

**Course Structure & Scheme**

**for**

**Master of Technology [Information Technology]  
Weekend Programme**

**(2002 – 2005)**

**Offered by**

**School of Information Technology**

**Guru Gobind Singh Indraprastha University  
Kashmere Gate, Delhi [INDIA] –110 006**

# M.Tech. [Information Technology] Weekend Programme

## FIRST SEMESTER

<b>Code No.</b>	<b>Paper</b>	<b>Credits</b>	<b>Contact Hrs. /Semester</b>	<b>Self Study Hours</b>
ITW – 601	Programming & Data Structure	3	40	15
ITW – 603	Computer Architecture	3	40	15
ITW – 605	Digital Electronics & Microprocessor	3	40	15
ITW – 607	Data Communication	3	40	15
<b>Practicals</b>				
ITW – 651	Lab – I	4	60	40
ITW – 653	Lab – II	4	60	40
	<b>TOTAL</b>	<b>20</b>		

# **M.Tech. [Information Technology] Weekend Programme**

## **SECOND SEMESTER**

<b>Code No.</b>	<b>Paper</b>	<b>Credits</b>	<b>Contact Hrs./ Semester</b>	<b>Self Study Hours</b>
ITW – 602	Object Oriented Technology	3	40	15
ITW – 604	Algorithm Analysis & Design	3	40	15
ITW – 606	Digital System Design	3	40	15
<b>Practicals</b>				
ITW – 652	Lab – III	3	60	40
ITW – 654	Lab – IV	3	60	40
ITW – 656	Term Paper – II*	2	-	
	<b>TOTAL</b>	<b>17</b>		

**\*Non University Exam System**

# M.Tech. [Information Technology] Weekend Programme

## THIRD SEMESTER

<b>Code No.</b>	<b>Paper</b>	<b>Credits</b>	<b>Contact Hrs./ Semester</b>	<b>Self Study Hours</b>
ITW – 701	Database Management System	3	40	15
ITW – 703	Advanced Computer Networks	3	40	15
ITW – 705	Operating Systems	3	40	15
<b>Practicals</b>				
ITW – 751	Lab – V	3	60	40
ITW – 753	Lab – VI	3	60	40
ITW – 755	Term Paper – III*	2	-	
	<b>TOTAL</b>	<b>17</b>		

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## M.Tech. [Information Technology] Weekend Programme

### FOURTH SEMESTER

Code No.	Paper	Credits	Contact Hrs./ Semester	Self Study Hours
ITW – 702	Software Engineering	3	40	15
ITW – 704	Cellular & Mobile Communication	3	40	15
	<b>Elective I (choose any one)</b>	3	40	15
ITW – 706	Computer Graphics			
ITW – 708	VLSI Design			
ITW – 710	Real Time Systems and Software			
ITW – 712	Data Warehousing & Data Mining			
ITW - 714	AI & Expert System			
ITW - 716	Digital Signal Processing			
ITW – 718	Theory of Computation			
ITW – 720	Internet & Web Technology			
ITW – 722	Network Security			
ITW – 724	Compiler Design			
<b>Practicals</b>				
ITW – 752	Lab – VII	3	60	40
ITW – 754	Lab – VIII	3	60	40
ITW – 756	Project work - I*	2	-	
	<b>TOTAL</b>	<b>17</b>		

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**M.Tech. [Information Technology]  
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FIFTH SEMESTER**

<b>Code No.</b>	<b>Paper</b>	<b>Credits</b>	<b>Contact Hrs./ Semester</b>	<b>Self Study Hours</b>
ITW - 801	Software Verification, Validation & Testing	3	40	15
	<b>Elective II (choose any one)</b>	3	40	15
ITW – 803	Neural Network			
ITW – 805	Embedded Systems Design			
ITW – 807	Fuzzy Logic			
ITW – 809	Digital Image Processing			
ITW – 811	Designing with ASICs			
ITW – 813	Object Oriented Software Engineering			
ITW – 815	Soft Computing			
ITW – 817	Software Project Management			
ITW – 819	Digital VLSI Design			
ITW – 821	Telecommunication Networks			
	<b>Elective III (choose any one)</b>	3	40	15
ITW – 823	Multimedia Technology			
ITW – 825	Natural Language Processing			
ITW – 827	Enterprise Resource Planning			
ITW – 829	Cognitive Psychology			
ITW – 831	Software Quality Assurance & Certification			
ITW – 833	Network Programming			
ITW – 835	Advanced VLSI Design			
ITW - 837	Advanced Digital Circuit Design			
ITW – 839	Mobile Computing			
<b>Practicals</b>				
ITW – 851	Lab – IX	3	60	40
ITW – 853	Lab – X	3	60	40
ITW – 855	Project Work – II*	2	-	
	<b>TOTAL</b>	<b>17</b>		

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# **M.Tech. [Information Technology] Weekend Programme**

## **SIXTH SEMESTER**

<b>Code No.</b>	<b>Paper</b>	<b>Credits</b>	<b>Contact Hrs./ Semester</b>
ITW – 802	Dissertation	20	-
ITW – 804*	Seminar & Progress Reports	03	-
ITW – 806*	Comprehensive Viva	01	-
	<b>Total</b>	<b>24</b>	

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**Note:**

1. The total number of credits of the programme M.Tech. [Information Technology] = 112
2. Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits.

## **ITW-601      Programming and Data Structures**

C program structures, Variables, Data Types, Declarations, Operators (Arithmetic, Relational, Logical), increment and decrement operators, Assignment operators and expressions, Arithmetic expressions, statements, symbolic constants, conditional expressions, Bitwise operators, precedence and order of evaluations, input-output functions.

Statements and Blocks, branching statements (if, switch), Loops (while, for, do-while, repeat-until), Break and continue, go to and labels.

Functions, external variables, scope rules, header files, static variables, initialization, parameter passing (call-by-value, call-by-reference), recursion, C preprocessor.

Pointers and addresses, pointers and function arguments, pointer and arrays, address arithmetic, character pointers and functions, pointer arrays, multidimensional arrays, initialization of pointer arrays, pointers and multidimensional arrays, command line arguments, memory management.

Structures: Defining and processing, passing to a function, Unions.

Files: Standard input and output, formatted output, formatted input, file access, miscellaneous functions.

### **Data Structures:**

Arrays : representation and basic operations.

Linked list : Singly, Doubly, Circular and Doubly circular, definition, representation and their basic operations.

Stacks and queues : insertion, deletion.

Trees : insertion, deletion, traversal (inorder, preorder and postorder), binary trees, AVL trees, B-trees, B+-trees.

### **Text:**

1. Gottfried, "Schaum's Outline series in C Programming", McGraw Hill.
2. Horowitz, E. and Sahni, S., "Fundamentals of Data Structures", Galgotia Publications.

### **References**

1. Kernighan and Ritchie, "The C programming Language", PHI.
2. Lipschultz, "Schaum's Outline series in Data Structures", McGraw Hill.
3. Hutchison, R., "Programming in C", McGraw Hill.
4. Johnsonbaugh, R. and Kalin M., "Applications programming in C", PHI.
5. Rajaraman, V., "Computer programming in C", PHI.

## ITW-603      Computer Architecture

### **Introduction:**

Overview of Digital Fundamentals

### **Register Transfer and Microoperation:**

Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations.

### **Basic Computer Organization and Design:**

Instruction Codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupts, Design of Basic Computer, Design of Accumulator Logic.

### **Microprogrammed Control Unit:**

Control Memory, Address Sequencing.

