM, When Not to Use Either JAXP and XML Schemes, XSLT, XSLTc, JDOM, JAXP, RI JAX-RPC, JAX-RPC Service Model, Data Types and Serialization, JAX-RPC Development, Advanced JAX-RPC, JAX-RPC Interoperability, JAX-RPC and J2EE, JAXM Messaging and MOM Messaging and Web Services Messaging in Java, JAXM Architecture, Designing with JAXM, Developing with JAXM, JAXR Registries and Repositories, JAXR Architecture, The JAXR Information Model, The JAXR, API, JAXR to UDDI Mapping, JAXR and ebXML Registry,JAXB, The Need for Binding and JAXB, When to Use JAXB, JAXB Architecture, Developing with JAXB, XML-to-Java Mapping, The JAXB API Validation with JAXB Customizing JAXB, When to Use Custom Declarations

Advance Topics: Transaction Management Concepts, A Transaction Model for Web Services, New Transaction Specifications, JSRs for Web Service Transaction Support Security, Security Considerations for Web Services, Web Services Security Initiatives, Canonical XML, XML Digital Signatures, Apache XML Security, XML Encryption Security Assertions, Markup Language Web Services Security Assertions, XML Access Control Markup Language, XML Key Management Specification, WS-I Specifications, SOAP and Firewalls Security and J2EE Java Cryptography Extensions, Implementation Scenarios, Identity Management, Liberty Alliance, Source ID, Practical Considerations, Systems Management, Interoperability, Pricing

Models, XML Pay Specification, Service Level Agreements, Testing Web Services Performance High Availability Scalability

Clustering Fault Tolerance Grid Computing Enabling Services

TEXT BOOKS:

1. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew: Java Web Services Architecture, Morgan Kaufmann – 2003
2. Richard Monsol-Haefel: J2EE Web Services, Pearson 2003
3. Steven Graham, Dong Davis,.., Building Web Services with Java, II Edition, Pearson-2005

PHES329	HIGH SPEED VLSI DESIGN

Clocked Logic Styles, Single-Rail Domino Logic Styles, Dual-Rail Domino Structures, Latched Domino Structures, Clocked Pass Gate Logic

Non-Clocked Logic Styles, Static CMOS, DCVS Logic, Non-Clocked Pass Gate Families.Circuit Design Margining, Design Induced Variations, Process Induced Variations, Application Induced Variations, Noise.

Latching Strategies, Basic Latch Design, and Latching single-ended logic, Latching Differential Logic Race Free Latches for Pre-charged Logic Asynchronous Latch Techniques.Signaling Standards, Chip-to-Chip Communication Networks, ESD ProtectionClocking Styles, Clock Jitter, Clock Skew, Clock Generation, Clock Distribution, Asynchronous Clocking Techniques

Skew Tolerant Design

TEXT BOOKS:

1. Kerry Bernstein & et. al., High Speed CMOS Design Styles, Kluwer, 1999.
2. Evan Sutherland, Bob stroll, David Harris, Logical Efforts, Designing Fast CMOS Circuits, Kluwer, 1999.
3. David Harris, Skew Tolerant Domino Design.
4. David Harris, Skew Tolerant Domino Design.

GROUP III

RF & MMIC DESIGN AND TECHNOLOGY

Lecture hours /Week: 04	**Exam hours: 03**
Total Lecture Hours: 60	**Exam Marks: 100**

Practical/Field work /Assignment- hours/week : 02

Radio Frequency Integrated Circuits (RFICs) and Monolithic Microwave Integrated Circuits (MMICs) are now used extensively in communications and radar applications. This PG course covers all the important MMIC design methods and Si and III-V RF device technologies.

Introduction to RF & MMIC design and technologies: GaAs/Si/InP/GaN: MESFET HEMT BJT HBT. Discrete RF/microwave devices: TEDs; negative differential conductivity; single temp., two-valley v-E model; dc to RF efficiency, Gunn diode power/frequency limits; Current-voltage waveforms and efficiency; IMPATT injector models; small signal analysis; high frequency IMPATT power; tunnel diodes; MISFETS, MESFETS and HBTs (SiGe, GaAs, InP, and GaN).

MMIC Circuit elements - active devices (CMOS, FET, HEMT, BJT, Schottky and PIN diodes), passive lumped elements, microstrip elements. Amplifier design principles. Power amplifier design. Low-noise amplifier design. Distributed amplifier design. Mixers and oscillators. Control circuits: phase shifters, switches and gain control. MMIC technologies. IC fabrication processes - Si RF CMOS ICs, MMICs on GaAs, InP, and GaN. Process control. On-wafer measurements. Advanced techniques; transceivers; active antennas; active filters; modulators/ demodulators. Applications.

Essential Text Books:

1. I.D. Robertson (Ed.), MMIC Design, IEE, 1995.
2. P. Ladbrooke, MMIC Design: GaAs FETs and HEMTs. Norwood, MA: Artech Hose, Inc., 1989.
3. Sitesh Kumar Roy and Monojit Mitra, Microwave Semiconductor Devices, Printice-Hall of India Private Limited, New Delhi,2003.
4. Tri. T. Ha, "Solid-state Microwave Amplifier Design", John Wiley & Sons, Inc., New York, 1981.

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Reference Books:

1. Microwave Semiconductor Devices, by Sigfrid Yngvesson, Kluwer Academic Publishers, 1991.
2. P.C.L.Yip, High-frequency Circuit Design and Measurement, Chapman & Hall.
3. G. Gonzales, Microwave Transistor Amplifiers - Analysis and Design, Prentice-Hall.
4. W.H. Hayward, Introduction to Radio Frequency Design, Prentice-Hall.
5. P. Combes, J. Graffaul, & G. Sautereau, Microwave Components, Devices and Active Circuits, J.Wiley.
6. Haigh, Everard, GaAs Technology and its Impact on Circuits and Systems, IEE.
7. S. M. Sze, Physics of Semiconductor Devices, 2nd edition, John Wiley & Sons, New York 1981.
8. Terry Edwards, Foundations for Microstrip Circuit Design, 2nd Ed., Wiley.

Suggested subject relevant to the chosen area: Group 3.

Thin film Instrumentation Technology

Chapter 1 : Kinetic Theory of gases and Vacuum Terminology

Ideal gas equations, mean free path, Conduction of gas flow, molecular flow, adsorption, outgasing & throughput.

Chapter 2 : Rotary, Roots and sorption Pumps

Introduction, Rotary Vacuum pumps, Roots Pumps & Sorption pumps

Chapter 3 : High Vacuum Pumps

Principles, Selection of backing Pumps, Selection of vapour fluid, Diffusion pump fluids, Magnifications to the Diffusion pumps & integrated vapour pumps

Chapter 4 : Measurement of Vacuum

Introduction, Different types of Vacuum gauges: Hydrostatic gauges, Thermal conductivity gauges, Ionization gauges, capacitance gauge and Spinning rotor gauge.