### **Central Processing Unit:**

Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

### **Computer Arithmetic:**

Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operation, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

### **Input – Output Organization:**

Peripheral devices, Input – Output interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input – Output Processor.

### **Memory Organization:**

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

### **Text:**

1. Mano, M “Computer System and Architecture”, PHI.

### **Reference:**

1. Pal Chaudhuri, P. “Computer Organization & Design”, PHI.
2. Malvino “Digital Computer Electronics: An Introduction to Microcomputers, 3/e”, McGraw Hill.
3. Malvino “Digital Principles and Applications, 4/e”, McGraw Hill.
4. Hayes. J.P., “Computer Architecture and Organization”, McGraw Hill
5. Stallings, W “Computer Organization & Architecture”, PHI.

## **ITW-605      Digital Electronics and Microprocessor**

**Number System:** Binary and other Number system, Base Conversion, Binary Arithmetic, Codes and Code conversion

**Boolean Algebra:** Boolean Function, Canonical and Standard forms, Digital Logic Gates, Gate Level Minimization: The map method, Four Variable map.

**Combinational Logic:** Combinational circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers

**Synchronous Sequential Logic:** Sequential Circuits, Latches, Flip-Flops, Registers, Shift Registers, Ripple Counters, Synchronous Counters

**Microprocessor:** Introduction, Microprocessor, Microcomputer, Architecture of 8086, Pin diagram, Instruction set, Assembly language programming, Assembler directives, Procedures and Macros, 8086 Minimum mode, System Timing diagram, Interrupt and Interrupt service procedures. Interfacing 8086 with 8251, 8254, 8255, 8259, 8279. 8086 maximum mode, 8087.

### **Text:**

1. Jain R. P., Modern Digital Electronics; TMH
2. Mano M. Morris, Digital Design; PHI
3. Douglas V. Hall; Microprocessor and Interfacing Programming and Hardware, TMH

### **References:**

1. Malvino A. P., Digital Computer Electronics, TMH
2. Balabanian N. & Carlson B., Digital Logic Design Principles, Wiley Pub.
3. Yarbrough J.M., Digital Logic; Thomson Learning Press
4. Liu Gibson; Microprocessor Systems : The 8086/8088 Family Architecture, Programming & Design, PHI

## **ITW – 607    Data Communications**

Data communications fundamentals: Communication model, computer communications architecture, OSI model, standards, signals, analog and digital transmission, transmission media, line configuration, topologies, data communications codes, error detection and correction methods.

Data Modem & Modulation: Data encoding methods, analog to digital, digital to analog etc., data modulation methods: ASK, FSK, PSK, QAM, M-ary systems. Data modems: modulation interface, operation on 2 wire, 4 wire and dial up lines.

Data communications methods: Data communication interface, line control unit, UART, USRT, Serial interface, terminal types.

Data link control & multiplexing: Flow control, error detection & control, IBM Bisync protocol, SDLC, HDLC, HDLC line procedures, time division multiplexing (TDM), FDM, line encoding, carriers.

Data communication networking: Switched networks, circuit switching, packet switching, broadcast networks, LAN, WAN topologies, ATM & Fram relay, cell relay.

### **Text Books:**

1. William Stallings – Data & Computer Communications, PHI (6<sup>th</sup> ed.)
2. W. Tomasi – Advanced Electronic Communication Systems

### **Reference Books:**

1. Forouzan - Data Communication & Networking, McGraw Hill, 2<sup>nd</sup> ed.
2. James Martin – Telecommunications & the Computer, PHI, 3<sup>rd</sup> ed.
3. PC Gupta – Data Communications, PHI, 2001

**ITW-651      Lab – I**

The practicals will be based on the following papers:

- a) Programming and data structures.
- b) Data Communication

**ITW-653      Lab – II**

The practicals will be based on the following papers:

- a) Computer Architecture.
- b) Digital Electronics & Microprocessor

## ITW- 602 Object Oriented Technology

General concepts of object oriented software, encapsulation, inheritance, polymorphism.

Review of C, difference between C and C++, cin, cout, new, delete operators.

Encapsulation, information hiding, abstract data types, object & classes, attributes, methods. C++ class declaration, state identity and behavior of an object, constructors and destructors, instantiation of objects, default parameter value, object types, C++ garbage collection, dynamic memory allocation, metaclass/abstract classes.

Inheritance, Class hierarchy, derivation – public, private & protected; aggregation, composition vs classification hierarchies, polymorphism, categorization of polymorphic techniques, method polymorphism, polymorphism by parameter, operator overloading, parametric polymorphism, generic function – template function, function name overloading, overriding inheritance methods, run time polymorphism.

Standard C++ classes, using multiple inheritance, persistent objects, streams and files, namespaces, exception handling, generic classes, standard template library: Library organization and containers, standard containers, algorithm and Function objects, iterators and allocators, strings, streams, manipulators, user defined manipulators, vectors, valarray, slice, generalized numeric algorithm.

### Text:

1. S. B. Lippman & J. Lajoie, “C++ Primer”, 3<sup>rd</sup> Edition, Addison Wesley, 2000.
2. A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH

### References:

1. E.Balaguruswamy, “Objected Oriented Programming with C++”, TMH
2. R. Lafore, “Object Oriented Programming using C++”, Galgotia.
3. D . Parasons, “Object Oriented Programming with C++”,BPB Publication.
4. R. S. Pressman “Software Engineering”, Mc Graw Hill
5. Rumbaugh et. al. “ Object Oriented Modelling & Design” , Prentice Hall
6. G . Booch “Object Oriented Design & Applications”, Benjamin,Cummings.
7. Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication.

## **ITW-604      Algorithm Analysis and Design**

### **Preliminaries:**

Growth of functions, Summations, Recurrences: The substitution method, the iteration method, the master method, Divide and Conquer paradigm, Dynamic programming, Greedy Algorithms.

### **Sorting and Order Statistics:**

Merge Sort, Heap sort, and Quick sort, sorting in linear time, Medians and Order statistics.

### **Searching and Data Structures for Disjoint Sets:**

Hash Tables, Binary Search Trees, Red-Black trees, order statistic tree, disjoint-set Operations, Linked list representation of disjoint sets, Disjoint set forests.

### **Graph Algorithms:**

Representation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithm for Kruskal's and Prim's for Finding Minimum cost Spanning Trees, Dijkstra's and Bellman Fort Algorithm for finding Single source shortest paths. All pair shortest paths and matrix multiplication, Floyd-Warshall algorithm for all pair shortest paths.

### **String matching:**

The naïve String Matching algorithm, The Rabin-Karp Algorithm, String Matching with finite automata, The Knuth Marris Pratt algorithm.

### **NP-Complete Problem**

Polynomial-time verification, NP-Completeness and Reducibility, NP-Completeness Proof, NP-Complete problems.

### **Text:**

1. T.H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", PHI.

### **References:**

1. A .V. Aho, J . E . Hopcroft, J . D . Ullman "The Design & Analysis of Computer Algorithms", Addison Wesley.
2. V . Manber "Introduction to Algorithms – A Creative Approach", Addison Wesley.
3. Ellis Harwitz and Sartaz Sahani "Fundamentals of Computer Algorithms", Computer Science Press.
4. Peter Linz, "An Introduction to Formal Languages and Automata", Narosa Publishing House.
5. J.E.Hopcroft & J.D.Ullman, "Introduction to Automata Theory, Languages and Computation", Addison Wesley.
6. K.L.Mishra & N.Chandrasekaran, "Theory of Computer Science", PHI.
7. John C.Martin, "Introduction to Languages and Theory of Computation", TMH

## **ITW-606      Digital System Design**

Digital System Design Process, Design automation, Hardware Description Language, Hardware Simulation, Oblivious Simulation, Event-driven simulation, Hardware synthesis, Level of abstraction.