Chapter 5 : Vacuum System Design

Introduction, Process & working pressure, Vacuum vessel, Vessel design, Characteristics of pumping systems, Sizing of the pumping systems, Sizing of backing line, Matching of components, Estimation of Pipe Line size in vacuum System.

Chapter 6 : Leak Detection Techniques:

Introduction, Leak rate & units, Rate Rise measurement, Tesla Coil, Halogen leak Detector, Thermal Conductivity gauge, Helium leak detector

Chapter 7 : Thin Film Deposition Techniques :

Introduction, Different techniques of deposition

Physical vapor Deposition (PVD): Introduction,Resistive Evaporation, flash Evaporation, E-beam Evaporation, Sputter deposition- DC diode bias, Triode, Magnetron, RF sputtering.

432 Chemical Deposition Methods: Introduction, overview and history-Electro deposition (Electrolytic, Electro less, Anodization), Chemical Vapour deposition: Plasma CVD, PE CVD, LP CVD,

other methods - Dip coating, spinning, Solution coating, spraying and polymerization

Text Books:

1. John A. Venables, Introduction to Surface and Thin Films Processes, Cambridge University Press, 2000.
2. M. Ohring, Materials Science of Thin Films: Deposition and Structure, 2002.
3. Leon I. Maissel and Reinhard Glang, Ed., Handbook of Thin Film Technology, McGraw-Hill Publishing Company, New Delhi (1970)

Reference Books:

1. Electronic Thin Film Science for Electrical Engineers and Materials Scientists, by K-N Tu, J. W. Mayer and L. C. Feldman, 1992.
2. John O'Hanlon, A User's Guide to Vacuum Technology
3. Zbigniew D. Jastrzebski, The Nature and Proprties of Engineering Materials, John Wiley & Sons Inc, New York (1976).
4. Additional and current papers from the literature where appropriate.
5. Preparation of Thin films - Joy George

Group IV

PHES401	DYNAMICS OF LINEAR SYSTEMS

1. Analysis of control systems in state space; State-Space modeling of synchronous machines, excitation systems, and speed governing systems, transmission lines and induction machines-solution techniques, State -Spaceequations in Canonical forms, controllability and absorbability, linear time - variant systems.MIMO systems, order of

MIMO systems, derivation of state space model of MlMO systems from transfer matrix, non-interaction in MIMO systems Control system design via pole placement, design of state observers (full order and minimum order), effect of addition of observer on a closed loop system,

2. Discrete - time control system: Introduction, spectrum analysis of sampling process, Shannon's sampling theorem, signal reconstruction, difference equations , Z Transforms , transfer function, inverse Z transforms, obtaining response between consecutive sampling instants, mapping between the s-plane and z-planes, Stability analysis of closed loop systems, jury stability test, stability analysis by use of bilinear transformation and Routh stability criterion. State space representation of discrete time systems. Solution techniques,

REFERENCE BOOKS ;

1. K-Ogata "Modern Control Engineering (II Edition)"
2. Nagarath and Gopal, " Control Systems Engineering"
3. Chidambara and Ganapathy, “Introduction to Control of Dynamic Systems"
4. P-M-Anderson and Fouad," Power System Control and Stability"
5. K.Ogata, "Discrete Time Control Systems"

PHES402	ENERGY MANAGEMENT SYSTEMS

History of Energy Management: Energy forecasting, limitations of conventional sources of energy ,Environmental impact of conventional sources of energy, Problems associated with current pattern of energy use in India, options for the future

Non Conventional sources of energy : Global & Indian Non-conventional sources of energy , basic principle of operation of solar photo- voltaic, solar thermal, wind , wave and tidal energy sources.

Energy Auditing: classification of energy audit, measures to be taken up after preliminary and detailed energy audit, power factor improvement & economics of P. F improvement. Electricity tariffs – Aims and objectives of a good tariffs, Fixed and running charges, types of tariffs. Energy conservation : Basic concepts and methods of energy conservation, Load management, plant operational management Demand side management : Introduction to DSM, Concept of DSM benefits from DSM, DSM Technique time of day pricing, time of day pricing models for planning, load management, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment, socio-economic awareness Programmes.

REFERENCE BOOKS :

D. P. Sen Gupta, K. P. Padiyar, Intr5ance SCA, M.A.Pai(Ed) "Recent advances in control and management of Energy systems", Interline publishers, Bangalore.(1993)

Ashok V Desai (ED) " Energy Demand analysis management and conservation " Wiley Eastern ltd. New Delhi

TERI Reports Jyothi Parekh " Demand side management " TMH Publishers

N.K.Bansal , Kleeman-Millin "Renewable Energy Sources and Conservation Technology" , Tata McGraw Hill. Non-Conventional Sources of energy .G.D.Rai

PHES403	DIGITAL SIGNAL PROCESSING

Discrete-Time signals and systems: Introduction, discrete-time signals-sequences, linear_shift invariant systems, stability and causality, linear constant-coefficient difference equations Frequency domain representation of discrete time systems and signals symmetry properties of Fourier transform, sampling of Continuous time signals, two dimensional sequence and system (Chapter 1 of ref) The Z-transform- introduction, Z-Transform, inverse Z-Transform, Z-Transform theorems and properties, system function (Chapter II of ref I)

The discrete Fourier transform: - introduction, representation of periodic sequences- the discrete fourier series, properties of discrete fourier series, summary of properties of DFS representation of periodic sequences, sampling the Z-transform, fourier representation of finite - duration sequences - the discrete fourier transform, summary of properties of the discrete fourier transform, linear convolution using the discrete transform- (Chapter III of ref I)

Flow graph and matrix representation of digital filters - introduction, signal flow graph representation of digital networks, matrix representation of digital networks, basic network structures for IIR systems, transposed forms, basic network structure for FIR systems, Tellegens theorem for digital filter and its application (Chapter IV of ref 1)

Digital filter design techniques:- Introduction, design of IIR digital filters from analog filters, design examples. Analog digital transformation, properties of FIR - digital filters, design of FIR filters, A comparison of IIR and FIR Digital filters, (Chapter V of ref I) Computation of the Discrete fourier transform- Introduction Goertzel algorithm, decimation- in - time FFT algorithms, decimation- in- frequency FFT algorithms, for N and composite numbers, general com[putational consideration in FFT algorithms, Chirp Z-Transform algorithm, (Chapter VI of ref I), DSP processors- a brief discussion,

REFERENCE BOOKS :

1. Alan V Oppenhelm & Ronald W Schafer, "Digital Signal Processing", Prentice Hall of India, 1991.
2. John G Proakis et. ah Digital Signal Processing, Principles, Algorithms and Applications Macmilliiti, 1992.
3. Chang, One dimensional digital signal processing.
4. Andrew Antonio, Digital Filters,

PHES405	NONLINEAR AUTOMATIC CONTROL THEORY

1. Describing Function Analysis*:* Introduction to Nonlinear systems, nonlinear control systems, describing functions, describing function analysis –of NL control systems, generalized describing function, dual input describing function, inverse describing function.

2. Phase plane _analysis *:* Introduction, methods for constructing trajectories, obtaining time solutions from phase plane plots, singular points, phase plane analysis of linear control systems, phase *plane* a analysis of non-linear control systems, point-care index of a singular point, bendixson's criterion, stability definitions of non-linear systems, extension of PP concept to higher order systems,

3, Numerical Methods: Introduction, Taylor sires expansion method. Modified -Eulers method-Adams "method, Milnes method ; Runge -Kutta method of " least square fit, *Z* form numerical-calculus method, Poincare Perturbation method, An approximation method for second order system.

4. Liapunov Stability Analysis**:** Introduction, definitions, the first method of liapunov, second method of liapunov, stability analysis of linear systems, stability analysis of non-linear systems, Krasovskis method and variable gradient methods.

5 Optimal and adaptive control systems*:* Introduction, optimization of an autonomous positioning system with ON-QFF non-linearity, simplified switching of second-order autonomous system, introduction to adaptive systems, input adaptation or response optimization, model adaptive systems.

REFERENCE BOOKS:

1. Non-Linear Automatic Control, by John E Gibson, Mc Graw Hill Publication,
2. Modern Control Engineering by Katsuhiko Ogata, Prentiiee Hall of IndiaPublications
3. Introduction to non-Linear analysis WJ Cunningham , Mc Graw Hill Publication*_
4. Analysis and Design of Non-Linear feed back control Systems, by George J Thaler and Marvin P Pastel, Me Graw Hill Publication.

PHES406	AI APPLICATIONS IN POWER SYSTEMS

Introduction: What is AI Definitions, history and evolution of AI, essential abilities of intelligence and AI applications. Problem solving: problem characteristics, problem search strategies, forward and backward reasoning, AND-OR graphs- goal trees, game trees, search methods- informed and uninformed search, breadth first search and depth first search methods.

Knowledge representation: logical formalisms: prepositional and predicate logic: syntax and semantics, wffs, clause form expressions, resolution- use of RRTs for proofs and answers, examples from electric power systems, Non-monotonic logic: TMS, modal, temporal and fuzzy logic.

Structured representation of knowledge: ISA/ISPART trees, associative/ semantic nets, frames and scripts, examples from electric power systems.

Expert system architecture: basic components, rule based systems, forward and backward chaining, ES features, ES development, ES categories, ES tools and examples from electric power systems.
AI languages: LisP and ProLog - Introduction, sample segments, LisP primitives, list manipulation functions, function predicates, variables, iteration and recursion, property lists, sample programs for examples from electric power systems.

REFERENCE BOOKS:

1. D.W.Patterson, ``Introduction to Artificial Intelligence and Expert Systems'', Prentice-Hall of India, 1992.
2. Charniak E. and Mcdermott D., ``Introduction to AI'', Addison-Wesley, 1985.
3. Rich, Elaine, Kevin Knight, ``Artificial Intelligence'', Tata McGraw-Hill, 1991.
4. Nils J.Nilson, ``Problem Solving Methods in AI'', McGraw-Hill, 1971.
5. Nils J.Nilson, ``Principles of AI'', Berlin Springer-Verlag, 1980.
6. Selected topics from IEEE, AIEE and CIGRE Journals.

PHES407	POWER SYSTEM RELIABILITY ENGG.

Basic concepts: adequacy, security, reliability, cost/worth/data, reliability test system (RTS); System adequacy evaluation: RTS, Monte Carlo simulation, contingency enumeration approach, basic distribution systems and reliability assessment; Assessment of reliability worth: interruption costs for commercial, industrial and residential users, interruption energy assessment rate; dependency effects in power system reliability and evaluation of statistical distributions.

REFERENCE BOOKS:

1. Roy Billington – Reliability assessment of large electric power systems, Kluwer Academic Publishers, USA, 1988,
2. R. Billington and A.N. Allen – Reliability evaluation of engineering systems; concepts and techniques, Longman London/ Plenum press, NY, 1983,
3. Hammersley J.M., Handscomb D.C. – Monte Carlo Methods, John Wiley and Sons Inc., NY, 1964
4. IEEE committee report, IEEE reliability test system, IEEE PAS, Vol. PAS98, 1979, pp 2047-54

PHES408	COMPUTER BASED INDUSTRIAL CONTROL

Concept of Continuous and discrete time Process Control, Single loop and multi loop control, multivariable control, Brief outline of Adaptive control Schematic representation of interconnected systems, supervisory control and data acquisition cquisition Direct Digital Control: PID control, Interfacing process with digital control, position algorithm, velocity algorithm, z transform based control algorithms

Programmable controllers, diagrammatic representation, functional blocks, architecture, interfacing, software (basic concepts)

Real time programming-multi tasking, state transition diagram, inter task communication development of algorithm, Outline of real time operating system

Modelling, simulation, intelligent controllers, AI based control, fuzzy based control, neural control Computer interfacing, methodology, computer control of process, case study

BOOKS:

1. Krishna Kant, Computer based Industiral Control, Prentice Hall (I), 1997
2. Hirota, K., Industrial Applications of Fuzzy Technology, Springer Verlag, 1993
3. Hertz, John, Krogh, Anders, Palmer, Richard, Introduction to Theory of Meural Computation, Addison-Wesley, 1991.
4. Eggebrecht, L. C., Interfacing to the IBM PC, Howard Samson & CO., 1983
5. Ahson, S.I., Microprocessors with application in Process Control, TMH. 1984

PHES409	MULTIMEDIA NETWORKS

Multimedia communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QOS application QOS. Multimedia information representation: Introduction, digital principles, text, images, audio, video Text and image compression: introduction , compression principles, text compression, image compression.

Audio and video compression: introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, h.261, h.263, MPEG, MPEG-1, MPEG-2, MPEG-4 and MPEG-7.

Multimedia Information Networks: introduction, network performance parameters, throughput, networking delay, delay variance, error rate, quality of service, QoS perspectives, QoS processing, multimedia transmission, requirements, transmission over WANs, Multimedia Transmission over LANs, ATM networks, Wireless LANs

Multimedia transport protocols: RTP and RTCP.

Multimedia Management protocols: H.323, SIP, SDP, SAP.

TEXT BOOKS

1. Multimedia Communications: Applications, Networks, Protocols, and Standards, Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.
2. Multimedia Information Networking, Nalin K. Sharda, PHI,2003.

REFERENCE BOOKS

1. Ralf Steinmetz, Klara Narstedt, “Multimedia Fundamentals: Vol 1-Media Coding and Content Processing”, Pearson Education, 2004.
2 Prabhat K. Andleigh, Kiran Thakrar, “Multimedia Systems Design”, PHI, 2004.