VHDL Language, Design methodology based on VHDL, Elements of VHDL, Describing components, Packages, Top down design, verification, Top-down design with VHDL, Subprograms, VHDL operators, Conventions & Syntax.

Basic concept in VHDL: Characterizing Hardware Language, Timing, Concurrency, modelling Hardware, Objects & Classes, Signal assignment, Inertial delay, Mechanism, Transport delay mechanism, Comparing Inertial and Transport.

Concurrent and Sequential Assignment: concurrent assignment, Event and Transaction, Delta delay, Sequential placement of transaction.

Type declaration and usage, Enumeration type for multi value logic, Array declaration, VHDL Operators, subprogram parameters, Types and overloading, Array attributes, Type attributes, Signal attributes, Entity attributes.

Structural Specification of Hardware: Inverter model, NAND gate model, Logic Design of Comparator, VHDL description of comparator, VHDL description of a simple test-bench, simulation, Logic design of Latch, Flip-flop, Counter and Registers.

Design Organization and Parameterisation: Definition and Usage of Subprograms, Procedure, Packaging components, Packaging subprograms, Design configuration – A general purpose test bench, Configuring Nested components.

Data flow Description in VHDL: Multiplexing and data selection, General Multiplexing, Guarded signal assignments, Block Declaration Parameters, Resolving between several driving values, State machine description, A sequence detector, Allowing multiple active states, Mealy and Moore machine, Generic State Machine, General data flow circuits.

Behavioural description of Hardware: process Statements, Assertion Statement, Sequential wait statement, and Behavioural state machine, two-phase clocking Implementation.

MSI based design: Top level Partitioning, Description of Component, Design implementation

Overview of PAL, PLA, FPGA, CPLD

### **Text book:**

1. VHDL: Analysis and Modelling of Digital Systems by Z. Navabi; McGraw Hill Pub.
2. Digital Systems Design using VHDL by C.H. Roth; Jyco Publishing

### **References:**

1. VHDL primer by J. Bhasker; Addison Wesley Longman Pub.
2. VHDL by Douglas Perry
3. The Designer Guide to VHDL by P.J. Ashendern; Morgan Kaufmann Pub.
4. Digital System Design with VHDL by Mark Zwolinski; Prentice Hall Pub.
5. Designing with FPGA & CPLDs by Zeidman; CMP Pub.
6. HDL Chip Design by Douglas J. Smith; Doone Pub.
7. Digital System Design with VHDL and Synthesis – An Integrated approach by K.C. Chang; IEEE Computer Society Pub.
8. VHDL – Techniques, Experiments and Caveats by Joseph Pick; McGraw Hill Pub.
9. VHDL for PLD by Shakeel; Addison Wesley Pub.
10. VHDL coding styles and Methodologies by Ben Cohen; Kluwer Academic Pub.

**ITW-652      Lab – III**

The practicals will be based on the following papers:

- a) Algorithm analysis and Design

**ITW-654      Lab – IV**

The practicals will be based on the following papers:

- a) Object Oriented Technology
- b) Digital System Design

**ITW – 656      \*Term Paper - II**

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## **ITW-701      Database Management Systems**

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, data models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modelling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: data definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2.

DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Tablespaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

Relational data base design: function dependencies & normalization for relational dataases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures.

Concepts of object oriented database management systems, Distributed Data Base Management Systems.

### **Text:**

1. Desai, B., “An introduction to database concepts”, Galgotia publications.

### **References:**

1. Date, C. J. , “An introduction to database systems”, 7<sup>th</sup> Edition, Addison Wesley.
2. Date, C. J. , “An introduction to database systems”, 3<sup>rd</sup> Edition, Narosa publishing house.
3. Elmsari and Navathe, “Fundamentals of database systems”, Addison Wesley.
4. Ullman, J. D., “Principals of database systems”, Galgotia publications.
5. DB2 Manuals

## **ITW –703    Advanced Computer Networks**

Introduction: Review of ISO-OSI and TCP/IP model.

Network Layer: Routing algorithms and protocols, Congestion control algorithm, Router Operation, Router configuration, Internetworking, IP Protocol, IPv6 (an overview), Network layer in ATM Network.

Transport Layer: Transport Service, Transport Protocol (TCP, UDP, ATM AAL layer protocol).

Application layer: Security, DNS, SNMP, RMON, Electronic Mail, WWW.

Network Security: Firewalls (Application and packet filtering), Virtual Public Network.

### **Text:**

1. Forouzan, B.A., “TCP/IP Protocol”, TMH
2. Laura Chappell (ed), “Introduction to Cisco Router Configuration”, Techmedia, 1999.

### **Reference:**

1. Tananbaum A.S., “Computer Networks”, 3<sup>rd</sup> Ed, PHI, 1999.
2. Forouzan, B. A., “ Data Communication and Networking
3. Black U., “Computer Networks-Protocols, Standards and Interfaces”, PHI, 1996.
4. Stallings W., “Computer Communication Networks”, PHI.
5. Stallings W., “SNMP, SNMPv2, SNMPv3, RMON 1&2”, 3<sup>rd</sup> Ed., Addison Wesley, 1999.
6. Michael A. Miller, “Data & Network Communications”, Vikas Publication.
7. William A. Shay, “Understanding Data Communications & Networks”, Vikas Publication.

## **ITW - 702    Software Engineering**

### **Introduction:**

Software Crisis, Software Processes, Software life cycle models: Waterfall, Prototype, Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM

### **Software Metrics:**

Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics.

### **Software Project Planning:**

Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

### **Software Requirement Analysis and Specifications:**

Problem Analysis, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping.

### **Software Design:**

Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.

### **Software Reliability:**

Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Calendar time Component, Reliability Allocation.

### **Software Testing:**

Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: Path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools & Standards.

### **Software Maintenance:**

Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

### **Text:**

1. K.K.Agrawal & Yogesh Singh, “Software Engineering”, New Age Publication, 2001.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, 3<sup>d</sup> ed., McGraw Hill Int. Ed., 1992.

### **Reference:**

1. R. Fairley, “Software Engineering Concepts”, Tata McGraw Hill, 1997.
2. P. Jalote, “An Integrated approach to Software Engineering”, Narosa, 1991.
1. Stephen R. Schach, “Classical & Object Oriented Software Engineering”, IRWIN, 1996.
2. James Peter, W Pedrycz, “Software Engineering”, John Wiley & Sons
3. I. Sommerville, “Software Engineering ”, Addison Wesley, 1999.

**ITW-751    Lab – V**

The practicals will be based on the following papers:

- a) Database Management System

**ITW-753    Lab – VI**

The practicals will be based on the following papers:

- a) Advanced Computer Network

**ITW – 755    \*Term Paper – III**

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## **ITW-705      Operating Systems**

### **Overview:**

Importance of Operating Systems; Basic Concepts and Terminology; An Operating System Resource Manager: Memory Management Functions, Processor Management Functions, Device Management Functions, Information Management Functions;.