PHES410	COMPUTER ARCHITECTURE

Parallel computer Model: State of computing, multiprocessor & multi-computer multivector & SIMD, VLSI Models (Ref. 2: 1.1 - 1.4)

Instruction Level parallel Processing Introduction (Ref. 1: 4.1, 4.2, 4.3)

Pipe lined processors (Ref. 1: 5.1, 5.2, 5.3)

Linear and Non-linear pipelines for corruption –carry-save adder pipes for integer multiplication- 4 stage fixed point multiplication of 8 bit integer Non-linear pipe theory-State transition diagram-issue latencies for non-linear pipes-use of delay to improve issue latencies (Ref. 2: 6.1, 6.2, 6.4)

Scalar and Super scalar processing – data control and resource dependencies, register renaming –reservation stations-reorder buffers- Case studies-Power PC 620, CISC processors with RISC core-Pentium Pro Case study (Ref.1: 7.7 to 7.10 with enough background from earlier sections to appreciate these articles)

branch Control (Ref.1: 8.4 with back ground from earlier sections)

Data Parallel Architecture: Introduction (Ref.1: 10)-Static and dynamic interconnection networks – omega l and baseline networks (Ref. 2: 2.4) SIMD systems – case study –

MPP and CMS (Ref.1: 11.3, 11.4) Vector Processing – Case study – Cray family (Ref.1: 14.3 to 14.7) Introduction to Systolic architecture – example matrix multiplication (Ref. 1: 13.3)

.

. Multiprocessors and Multicomputers cache coherence and Synchronization mechanism (Ref. 2: 7.2) Three generation of multicomputers (Ref. 2: 7.3)

Data Flow Architecture: Data Flow and Hybrid Architecture – Data Flow Architecture (Ref. 2: 9.5)

Case Study: VLIW Architecture (Ref. 2: 4.2.2) – Super scalar and RISC processor (Selected Sections from Chapter 4 and Ref. 2) SPARC.

TEXT BOOKS

Advanced Computer Architectures – A design space approach, Dezso Sima, Terence Fountain, Peter Kacsuk, Pearson Education 1997.

Advanced Computer Architecture Parallelism, Scalability, Programmability, Kai Hwang, Tata Mc Graw Hill, 2003.

PHES411 **PATTERN CLASSIFICATION**

Introduction:

Machine Perception, Pattern Recognition Systems, The Design Cycle, Learning and Adaptation.

Bayesian Decision Theory:

Bayesian Decision Theory-Continuous Feature, Minimum – Error – Rate Classification, Classifiers, Discriminant Functions, and Decision Surfaces, The Normal Density, Discriminant Functions for the Normal Density, Error Probabilities and Integrals, Error Bounds for Normal Densities, Bayes Decision Theory – Discrete Features,

Maximum- likelihood and Bayesian Parameter Estimation:

Maximum- Likelihood Estimation, Bayesian Estimation, Bayesian parameter estimation, Gaussian Case, General Theory, Sufficient Statistics, Problems of Dimensionality, Component Analysis and Descriminats,

Non Parametric Techniques:

Density Estimation, Parzen Windows, Kn-Nearest- neighbor Estimation, the nearest neighbor Rule, Metrics and Nearest Neighbor Classification, Fuzzy Classification,

Linear Discriminant Functions:

Linear Discriminant Functions and Decision Surface, Generalized Linear Discriminant Functions, The Two Category Linearly Sufferable Case,

Unsupervised Learning and Clustering:

Mixture Densities and Identifiability, Maximum Likelihood Estimates, Applications to Normal Mixtures, Unsupervised Bayesian Learning, Data Discrimination and Clustering, Criterion Functions for Clustering, Iterative Optimization, Hierarchical Clustering, The Problem of Validity, Online Clustering, Graph Theoretic Methods, Component Analysis, Low Dimensional Representation and Multi-Dimensional Scaling.

Multilayer Neural Networks:

Feed Forward Operation and Classification, Back Propagation Algorithm, Error Surfaces, Back Propagation as Feature Mapping, Bayes Theory and Probability, Related Statistical Techniques, Practical Techniques for Improving Back Propagation, Second Order Methods, Additional Networks and Training Methods, Regularization, Complexity Adjustment and Pruning.

Introduction to Biometric Recognition:

Biometric Methodologies: Finger Prints, Hand Geometry, Facial Recognition, Iris Scanning, Retina Scanning. Identification Verification - The Distinction, Performance Criteria.

TEXT BOOKS

1. Richard O. Duda, Peter E. Hart, David G. Stork; "Pattern Classification", A Wiley-Interscience Publication, John Wiley & Sons, Inc, 2000 Second Addition.
2. K. Jain, R. Bolle, S. Pankanti (Eds.), "Biometrics: Personal Identification in Networked Society", Kluwer Academic Publishers, 1999.

Introduction

An Embedded System; Characteristics of Embedded Systems; Software embedded into a system; Real Time Definitions, Events and Determinism, Synchronous & Asynchronous Events, Determinism, Time-Loading, Real-Time Design Issues, Example Real Time Systems.

Embedded Microcontroller Cores and Architecture 8051 Micro controller; Architecture; Instruction sets; Assembly language programming; I/O port programming; Timer / counter programming;, Serial Communication; Interrupts programming.

Real Time specifications and design technique:

Mathemetical specifications, flow charts, structure charts, Finite state automata, data flow.diagrams, Petri Nets, Warnier Orr Notation, State charts.

Processor And Memory Organization : Structural Units in a Processor; Memory Devices, Memory selection for an embedded system; Direct Memory Access, DMA controllers; Interfacing Processor, Memory and I/O Devices; Interrupt servicing (handling) mechanism; Context and the periods for context-switching; Deadline and interrupt latency.

Language Features: Parameter passing, Recursion, Dynamic allocation, Typing, exception handling, abstract data typing.

Real Time Kernels: Real Time and Embedded Operating Systems; Interrupt Routines in RTOS environment; co routines, Interrupt driven systems, Foreground/background systems, Full-featured Real Time Operating Systems.

Inter-Process Communication and Synchronisation Of Processes: Multiple processes in an application; Problem of sharing data by multiple tasks and routines; Inter Process Communication, Mailboxes, Critical Regions, Semaphores, Deadlock.

Programming Languages and Tools: Desired language characteristics; Data typing; Control Structures; Packages; Exception Handling; Overloading; Multitasking; Task Scheduling; Timing specification; Programming environments; Runtime support.

System Performance Analysis and Optimization: Response time calculations, Interrupt latency, Time-loading and its Measurement, Reducing response times and time loading, I/O performance

Fault Tolerance and Reliability: Reliability definitions, Testing: unit and system level; Fault tolerance-N-version programming, built in test software, CPU and Memory testing.