### **Process Management:**

Processes: Concept, Job Scheduler, Process Scheduling, operation on process, Threads, Overview of Interprocess communication

CPU Scheduling: Scheduling criteria, Scheduling Algorithms, Algorithm Evaluation

Process Synchronization: Synchronization Hardware, Semaphores, Classical Problem of Synchronization, Monitors and Atomic Transaction

Deadlocks: System model, Deadlock Characterization, Deadlocks Prevention, Deadlocks Avoidance, Deadlocks Detection, Recovery from Deadlock

### **Storage Management:**

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation and Segmentation with Paging

Virtual Memory: Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, and Demand Segmentation

### **Information Management:**

Introduction; File Concept, Directory Structure, Protection, Overview of File-System Structure, Allocation Method, Free-Space Management, Directory Implementation

### **I/O Systems:**

I/O Hardware, Application of I/O interface, Overview of Kernel I/O Subsystem, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability

### **Text:**

1. Silberschatz and Galvin, “Operating System Concepts”.

### **References:**

1. Tannenbaum, “Operating systems Concepts”, PHI.
2. Peterson, “Operating System”.
3. Madnick E., Donovan J., “Operating Systems”, Tata McGraw Hill.

## **ITW – 704 Cellular & Mobile Communication**

### **Introduction to Cellular Mobile Systems**

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems.

### **Elements of Cellular Radio Systems Design**

General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems.

### **Interference**

Introduction to co-channel interference, real time co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co-channel interference – different types.

### **Cell Coverage for Signal & Traffic**

General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model- characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.

### **Cell Site Antennas and Mobile Antennas**

Characteristics, antenna at cell site, mobile antennas

### **Frequency Management and Channel Assignment**

Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment.

### **Hand Off, Dropped Calls**

Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

### **Operational Techniques**

Parameters, coverage hole filler, leaky feeders, cell splitting and small cells, narrow beam concept.

### **Text Books:**

1. Mobile Cellular Telecommunications; 2<sup>nd</sup> ed.; William, C Y Lee McGraw Hill
2. Wireless and Digital Communications; Dr. Kamilo Feher (PHI)

### **Reference Book**

1. Mobile Communication Hand Book; 2<sup>nd</sup> Ed.; IEEE Press
2. Mobile Communication Engineering – Theory & Applications; TMH

## ITW – 706 Computer Graphics

Basic raster graphics algorithms for drawing 2 D Primitives liner, circles, ellipses, arcs, clipping, clipping circles, ellipses & polygon.

Polygon Meshes in 3D, curves, cubic & surfaces, Solid modeling.Geometric Transformation: 2D, 3D transformations, window to viewport transformations, acromatic and color models.

Graphics Hardware: Hardcopy & display techniques, Input devices, image scanners

Shading Tech: Transparency, Shadows, Object reflection, Gouraud & Phong shading techniques. Visible surface determination techniques for visible line determination, Z-buffer algorithm, scanline algorithm, visible surfaces ray-tracing , recursive ray tracing, radio-city methods.

Procedural models, fractals, grammar-based models, multi-particle system, volume rendering.

### **Text:**

1. Foley et. al., “Computer Graphics Principles & practice”, AWL.

### **References:**

1. R.H. Bartels, J.C. Beatty and B.A. Barsky, “An Introduction to Splines for use in Computer Graphics and Geometric Modeling”, Morgan Kaufmann Publishers Inc., 1987.
2. D. Hearn and P. Baker, “Computer Graphics”, Prentice Hall, 1986.
3. C.E. Leiserson, T.H. Cormen and R.L. Rivest, “Introduction to Algorithms”, McGraw-Hill Book Company, 1990.
4. W. Newman and R. Sproul, “Principles of Interactive Computer Graphics, McGraw-Hill, 1973.
5. R. Plastock and G. Kalley, “Theory and Problems of Computer Graphics”, Schaum’s Series, McGraw Hill, 1986.
6. F.P. Preparata and M.I. Shamos, “Computational Geometry: An Introduction”, Springer-Verlag New York Inc., 1985.
7. D. Rogers and J. Adams, “Mathematical Elements for Computer Graphics”, MacGraw-Hill International Edition, 1989
8. David F. Rogers, “Procedural Elements for Computer Graphics”, McGraw Hill Book Company, 1985.
9. Alan Watt and Mark Watt, “Advanced Animation and Rendering Techniques”, Addison-Wesley, 1992.

## ITW- 708 VLSI Design

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers.

Circuits and System Representation: Behavioural Representation, structural representation, and physical representation

CMOS Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS.

Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule

Latch up: Physical origin of Latch up, Latch up triggering, Latch prevention, Internal Latch up prevention techniques, I/O Latch up Prevention

Switching Characteristics: analytic delay models, empirical delay model, gate delay.

Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation.

CMOS design Methods: Design Strategies, Structural design strategies, Hierarchy, Regularity, Locality.

Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reconfigurable Gate Array: Xilinx Programmable Gate Array, Altera, concurrent logic, Gate array design, Full custom mask design

Design Methods: Behavioural Synthesis, RTL synthesis, Placement, Routing, Layout Synthesis.

Design Capture Tools: HDL Design, Schematic, Layout Design, Floorplanning, Chip composition  
Design Verification: Simulation, Timing verifier, Netlist Comparisons

**Text Books:** 1. Principles of CMOS VLS Design – A System Perspective by Neil H.E. Weste and Kamran Eshraghian; Addison Wesley Pub.

**References:**

1. Digital Integrated Circuits by Demassa & Ciccone, Willey Pub.
2. Modern VLSI Design: system on silicon by Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design by Douglas A. Pucknell & Kamran Eshraghian; PHI
4. Digital Integrated Circuits: A Design Perspective by Jan M. Rabaey; PHI

## **ITW - 710 Real Time Systems and Software**

Introduction, Real-time Versus Conventional Software, Computer Hardware for Monitoring and Control, Software Engineering Issues.

Process and State-based Systems model, Periodic and Sporadic Process, Cyclic Executives, CE definitions and Properties, Foreground-Background Organizations, Standard OS and Concurrency – Architectures, Systems Objects and Object-Oriented Structures, Abstract Data Types, General Object Classes

Requirements and Design Specifications: Classification of Notations, Data Flow Diagrams, Tabular Languages, State Machine, Communicating Real Time State Machine- Basic features, Timing and clocks, Semantics Tools and Extensions, Statecharts-Concepts and Graphical Syntax, Semantics and Tools

Declarative Specifications: Regular Expressions and Extensions, Traditional Logics-Propositional Logic, Predicates, Temporal logic, Real time Logic

Deterministic Scheduling : Assumptions and Candidate Algorithms, Basic RM and EDF Results, Process Interactions-Priority Inversion and Inheritance

Execution Time Prediction: Measurement of Software by software, Program Analysis with Timing Schema, Schema Concepts, Basic Blocks, Statements and Control, Schema Practice, Prediction by optimisation, System Interference and Architectural Complexities

Timer Application, Properties of Real and ideal clocks, Clock Servers – Lamport’s Logical clocks, Monotonic Clock service, A software Clock server, Clock Synchronization- Centralized Synchronization, Distributed Synchronization

Programming Languages: Real Time Language Features, Ada-Core Language, Annex Mechanism for Real Time Programming, Ada and Software Fault Tolerance, Java and Real-time Extensions, CSP and Occam

Operating Systems: Real Time Functions and Services, OS Architectures-Real Time UNIX and POSIX, Issues in Task management- Processes and Threads, Scheduling, Synchronization and communication

**Text Book:** Real – Time Systems and software by Alan C. Shaw ; John Wiley & Sons Inc

## **ITW – 712 Data Warehousing and Data Mining**

Data Warehousing: Definition, Scope, Practical Implications, Structures and functions.

Data Mining: Process, Technologies & Rules, platform tools & tool characteristics, operational vs. information systems.

Types of Data Warehouses: Host based, single stage, LAN based, Multistage, stationary distributed & virtual data-warehouses.

Data warehouses architecture: Metadata, operational data & operational data bases. Data warehouse architecture model, 2-tier, 3-tier & 4-tier data warehouses.

OLAP & DSS support in data warehouses.

Data Mining: Knowledge discovery through statistical techniques, Knowledge discovery through neural networks, Fuzzy tech. & genetic algorithms.

### **Text:**

1. “Building the Data Warehouse”, W.H.Inmon, John Wiley & Sons.
2. “Developing the Data Warehouse”, W.H.Inmon, C.Kelly, John Wiley & Sons.

### **Reference:**

1. “Managing the Data Warehouse”, W.H.Inmon, C.L.Gassey, John Wiley & Sons.
2. “Advances in knowledge discovery & Data Mining”, Fayyad, Usama M. et. al.,MIT Press.
3. “Data Mining”, A. K. Pujari; Longman Publisher

## **ITW – 714 AI & Expert System**

### **Scope of AI**

Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

### **Problem solving**

State space search; Production systems, search space control: depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

### **Knowledge Representation**

Predicate Logic: Unification, modus ponens, resolution, dependency directed backtracking. Rule based Systems : Forward reasoning: conflict resolution, backward reasoning: use of no backtrack.

Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

**Handling uncertainty** Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic.

### **Learning**

Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

### **Expert Systems**

Need and justification for expert systems, knowledge acquisition, Case studies: MYCIN, RI.

### **Text:**

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.

### **Reference:**

1. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
2. Peter Jackson, "Introduction to Expert Systems", AWP, M.A., 1992.
3. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
4. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House, 1994

## **ITW – 716 Digital Signal Processing**

Discrete time signals and systems, Z-transforms, structures for digital filters, design procedures for FIR and IIR filters. Frequency transformations: linear phase design; DFT. Methods for computing FFT. Noise analysis of digital filters, power spectrum estimation.

Signals and signal Processing: characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications.

Time Domain Representation of Signals & Systems: Discrete Time Signals, Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

Transform-Domain Representation of Signals: the Discrete-Time Fourier Transform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse z-transform, properties of z-transform, transform domain representations of random signals.

Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals.

Digital Processing of Continuous-Time Signals : sampling of Continuous Signals, Analog Filter Design, Anti-aliasing Filter Design, Sample-and-hold circuits, A/D & D/A converter, Reconstruction Filter Design.

Digital Filter Structure: Block Diagram representation, Signal Flow Graph Representation, Equivalent Structures, basic FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters. cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator.

Digital Filter Design: Impulse invariance method of IIR filter design, Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, FIR filter Design based on truncated Fourier series, FIR filter design based on Frequency Sampling approach.

Applications of DSP.

### **Text / Reference:**

1. Sanjit K. Mitra, "Applications DSP a Computer based approach" , TMH.
2. Allan Y. Oppenheim & Ronald W. Schacter , "Digital Signal Processing", PHI

## **ITW – 718 Theory of Computation**

Mathematical notation and terminology, sets, sequences, graphs, proof.

Regular languages, finite automates, DFA's, NFA's, regular expression, pumping lemma, non-regular languages, content free grammars, chomsky normal form, push down automata, pushdown automata equivalence with content free grammer, pumping lemna for content free languages, turing machines, computable languages, multi-tape TM non-deterministic TM, equivalence of TM models, Church's hypothesis, Turing machine as enumerator, decidable languages, the halting problem, Rice's therorem, mapping reducibility, turing reducibility complexity theory, time complexity (big Q, small Q) analysing complexities, relationships among computing models), the class P problem, the class NP, P V NP, NP completeners, cook-Levine theorem.

### **Text / Reference:**

1. J. Hopcroft and J. Ullman, "Introduction to Automata theory languages and computation", AWL, 2002

**Overview of Internet & Web:** Basics of Internet, Networking & Web concepts. Network topologies, types & layers. Internet & Web protocols like TCP/IP, ARP, RARP, PPP, Telnet, ftp etc. Subnets & Hosts, WWW, Domain Names, Websites, Browsers, Search Engines, Counters, Internet Chat etc. Hardware & Software requirements for Internet & Web based applications. Overview of various Internet & Web technologies.

**Web Design:** Key issues in web site design, Structure of a Web Page.

Introduction to HTML, Head & Body Sections, Content layout and presentation, Various HTML Tags, Table Handling, Frames.

**Techniques & Tools:** Graphics & Animation techniques. Usage of various web based tools like Microsoft Front page, Macromedia Dream Weaver, Adobe photoshop, Ulead Gif Animator, Macromedia Flash etc.

**Interactivity & Security:** Client Server Model, Creating interactive dynamic HTML Forms. CGI, Role of databases in interactive applications. Server issues & Security methods like firewalls etc.

**Active Server Pages:** *Creating interactive applications using active server pages:*

Client & server side script in VBScript, Variables & Constants, creating modules, creating objects from classes, using ASP's Object Model, Arrays, Collections, Control Structures, using request & response objects. Integration with database. Overview & usage of various other internet & web based technologies like

JSP, PHP, Java Applets, Java Script, E-Commerce, etc.

Concept of Web Engineering.

### **Text**

1. Internet and Web Technologies by Raj Kamal, TMH
2. Web publishing by Monica D'Souza, TMH
3. Active Server Pages by Heith Morneau, Vikas Publishing House

### **References**

1. Web Design by David Crowder and Rhonda Crowder, IDG Books India
2. Database Driven Web Sites by Mike Morrison, Vikas Publishing House
3. Mark Swank & Drew Kittel, "World Wide Web Database", Samsnet.
4. ASP 3 Programming, Eric A. Smith, IDG Books India.

## **ITW – 722 Network Security**

### **Basic concepts:**

Information system reviewed, LAN, MAN, WAN, Information flow, Security mechanism in OS,,  
Targets: Hardware, Software, Data communication procedures

### **Threats to Security:**

Physical security, Biometric systems, monitoring controls, Data security, systems, security,  
Computer System security, communication security.

### **Encryption Techniques:**

Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key  
management.

### **Message Authentication and Hash Algorithm:**

Authentication requirements and functions secure Hash Algorithm, NDS message digest algorithm,  
digital signatures, Directory authentication service

### **Firewalls and Cyber laws:**

Firewalls, Design Principles, Trusted systems, IT act and cyber laws, Virtual private network

### **Future Threats to Network:**

Recent attacks on networks, Case study

### **Text:**

1. William Stallings “Cryptography and Network Security” Pearson Education

### **References:**

1. Charels P. Pfleeger “Security in Computing” Prentice Hall
2. Jeff Crume “Inside Internet Security” Addison Wesley

## **ITW – 813 Object Oriented Software Engineering**

### **Introduction:**

The system life cycle, concept of object orientation, object oriented system development.

### **Architecture:**

Model architecture, requirement model, analysis model.

### **Construction:**

The design model, Block design

### **Database:**

Relational DBMS, Object DBMS

### **Components:**

Use of components, Component management

### **Testing:**

Unit testing, integration testing, system testing, case studies

### **Text / References:**

1. “Object Oriented Software Engineering”, by Ivar Jacobson, Magnus Christerson Patric Jonsson, Addison Wesley Publication.