TEXT BOOKS

1. Rajkamal; "Embedded Systems Architecture; Programming and Design"; Tata McGraw Hill Publications.
2. Phillip A. Laplante .;: " Real –Time Systems Design and Analysis" –-3rd Edition, Apr 2004. Wiley-IEEE Press

REFERENCE BOOKS

1. C.M. Krishna; Kang G.Shin; "Real Time Systems"; McGraw-Hill; 1997.
2. Mohammed Ali Mazidi; Janice Gillispie Mazidi "The 8051 Microcontroller and Embedded Systems"; Pearson Education Asia 2002.
3. David E Simon; An Embedded software primer; Addison Wesley; 2000.
4. Raymond J.A. Buhr; Donald L. Bailey; "An Introduction To Real Time Systems"; Prentice Hall International; 1999.
5. Rajkamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education.

PHES413	DATA WAREHOUSING & MINING

1. Introduction to data warehousing – The need for data warehousing (1.2), Operational and informational Data stores(1.5), Data warehouse definition and characteristics (1.6), Data warehouse architecture (1.7)

2. Data warehousing component - Data warehouse Database (6.2), Sourcing, Acquisition, Cleanup and transformation tools (6.3), Metadata (6.4), Access tools (6.5), Data marts(6.6), Data warehousing administration and management (6.7), Information delivery system

3. Online analytical processing(OLAP) - Need for OLAP (13.1), Multidimensional data model (13.2), OLAP guidelines(13.3), Multidimensional vrs. Muiltirelational (OLAP (13.4), Categorization of OLAP tools (13.5), OLAP tools internet (13.6)

4. Statistics- Data counting and probability (15.1), Hypothesis testing (15.2), Contingency Tables, The chi square test, and non casual relationship.

5. Introduction to data mining – The motivation (17.2), Learning from past mistake (17.3), Data mining (17.4), Measuring data mining effectiveness(17.5), Embedded data mining into business process (17.6), What is decision tree (18.1), Business score card (18.2), Where to use decision tree (18.3), The general idea (18.4), How the decision tree works (18.5). Case study: Prediction wireless communication churn with CART.

6. 6 Nearest neighbor and clustering - Where to use clustering and nearest neighbor prediction (20.2), How clustering and nearest neighbor prediction works (20.4) Case study: Image recognition for human handwriting Genetic Algorithm - What are Genetic Algorithms (21.1), Where to use Genetic Algorithm? (21.2), The general idea (21.3), How the Genetic algorithm works (21.4) Case study: Optimizing predictive customer segment

TEXT BOOKS

1. Data warehousing, Data mining and OLAP by Alex Berson & Stephon J. Smith, Tata McGraw Hill.

2. Data Warehousing in the Real World – A Practical Guide for Building Decision Support Systems, Sam Anahory & Dennis Murray, Pearson Education.

REFERENCE BOOKS

1. Data Mining – Introductory and Advanced Topics, Margaret H. Dunham, Pearson Education.

2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, & Vipin Kumar, Pearson Addison Wesley, 2006.

PHES414	MULTIMEDIA INFORMATION SYSTEMS

Multimedia Information, Delay –sensitive and Time-based Media data Modeling, Multimedia storage and retrieval techniques, Multimedia communications: Synchronization delay compensation, QoS negotiations protocols, Architecture and Issues for Distributed Multimedia Systems, Prototype Multimedia systems: Video–on-Demand, Video conferencing.

REFERENCE BOOKS:

1. Grosky WL, Jain R, and Mehrotra R.: "The Handbook of Multimedia Information Management", Prentice -Hall 1997.

1. Koegel Buford JF, : "Multimedia Systems" Addison – Wesley , 1994

2. Relevant Research Papers from Journals / Conferences.

PHES415	SYSTEM PERFORMANCE & EVALUATION

Introduction

Performance evaluation methods, Analytical versus Simulation modeling, Performance measurement and Benchmarking. Workload modeling, Random variables. Commonly used distributions. Stochastic processes, Markov chain models of computer systems, Steady – state Transient analyses, Queuing models.Single server and multi-server queues, Open and close queuing networks. Discrete event simulation, Simulation Languages

Random Number Generation and Testing, model verification and validation, Analysis of simulation results, Confidence interval Variance reduction techniques.Case studies of Analytical and simulation studies of computer systems.

REFERENCE BOOKS:

1. Raj Jian. "The Art of Computer Systems Performance Analysis". John Wiley and sons, New York, USA, 1991
2. Trivedi K S, **"**Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall of India, Reprinted in 1990
3. Law A M and Kelton W.D. "Simulation Modeling and Analysis ", McGraw Hill, New York, USA, 1991

Performance issues: measurements profiling & development tools. Sustained Vs Peak performance

High Performance sequential computers: Effects of the memory Hierarchy, Out-of-Order execution, super scalar processor,

Vector Processing

Shared-Memory processing: Architecture (Extension of the memory Hierarchy) perforamance paradigm, Open MP.

Distributed memory processing: Architectural issues, (Network & Interconnections), Program paradigm, MPI (+MPI2)

Grids: Computational Grid, Data Grid, Performance of libraries & packages

The productivity crisis & future direction: Development overheads, Petaflops Programming, New parallel languages, UPC, Titanium, and Co-Array FORTRAN.

TEXT BOOKS:

1. Charles Severance and Kevin Dowal, "High-Performance Computing", 2nd Ed, 1998, O'Reilly Gear

2. Rajkumar Buyya,"High Performance Cluster Computing", (paper back 2nd Ed, Prentice Hall, 1998

3. Lloyd D. Fosdick, etal, "Introduction to High-Performance Scientific Computing", The MIT Press, 1996.

PHES417	ELECTRICAL MACHINE DYNAMICS

Dynamic Equation of motion: Electro mechanical systems-Analytical techniques, Transducers-physical systems, Fundamentals of systems dynamics

Lagrange's equations: Applications of Lagrange's equation to electro mechanical system, Solution of electro dynamical equations, Euler's method, Runge-Kutta method.

Generalized machine concepts: KRON's machine, performance equation, dynamic variables, machines with uniform gap, machines with Saliency

Dynamics of machines: Commutator machines-induction machines-synchronous machines-small oscillations-synchronous machine equation during small oscillations, general equations for small oscillations, representation of the oscillation equations in state variable form. Generalized analysis of N-M winding machines

TEXT BOOKS:

1. Adkins "Generalized theory of Electrical machines", Dover, 1980

2. D.P.Sen Gupta and J.W.Lynn "Generalized theory of machines".

3. Seely "Electro mechanical energy conversion", MGH 1962

4. Bimbhra PS "Generalized theory of Electrical machines", Khanna 1995

PHES418	VLSI TECHNOLOGY

Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques.

Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles. **Oxidation:** Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films. Oxidation technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI.

Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation.

Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modeling and technology.

Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal interconnects; Multi-level metallization schemes.

Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI. Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOS technologies

TEXT BOOKS:

1. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S.K. Gandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
3. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

REFERENCE BOOKS:

1. Stephena, Campbell, “the Science and Engineering of Microelectronic Fabrication”, Second Edition, Oxford University Press, 2005
2. Yuan Taur, Tak. H. Ning, “Fundamentals of Modern VLSI Devices”, Cambridge University Press, 2003

PHES419	POWER ELECTRONICS SYSTEM DESIGN WITH ICS

Introduction — measurements techniques for voltages, current, power, p.f in thyristorised AC & DC circuits — other measurement and recording of waveforms — sensing of current, voltage power in thyristorised circuits — sensing of speed, review of PWM ICs basic concepts of digital logic circuits — Design of Combinational and sequential circuits — PLL A/D & D/A converters, 555 timer, Op-amps, Implementation of gating — PLCs developing a microprocessor based system.

TEXT BOOKS:

1. G. K. Dubey "Thyristorised power controller" Wiley Eastern.
2. J. R. Gibson,"Electronic Logic circuits" ELBS

REFERENCE BOOKS:

1. Data Book "National semiconductor" –
2. Data Book I & II "Motorola — Linear ICs"
3. Unitriode Applications data book

PHES420	DIGITAL SWITCHING SYSTEMS

Introduction: Review of probability, Poisson and exponential distributions, queueing theory, Markov process, Issues, architectures and performance analysis for statistical bandwidth sharing (multiplexing) and traffic switching in telecommunication networks.

Digital Switching: Switching functions, SDS, TDS, Two Dimension switching, Digital switching in analog environment.

Reliability Modeling and analysis: Purpose, system reliability assessment, failures Models, state Transitions Diagram CPC, clock subsystems, N/W Controller subsystem, switching N/W, link and trunk downtimes, call stuffs.

Switching Systems S/W and quality analysis: O.S, Data base Management S/W architecture, calls models, call features, file cycle, Methodology for assessing quality Maintenance

Analysis of Networked switching systems: Scope, digital switching systems Model, H/W architecture, S/W architecture Recovery stating us, Reliability analysis

Advanced Topics: Interconnection networks for circuit and fast packet switching and their blocking and queueing analysis; call processing architectures; switching systems capacity analysis and traffic overload control. Statistical multiplexing; blocking analysis in circuit multiplexed networks with single rate or Multirate traffic, call-level multiplexing, burst-level multiplexing, Models for packetised sources, such as voice and video, Models forperformance analysis of integrated packet networks, calculation of performance measures; analysis and design of traffic controls.

TEXT BOOKS:

1. Syed R. Ali, “Digital switching systems : System Reliability & Analysis”, Tata McGraw hill edition, 2002.
2. John Bellamy, “Digital telephony”, John Wiley and Sons, 1990.
3. J. E. Flood “Telecommunication switching, traffic and Networks”, Pearson Education, 1999

REFERENCE BOOKS:

1. Thiagarajan Viswanathan, “Telecommunication switching systems & networks” PHI, 2001
2. Pattavina, “Switching Theory – Architecture & Performance in Broadband ATM Networks”, John Wiley & Sons, 1998.
3. Hui. J.Y., “Switching and Traffic Theory for Integrated Broadband Networks”, Kluwer, 1990
4. F.J.Redmill and A.R.Valder, “SPC Digital Telephone Exchanges”, IEE (UK) 1990.

PHES421	DESIGN OF ANALOG & MIXED MODE VLSI CIRCUITS

Introduction to CMOS analog circuits, MOS transistor DC and AC small signal parameters from large signal model, Common source amplifier with resistive load, diode load and current source load, Source follower, Common gate amplifier, Cascode amplifier, Folded Cascode, Frequency response of amplifiers, Current source/sink/mirror, Matching, Wilson current source and Regulated Cascode current source, Band gap reference, Differential amplifier, Gilbert cell, Op-Amp, Design of 2 stage Op-Amp, DC and AC response, Frequency compensation, slew rate, Offset effects, PSRR, Noise, Comparator, Sense Amplifier, Data Converter Fundamentals, Analog Versus Discrete Time signals, Converting analog signals to Digital signals, Sample and Hold Characteristics, Data Architectures, DAC and ADC specifications. Mixed Signal Layout Issues, DAC Architectures,R-2R Ladder Networks, Current steering, Pipeline DAC. ADC Architectures, Flash, The Two step Flash ADC, The Successive Approximation ADC, RF amplifier, Oscillator, PLL, Mixer.

TEXT BOOKS:

1. Phillip. E. Allen, Douglas R. Holberg, “CMOS Analog circuit Design” Oxford University Press, 2002
2. Razavi B., “RF Microelectronics”, Prentice Hall, 1998.
3. Baker, Li, Boyce, “CMOS: Circuit Design, Layout and Simulation”, Prentice Hall of India, 2000
4. Bosco Leung, “VLSI for Wireless Communication”, PH, 2002

REFERENCE BOOKS:

1. Razavi B., “Design of Analog CMOS Integrated Circuits”, TMH, 2003
2. Mukherjee, “VLSI System Design: Introduction to NMOS and CMOS VLSI System Design”, Prentice-Hall, 1986
3. R. L. Geiger, P. E. Allen, and N. R. Strader, “VLSI Design techniques for analog and digital circuits”, McGraw-Hill, 1990
4. T. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press 1998.
5. Reinhold Ludwig, Pavel Bretchko, RF Circuit Design, Pearson Education, 2001

PHES422	WIRELESS COMMUNICATIONS

Radio propagation: Free space propagation model, Relating power to electric field, reflection, ground reflection diffraction, scattering, practical link budget design using path loss models, outdoor propagation models, indoor propagation models, signal penetration into buildings, ray tracking and site specific modeling, small scale multi-path propagation, impulse response model of a multi-path channel, small scale multi-path measurements, parameters of mobile multi-path channels, types of small scale fading, Rayleigh and Ricean distributions, statistical models for multi-path fading channels.

Diversity techniques: Concepts of Diversity branch and signal paths, Combining and switching methods, C/N, C/I performance improvements, Average P_e, performance improvement, RAKE receiver.

Cellular concept: Frequency reuse, channel assignment strategies, handoff strategies; interference and system capacity, trunking and grade of service, improving coverage and capacity in cellular systems, FDMA, TDMA, spread spectrum multiple access, SDMA, packet Radio, capacity of cellular systems

Personal Mobile Satellite Communications: Integration of GEO, LEO, and MEO Satellite and Terrestrial mobile systems, personal satellite Communications programs.

CDMA Systems Implementation: Is-95 System Architecture, Soft Handoff and Power Control in IS-95 CDMA, cdma2000 System.