**ITW-752      Lab – VII**

The practicals will be based on the following papers:

- a. Cellular & Mobile Communication

**ITW-754      Lab – VIII**

The practicals will be based on the following papers:

- a. Elective I
- b. Software Engineering

**ITW – 756      \*Project Work – I**

Minor Project

\* NUES

## ITW – 801 Software Verification, Validation & Testing

**Introduction:** What is software testing and why it is so hard?, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory & Discrete Mathematics.

**Functional Testing:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

### **Reducing the number of test cases:**

Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing

**Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

**Object Oriented Testing:** Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing.

**Testing Tools:** Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools.

### **Text:**

1. William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York, 1995.
2. Cem Kaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York, 1993.
3. Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, “Software Testing”, Pearson Education Asia, 2002

### **Reference:**

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
2. Boris Beizer, “Black-Box Testing – Techniques for Functional Testing of Software and Systems”, John Wiley & Sons Inc., New York, 1995.
3. K.K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International Publishers, New Delhi, 2003.
4. Marc Roper, “Software Testing”, McGraw-Hill Book Co., London, 1994.
5. Gordon Schulmeyer, “Zero Defect Software”, McGraw-Hill, New York, 1990.
6. Watts Humphrey, “Managing the Software Process”, Addison Wesley Pub. Co. Inc., Massachusetts, 1989.
7. Boris Beizer, “Software System Testing and Quality Assurance”, Van Nostrand Reinhold, New York, 1984.
8. Glenford Myers, “The Art of Software Testing”, John Wiley & Sons Inc., New York, 1979.

## ITW – 803 Neural Networks

Biological, Analogy, Architecture classification, Neural Models, Learning Paradigm and Rule, single unit mapping and the preception.

Feed forward networks – Review of optimization methods, back propagation, variation on backpropagation, FFANN mapping capability, Mathematical properties of FFANN's Generalization, Bias & variance Dilemma, Radial Basis Function networks.

Recurrent Networks – Symmetric hopfield networks and associative memory, Boltzmann machine, Adaptive Resonance Networks

PCA, SOM, LVQ, Hopfield Networks, Associative Memories, RBF Networks, Applications of Artificial Neural Networks to Function Approximation, Regression, Classification, Blind Source Separation, Time Series and Forecasting.

### Text / Reference:

1. Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2. Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.
3. Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation",
4. Addison-Wesley, California, 1991.
5. Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
6. Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
7. Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.
8. Cherkassky V., F. Kulier, "Learning from Data-Concepts, Theory and Methods", John Wiley, New York, 1998.
9. Anderson J.A., E. Rosenfield, "Neurocomputing: Foundations of Research, MIT Press, Cambridge, MA, 1988.
10. Kohonen T., "Self-Organizing Maps", 2<sup>nd</sup> Ed., Springer Verlag, Berlin, 1997.
- 11 Patterson D.W., "Artificial Neural Networks: Theory and Applications", Prentice Hall, Singapore, 1995.
10. Vapnik V.N., "Estimation of Dependencies Based on Empirical Data", Springer Verlag, Berlin, 1982.
11. Vapnik V.N., "The Nature of Statistical Learning Theory", Springer Verlag, New York, 1995.
12. Vapnik V.N., "Statistical Learning Theory: Inference from Small Samples", John Wiley, 1998.

## **ITW - 805 Embedded System Design**

### **Introduction to an embedded systems and its design:**

Introduction to ES & its applications, Design parameters of an ES and its significance (with respect to all parameter), Present trends in ES, Embedded system design life cycle, Product specifications and hardware, software partitioning, Co-design

### **RTOS & its overview:**

Spell of OS 2 Difference between OS 2 RTOS, Role of RTOS in ES 2 its process models (Process transition diagram), Course structure, Overview Window, CE, Unix, Mino Kernel, UCOs & RT linux, Interrupt roating in RTOS & ^ Inblow response cycle, Different IPC machines in RTOS, Scheduling construm in RTOS (hand 2 soft), Memory sowing and its protechan, Encapsulation of Semephores and Queues, Timon in RTOS (Watch dog timer)

### **Processor Selection:**

Role of processor selection in ES (Mp V/s Uc), Mino control – 8051, 16232 bit mino controller 2 its processor, More about micro controller applications with respect to embedded system design, DSP's in ES, New trends in processing and DSP's.

### **Cost Compiler and cross assembly for embedded systems**

Why we need cross compiler / Assemble, Embedded software development take chain and software development tool chain, Compiler linker, locators, cross assembles, GCC compiler.

### **Basic Concepts of Device Driving:**

Device drives introduction & how device driver are different from the normal ports, Seviceal communication enterface device drivers.

### **System Synthesis and Debugging Techniques:**

Introduction to system synthesis & Hardware and Software, Biomultation & methods to improve to speed of simulations, Emulators (ICE) and its type, How emolutors an difference for simulations, Introduction JTAG and OCP (on chich and debugging)

### **Communication Protocols with reference to ES:**

Introduction to protocol, why we need in ES, Overview TCP (IP), UDD< wings protocols, IrDA, Blue Box, IEEE 8811

Other design issues and current trends on its application of ES

Memory optimization, Poorer optimization, Co-simulation of its system on chip and SOS (System on Slices), Revision of Cost

### **Text / References:**

1. “An Embedded Software Primer”, David E. Simon, Pearson Education
2. John Catsoulis, “Designing Embedded Hardware”, O'reilly
3. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley & Sons, Inc
4. Karim Yaghmour, “Building Embedded Linux Systems”, O'reilly
5. Michael Barr, “Programming Embedded Systems”, O'reilly
6. Alan C. Shaw, “Real-time systems & software”, John Wiley & sons, Inc.
7. Wayne Wolf, “ Computers as Components”, Harcourt India Pvt. Ltd.

### **Classical and Fuzzy Sets:**

Overview of Classical Sets, Membership Function,  $\alpha$ -cuts, Properties of  $\alpha$ -cuts, Decomposition Theorems, Extension Principle.

### **Operations on Fuzzy Sets:**

Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

### **Fuzzy Arithmetic:**

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

### **Fuzzy Relations:**

Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

### **Possibility Theory:**

Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

### **Fuzzy Logic:**

Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

### **Unertainty based Information:**

Information & Uncertainty, Nonspecificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

### **Applications of Fuzzy Logic**

#### **Text:**

1. G.J.Klir & B.Yuan, “Fuzzy sets & Fuzzy logic,” PHI, 1995.

#### **References :**

1. G.J.Klir & T.A. Folyger, “Fuzzy Sets, Uncertainty & Information”, PHI, 1988.
2. Kosko “Neural Networks and Fuzzy System: A Dynamical System Approach to Machine Intelligence”
3. Timothy Ross “ Fuzzy Logic and Engineering Application” Tata McGraw Hill

## **ITW – 809    Digital Image Processing**

### **Introduction And Digital Image Fundamentals**

Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbours, connectivity, Distance measure between pixels, Imaging Geometry.

### **Image Transforms**

Discrete Fourier Transform, Some properties of the two-dimensional fourier transform, Fast fourier transform, Inverse FFT.

### **Image Enhancement**

Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Lowpass filtering, Highpass filtering, Homomorphic filtering, Colour Image Processing.

### **Image Restoration**

Degradation model, Diagonalization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

### **Image Compression**

Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.

### **Image Segmentation**

Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

### **Representation and Description**

Representation schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

### **Recognition and Interpretation**

Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretation.

#### **Text:**

1. Rafael C. Gonzales & Richard E. Woods, "Digital Image Processing", AWL.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI.

#### **Reference:**

1. Rosefield Kak, "Digital Picture Processing",
2. W.K. Pratt, "Digital Image Processing",

## **ITW – 811    DESIGNING WITH ASICS**

Types of ASICs – Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

ASIC Library design: Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC.