Signal reception: Wireless signaling environment, basic receiver signal processing for wireless, blind multi-user detection, linear receivers for synchronous CDMA, blind multi-user detection direct methods, blind multi-user detection subspace methods, performance of blindmulti-user detector, subspace tracking algorithms, blind multi-user detector in multi-path channels.

TEXT BOOKS:

1. **Theodore S. Rappaport**, "Wireless Communications: Principles and Practice," 2nd edition, Prentice Hall of India, 2005.

2. **Kamilo Feher**, "Wireless Digital Communications: Modulation and Spread Spectrum Techniques," Prentice Hall of India, 2004.

3. **Vijay K. Garg**, "IS-95 CDMA and cdma2000," Pearson Education (Asia) Pte. Ltd, 2004.

4. **Xiaodong Wang** and **Vincent Poor**, "Wireless Communication Systems: Advanced Techniques for Signal Reception," Pearson Education (Asia) Pte. Ltd, 2004.

PHES423	THEORY & DESIGN OF BIO – MEDICAL INSTRUMENTS

Transducers; Ultrasonic Instruments; Electrodynamics & Magnetostrictive Transducers; Force balanced transducers; Fiber optic transducers; Signal Processing Circuitry & Microprocessors; Biotelemetry; Frequency discriminators & Phase Locked loops

TEXT BOOKS:

1. Walter Welkowitz, and others, "Biomedical Instruments-Theory and Design", Academic Press 1992, II edition
2. R.S.C. Cobbold, "Transducers for biomedical measurements: Principle and practice", John Wiley 1974
3. Tatsno Togawa, Toshiyo Tarnura, P.Akeoberg, "Biomedical transducers and Instrument", CRC Press, 1997

PHES 424 LOW POWER VLSI DESIGN

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation

Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Low Power Design

Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network

Algorithm & architectural level methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

TEXT BOOKS:

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002

2. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic, 1997 Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000

PHES425	SYNTHESIS AND OPTIMIZATION OF DIGITAL CIRCUITS

Introduction: Microelectronics, semiconductor technologies and circuit taxonomy, Microelectronic design styles, computer aided synthesis and optimization.

Graphs: Notation, undirected graphs, directed graphs, combinatorial optimization, Algorithms, tractable and intractable problems, algorithms for linear and integer programs, graph optimization problems and algorithms, Boolean algebra and Applications.

Hardware Modeling: Hardware Modeling Languages, distinctive features, structural hardware language, Behavioral hardware language, HDLs used in synthesis, abstract models, structures logic networks, state diagrams, data flow and sequencing graphs, compilation and optimization techniques.

Two level combinational logic optimization: Logic optimization, principles, operation on two level logic covers, algorithms for logic minimization, symbolic minimization and encoding property, minimization of Boolean relations.

Multiple level combinational optimizations: Models and transformations for combinational networks, algebraic model, Synthesis of testable network, algorithm for delay evaluation and optimization, rule based system for logic optimization.

Sequential circuit optimization: Sequential circuit optimization using state based models, sequential circuit optimization using network models.

Schedule Algorithms: A model for scheduling problems, Scheduling with resource and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits.

Cell library binding: Problem formulation and analysis, algorithms for library binding, specific problems and algorithms for library binding (lookup table F.P.G.As and Antifuse based F.P.G.As), rule based library binding.

Testing: Simulation, Types of simulators, basic components of a simulator, fault simulation Techniques, Automatic test pattern generation methods (ATPG), design for Testability (DFT) Techniques.

TEXT BOOKS:

1. Giovanni De Micheli, “Synthesis and Optimization of Digital Circuits," Tata McGraw-Hill, 2003.
2. Srinivas Devadas, Abhijit Ghosh, and Kurt Keutzer, “Logic Synthesis,” McGraw-Hill, USA, 1994.
3. Neil Weste and K. Eshragian,”Principles of CMOS VLSI Design: A System Perspective,2nd edition, Pearson Education, 2000.
4. Kevin Skahill, “VHDL for Programmable Logic,” Pearson Education, 2000.

PHES426	SPEECH AND AUDIO PROCESSING

Digital models for the speech signal: Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals.

Time domain models for speech processing: Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing.

Digital representations of the speech waveform: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion.

Short time Fourier analysis: Linear Filtering interpretation, Filter bank summation method, Overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems.

Homomorphic speech processing: Homomorphic systems for convolution, Complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder.

Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications.

Speech Enhancement: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation.

Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

Automatic Speech Recognition: Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks.

Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

TEXT BOOKS:

1. L. R. Rabiner and R. W. Schafer**,** "Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
2. D. O'Shaughnessy, "Speech Communications: Human and Machine," Universities Press, 2001.
3. L. R. Rabiner and B. Juang, "Fundamentals of Speech Recognition," Pearson Education (Asia) Pte. Ltd., 2004.
4. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

PHES427	• NET TECHNOLOGY

Net Framework: The Architecture of.Net Framework Development Platform, Building, Packaging, Deploying, and Administering Applications and types Shared Assemblies

Common Language Runtime: Type Fundamental Primitive, Reference and Value Types Common Object Operations Type Members Constants and Fields Methods Properties Events Working with Text Enumerated Types and Bit Flags Arrays Interfaces Custom Attributes Delegates Exceptions Automatic Memory Management CLR Hosting AppDomains Refletion

Language Fundamentals: Introduction to C# Expressions and Control Structures Strings and Regular Expressions Arrays and Collections Objects and Classes File and Stream I/O and Object Persistence XML Fundamentals Multithreaded Programming Events and Delegates Reflection and Code Attributes Assemblies and AppDomains COM and Windows Interoperability High Performance Programming

Applications: Introduction to Windows Forms, Windows Forms User Interface Controls, Creating Visually Compelling Windows Forms Applications Consuming Web Services Smart Clients Deploying Windows Applications, Introduction to Web Forms and ASP•NET Web UI Controls State Management in ASP•NET Caching Advanced ASP•NET Deploying ASP•NET Applications Using •NET Data Providers Creating a Custom ADO•NET Data Provider Typed DataSets and XSD Windows Forms Data Binding Web Forms Data Binding Introduction to Web Services Using WSE 2.0 ode Access Security Securing Sensitive Data Securing ASP•NET Web Applications Licensing and Intellectual Property Interface Programming Remoting COM+ Enterprise Services Enterprise Templates

TEXT BOOKS:

1. Jeffery Richter: Applied Microsoft •NET Framework programming, WP Publishers 2003
2. Kevin Hoofman, Lonny Kruger: "Microsoft Visual C# •NET" 2003, Pearson 2005
3. Angshuman Chakraborti, Miscrosoft "•NET Framework", PHI 2002

PHES428	PARALLEL SYSTEMS

Principles of Pipelining and Vector Processing: Vector Processing Requirements, Characteristics of Vector Processing, Multiple Vector Task Dispatching, Pipelined Vector Processing Methods

Pipeline Computers and Factorization: Scientific Attached Processors, The Architecture of AP 120B, Recent Vector Processors, The Architecture of Cray-1, Pipeline Chaining and Vector Loops, The Architecture of Cyber-205 and CDC-NASF, Vectorization and Optimization Methods, Language Features in Vector Processing, Design of Vectorizing Compilers, Optimization of Vector Operations

Structures and algorithms for Array Processors: SIMD Array Processors, SIMD Computer Organizations, Masking and Data Routing Mechanisms, Inter-PE Communications, SIMD Interconnection Networks, Static versus Dynamic Networks, Mesh-Connected Iliac Networks, Cube Interconnection Networks, Barrel Shifter and Data Manipulator, Parallel Algorithms for Array Processors, SIMD Matrix Multiplication, Associative Array Processing, Associative Memory Organizations

SIMD computers and Performance Enhancement: The Iliac –IV Systems Architecture, Applications of the Iliac –IV, The MPP System Architecture, Processing Array, Memory, and Control

TEXT BOOKS:

4. Hwang and Briggs, " Computer Architecture and Parallel Processing"; MGH.VLSI, 1984
5. Kai Hwang, "Advanced computer architecture"; TMH, 1993
6. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication, 1998
7. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing, 1998

REFERENCE BOOKS:

5. D. A. Patterson and J. L. Hennessey, "Computer organization and design," Morgan Kaufmann, 2002.
6. J. P. Hayes, "Computer Architecture and organization"; MGH, 1998
7. R.K.Ghose, Rajat Moona & Phalguni Gupta, "Foundation of Parallel Processing"; Narosa Publications, 1998
8. Kai Hwang and Xu, "Scalable Parallel Computing"; MGH, 1998.

PHES429	ADVANCED DATA NETWORKS

Introduction: Message & switching, Layering, A distributed algorithm problem.

Physical Layer: Channels & Modems, Error detection, ARQ, Framing, Standard DLCs, Initialization & disconnect for ARQ protocols, PPP at network layer, the transport Layer, Broadband ISDN & the ATM

Delay models in networks Introduction, Queuing Models, M/M/1 queuing system, M/M/m, M/M/∞, M/M/m/m & other Markov systems, M/G/1 system, Networks of transmission lines, Time reversibility, Networks of Queues

Multi-access communication: Introduction, Slotted multi-access & aloha system, Splitting algorithms, Carrier sensing, Multi-access reservations, Packet Radio networks

Routing in Data Networks: Introduction, Network algorithms & shortest path routing, Broadcasting routing information : coping with link failures, Flow models, optimal routing, & topological design, characterization of optimal routing, feasible direction methods for optimal routing, projection routing for optimal routing, routing in the codex network

Flow Control: Introduction, window flow control, rate control scheme, overview of flow control in practice, rate adjustment algorithms.

Text Books:

1. W. Stallings, "Data and Computer Communications"
2. J. Martin, "Computer Networks and Distributed Processing"
3. A. S. Tanenbaum, "Computer Networks"
4.

PHES430	OPTICAL COMMUNICATION & NETWORKING

Introduction: Propagation of signals in optical fiber, different losses, nonlinear effects, solitons, optical sources, detectors.

Optical Components: Couplers, isolators, circulators, multiplexers, filters, gratings, interferometers, amplifiers.

Modulation — Demodulation: Formats, ideal receivers, Practical detection receivers, Optical preamplifier, Noise considerations, Bit error rates, Coherent detection.

Transmission system engineering: system model, power penalty, Transmitter, Receiver, Different optical amplifiers, Dispersion.

Optical networks: Client layers of optical layer, SONET/SDH, multiplexing, layers, frame structure, ATM functions, adaptation layers, Quality of service and flow control, ESCON, HIPPI.

WDM network elements: Optical line terminal optical line amplifiers, optical cross connectors, WDM network design, cost trade offs, LTD and RWA problems, Routing and wavelength assignment, wavelength conversion, statistical dimensioning model.

Control and management: network management functions, management frame work, Information model, management protocols, layers within optical layer performance and fault management, impact of transparency, BER measurement, optical trace, Alarm management, configuration management.Suitable number of Assignments / Tutorials can be given based on the syllabus

TEXT BOOKS:

1. John M. Senior, “Optical fiber Communications”, Pearson edition, 2000.
2. Rajiv Ramswami, N Sivaranjan, “Optical Networks”, M. Kauffman Publishers, 2000.

REFERENCE BOOKS:

1. Gerd Keiser, “Optical Fiber Communication”, MGH, 1 991.
2. G. P. Agarawal, “Fiber Optics Communication Systems”, John Wiley NewYork, 1997
3. P.E. Green, “Optical networks”, Prentice Hall, 1994.

PHES431	ALTERNATE ENERGY SOURCES

Introduction to energy sources, need for non-conventional energy sources

Geothermal Energy: Introduction, origin and types of geothermal energy, operational and environmental problems, vapor dominated systems, liquid dominated systems, (flashed steam, binary cycle, total flow concept), petro-thermal systems, hybrid geothermal - fossil systems

Solar Energy: Introduction, extra terrestrial and terrestrial solar radiation, solar- electric conversion systems, solar thermal central receiver systems, the Heliostats, the receiver, the heat transport system, the thermal storage system, distributed solar thermal systems, other solar thermal power systems, solar ponds, photo voltaic energy conversion, solid state principles, semiconductors, the solar cell, photo-voltaic energy storage, satellite solar power systems

Wind Energy: Introduction, principles of wind power, wind turbine operation, site characteristics, new developments: small machines, large machines

- The magnetic effect, Madras rotor wind machine, The darrius machine, other wind turbine designs

- Energy From the Oceans: Introduction, ocean temperature differences, the open or Claude cycle, modification of the open OTEC cycle, the closed or Anderson cycle, OTEC cycle, recent OTEC

cycle developments, ocean waves, wave motion, energy and power from waves, wave-energy conversion by floats, high pressure accumulation wave machines, other wave machines, the tides, the simple single-pool tidal system, the modified single-pool tidal system, the two-pool tidal system

□ Energy Storage: Energy storage systems, pumped hydro, compressed air storage, energy storage by (i) flywheels (ii) electrical battery (iii) super conducting magnet, (iv) latent heat (v) chemical reaction (vi) thermal sensing.

REFERENCE BOOKS:

1. M. M. El-Wakil, “Power Plant Technology”, McGraw Hill International edition, 1984.

2. B. G. A. Skrotzki and W. A. Vopat, “Power station engineering and Economy”, TMH, 1990.

3. Selected topics from IEEE, AIEE and CIGRE Journals.

DISCUSSION TOPICS

General layout and characteristics of hydel, thermal and nuclear power plants, introduction to non-conventional power generation, load forecasting, load curves, load duration curves, selection of generating units.