Low level design entry: Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog.

Logic synthesis in verilog and & VHDL simulation.

ASIC Construction – Floor planning & placement – Routing.

### **References:**

1. J.S. Smith, “Application specific Integrated Circuits”, Addison Wesley, 1997.

## **ITW – 724    Compiler Design**

Classification of grammars, Context free grammars, Deterministic finite state automata (DFA) Non-DFA.

Scanners, Top down parsing, LL grammars, Bottom up parsing, Polish expression Operator Precedence grammar, IR grammars, Comparison of parsing methods, Error handling.

Symbol table handling techniques, Organization for non-block and block structured languages.

Run time storage administration, Static and dynamic allocation, Intermediate forms of source program, Polish N-tuple and syntax trees, Semantic analysis and code generation.

Code optimization, Folding, redundant sub-expression evaluation, Optimization within iterative loops.

### **Text / References:**

1. Tremblay, et. al., “The Theory and Practice of Compiler Writing”, McGraw Hill, New York, 1985.

## **ITW – 815    Soft Computing**

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic: Medicine, Economics etc.

Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA

### **Text:**

1. “An Introduction to Neural Networks”, Anderson J.A., PHI, 1999.
2. “Introduction to the Theory of Neural Computation”, Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
3. “Fuzzy Sets & Fuzzy Logic”, G.J. Klir & B. Yuan, PHI, 1995.
4. “An Introduction to Genetic Algorithm”, Melanie Mitchell, PHI, 1998.

### **Reference:**

1. “Neural Networks-A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 1999.
2. “Neural Networks: Algorithms, Applications and Programming Techniques”, Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

## **ITW – 817    Software Project Management**

Introduction to Software Project Management: The Nature of Software Production, Key Objectives of Effective Management, Quality, Productivity, Risk Reduction, The Role of the Software Project Manager

Planning the Project: Business Planning, Determining Objectives, Forecasting demand for the Product, Proposal Writing, Requirements analysis, Legal issues (patent, copyright, liability, warranty).

Technical Planning: Life-cycle models, Types of Plans, Plan documentation methods, Work breakdown structures, PERT and CPM, Gantt Charts, Standards, Planning for Risk Management and Control, Entry and Exit criteria, Intermediate checkpoints, Performance prediction and analysis People, Prototyping and modeling, Inspections and reviews, Process and process assessment, Development Methods, Metrics, Configuration management, Testing and quality assurance, Capacity Planning, Estimating – what it takes to do the job, Cost (direct and indirect), Resources, Time, Size and complexity of the product, Risk determination, Role of requirements and design in estimating, Financial planning – budgeting, Resource Allocation, Organizational considerations, (teams, hierarchies, etc.), Technology, Human factors and usability, Tools and environments, Transition of the Product to the user.

Managing the Project: Managing the Task, Project Control, Managing to the Plan, Reviews, Feedback and Reporting Mechanisms, Configuration Management, Quality Control and Quality Assurance, Managing Change, Readjusting Goals and Milestones, Risk Management, Testing Phases, Formalized Support Activities, Managing the Team, Team Organizations, Recruiting and Staffing – picking the right people, Technical leadership, Avoiding obsolescence – training, etc.) Managing the Context, Communication Skill, Decision Theory, Business Management, Assessing the Organization's ability to perform the process, Probability and Statistics, Managing Product Support and Maintenance.

Evaluating the Project.

### **Text:**

1. Tom Gilb, Finzi Susannah, “Principles of Software Engineering Management”, Addison-Wesley, England, 1988.
2. Philip Metzger, “Managing A Programming Project”, Prentice Hall, New Jersey, 1981.

### **Reference:**

1. Tom Demarco, “Controlling Software Project Management, Measurement” , Prentice Hall, New Jersey, 1986.
2. Barbee Mynatt, “Software Engineering with Student Project Guidance”, Prentice Hall, New Jersey, 1990.
3. Richard Thayer, “Tutorial: Software Engineering Project Management”, IEEE Inc, CA, 1987.
4. Mark Norris, Peter Rigby, Malcolm Payne, “The Healthy Software Project – A Guide to Successful Development & Management”, John Wiley & Sons, 1993
5. Dennis Lock, “Handbook of Project Management”, Jaico Publishing House, 1994.
6. Neal Whitten, “Managing Software Development Projects”, John Wiley, 1995.
7. Sanjiv Purba, David Sawh & Bharat Shah, “How to Management a Successful Software
8. Project – Methodologies, Techniques, Tools”, John Wiley, 1995.

## **ITW – 819    Digital VLSI Design**

### **UNIT I**

Programmable logic primer: Use of programmable logic – definition of programmable logic device – simple PLDS – The 22V10, CPLD, FPGA, PREP benchmarks – future directions of programmable logic, Field programmable Gate Arrays: The Xilinx logic cell array – advance features of the 4000 series – The Actel Act – Altera FLEX technology trends.

### **UNIT II**

Design flow & Multilevel logic minimization: Design specification and minimization, design entry, low level design entry – design verification, Design realization and prototyping – review of logic design – minimization of combinational functions – the Quine McClusky algorithm – representation of Boolean functions – multilevel logic minimization methods – technology mapping Relating literal count to number of CLBs.

### **UNIT III**

Finite State Machines: FSM – state transition table – state assignment for EPGAS, Aarand and one Hot Encoding – the problem of asynchronous inputs – Asynchronous outputs – designing with programmable logic sequences – state reduction – use of other types of PLDs for state machines – leasing states – state assignment methods partitioning state machine – linked state machines.

### **UNIT IV**

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.

### **UNIT V**

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. Design guidelines and case studies: Design guidelines download – clocks – global buffers and internal Oscillator – tristate buses horizontal and vertical long lines – pad assignment, conflicts and programming pins, gated clocks, asynchronous designs – synchronizer – some example case studies.

### **References:**

1. Chan & Mourad, “Digital design using field programmable gate arrays”, Prentice Hall, 1994.
2. J.V. old field & R.C. Dorf, “Field programmable gate arrays”, John Wiley, 1995.
3. Martin Bolton, “Digital System design with programmable logic”, Addison Wesley, 1990.

## ITW – 821 TELECOMMUNICATION NETWORKS

Evolution of Tele-Communication Networks, Basic Switching System, Simple Tele-phone Communication, Brief Introduction to Electromagnetic Exchanges, Electronic Switching – Space Division Switching Stored Programme Control – Centralized SPC, Distributed SPC, Software Architecture, Application Software – Enhanced Services, Multi Stage Switching Networks.

Speech Digitization, Quantization Noise, Companding, Differential Coding, Delta Modulation, Vocoders, Pulse Transmission on Transmission line concepts, Line Coding, NRZ and RZ Codes, Manchester Coding, AMI Coding, Walsh Codes, TDM,

Time Division Switching – Time Division space switching, Time Division Time Switching, Time multiplexed space switching, Time multiplexed Time Switching, Combination Switching.

Traffic Engineering, Grade of Service and Blocking Probability – Telephone Networks, Subscriber Loops, Switching Hierarchy and Routing, Transmission Plans and Systems, Signaling Techniques, In Channel, Common Channel.

Access Technology; WLL, (Wire less loop), ADSL (Asymmetrical Digital Subscriber Loop) AVCC( Advanced Intelligent Network), BMFB

Wired, Wireless, broadcast, point to point, Satellite medium-SCPC, VSAT broadcast medium etc, link budget analysis, Link behavior, Peburst, error, Optimum packet size, error control, Elementary coding ideas , ATM transport mechanism, ISDN

## **ITW – 823    Multimedia Technology**

Introduction:

Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

Components of multimedia: Text, Graphics, Audio, Video.

Design & Authoring Tools, Categories of Authority Tools, Types of products.

Animation:

Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation.

Introduction to MAYA(Animating Tool):

Fundamentals, Modeling: NURBS, Polygon, Organic, animation, paths & boxes, deformers.

Working with MEL: Basics & Programming

Rendering & Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.

### **Text/References:**

1. David Hillman, "Multimedia Technology & Applications", Galgotia Publications.
2. Rajneesh Agrawal, "Multimedia Systems", Excel Books.
3. Nigel Chapman & Jenny Chapman, "Digital Multimedia", Wiley Publications.
4. D.P. Mukherjee, "Fundamentals of Computer Graphics and Multimedia", PHI.

## **ITW – 825 Natural Language Processing**

Morphological analysis, syntactic processing, grammars, Top-down and Bottom-up Parsing, Augmented Transition Network, Unification Grammar, Semantic analysis, Lexical Processing, Sentence-level processing, Semantic grammar, Case Grammar, Conceptual Parsing, Approximately compositional Semantic Interpretation, Montague Semantics, Discourse and Pragmatic Processing, Modeling Beliefs, Speech Acts, Conversational Postulates.

### **References:**

- a. James Allen, "Natural Language Understanding", Benjamin-Cummings Publ. Comp. Ltd.
- b. Terry Winograd, "Language as a Cognitive process".3

## **ITW – 827 Enterprise Resource Planning**

### **Introduction:**

ERP: An Overview, Enterprise-An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, On-line Analytical Processing (OLAP), Supply Chain Management

### **ERP Implementation:**

To be or not to be, ERP Implementation Lifecycle, Implementation Methodology, Not all Packages are Created Equal!, ERP Implementation-The Hidden Costs, Organizing the Implementation, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring, After ERP Implementation...

### **The Business Modules:**

Business Modules in an ERP Package, Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution

### **The ERP Market:**

ERP Market Place, SAP AG, PeopleSoft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD, System Software Associates, Inc. (SSA)

### **ERP-Present and Future:**

Turbo Charge the ERP System, Enterprise Integration Applications (EIA), ERP and E-Commerce, ERP and Internet, Future Directions in ERP, Appendices"

### **Text/References :**

- 1 S. Sadagopan, "Enterprise Resource Planning", Tata McGraw Hill.
- 2 Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill.

## **ITW – 829 Cognitive Psychology**

A Brief history of the cognitive approach, cognitive science, Neuro science, Artificial intelligence, The Parallel processing approach.

Perceptual Process: Perception, pattern recognition, theories of pattern recognition, Bottom-up vs Top-down Processing, Template matching, feature analysis, prototype matching, pattern recognition: The role of the perceives.

Communication and Language Processing: Linguistic Hierarchy, Chomsky's theory of grammar, Psycho-linguistic aspects, Abstraction of linguistic ideas, knowledge and comprehension, non-verbal abstraction – musical syntax, The language of motion.

Memory Modules: Memory, process, storage, Short term memory, long term memory, organization in memory, simulation modules of learning and memory, mnemonics, syntactic and semantic issues, Concept formation, problem solving.

Contribution of cognitive psychology to advances in Artificial Intelligence, computer based learning/teaching systems, knowledge acquisition and knowledge based systems, expert systems.

### **References:**

1. Marc de May, "The cognitive Paradigm", Reidel, 1982
2. R. C. Shank, P. Childers, "Cognitive computer on language, Learning and AI", 1984
3. P.C. Kendall, "Advances in Cognition behavioural research and therapy", Academic Press, 1984.
4. Solso, R.L. "Cognitive Psychology (3<sup>rd</sup> Edition), 1991, Allyn & Balon.
5. Matlin M.W., "Cognition (3<sup>rd</sup> Edition), 1995, Harcourt Brace (Prism Indian Edition).
1. Leahey T.H. & Harris R.J., "Learning and Cognition (4<sup>th</sup> Edition), 1997, PHI

## **ITW – 831 Software Quality Assurance & Certification**

Concepts and Overview: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software.

Software Quality Assurance: The Philosophy of Assurance, The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques.

Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.

Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.

Configuration Management: Maintaining Product Integrity, Change Management, Version Control, Metrics, Configuration Management Planning.

Error Reporting: Identification of Defect, Analysis of Defect, Correction of Defect, Implementation of Correction, Regression Testing, Categorization of Defect, Relationship of Development Phases.

Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken.

Traceability, Records, Software Quality Program Planning, Social Factors: Accuracy, Authority, Benefit, Communication, Consistency, and Retaliation.

### **Text:**

1. Robert Dunn, "Software Quality Concepts and Plans", Prentice-Hall, 1990.
2. Alan Gillies, "Software Quality, Theory and Management", Chapman and Hall, 1992.

### **Reference:**

1. Michael Dyer, "The Cleanroom approach to Quality Software Engineering", Wiley & Sons, 1992.
2. Daniel Freedman, Gerald Weinberg, "Handbook of Walkthroughs, Inspections and Technical Reviews", Dorset House Publishing, 1990
3. Tom Gilb, "Principles of Software Engineering Management", Addison-Wesley, 1988.
4. Tom Gilb, Dorothy Graham, "Software Inspection" Addison-Wesley, 1993.
5. Watts Humphrey, "Managing the Software Process", Addison-Wesley, 1990.
6. Watts Humphrey, "A Discipline for Software Engineering", Addison-Wesley, 1995.
7. Arthur Lowell, "Improving Software Quality An Insiders guide to TQM", 1993, Wiley & Sons.

## **ITW – 833 Network Programming**

### Introduction

TCP/IP Architecture, TCP/IP addressing, services, FTP, SMTP, TFTP, SNMP, Network file system, domain name system, transport layer protocols, user datagram protocol, transmission control protocol.

### Interprocess communications

File and record locking, pipes, FIFO's, stream and messages, message queues, samphorers.

### Sockets

Sockets system calls, reserved parts, stream pipes, socket option, asynchronous I/O, Sockets and signals

### Transport Lay Interface

Elementary TLI functions, stream and stream pipes, asynchronous I/O I/O multiplexing

### Remote Procedure calls

Remote login, remote command execution, external data representation.

### **Text/Reference:**

1. A. Stevens, "TCP/IP Illustrated", Vol. 1-3, Addison Wesley, 1998
2. R. Stevens, "Unix Network Programming", PHI 1998
3. J. Martin, "TCP/IP Networking – Architecture, Administration and programming", Prentice Hall, 1994.
4. D.E. Comer, "Internetworking with TCP/IP, Vol. 1, Principles, Protocols, and architecture, PHI, 2000

## **ITW - 835    Advanced VLSI Design**

Integrated Circuit and Modeling: MOS and BJT transistor modelling for MOS transistor & BJT - SPICE modelling parameters – CMOS and bipolar processing – CMOS and Analog layout consideration

CMOS current mirror – CS, CG and CD amplifier – cascade gain stage, bipolar current mirror, bipolar gain stage, frequency response – SPICE simulator Examples

Noise Analysis: Time and frequency domain analysis noise models and analysis – OP AMP Two Stage CMOS OP AMP, OP Amp compensation, Fielded cascade and differential Op AMP- SPICE simulation Examples – CMOS and BiCMOS comparators.

MOS and CMOS sample and hold circuit, Bipolar and BiCMOS sample and hold switched capacitor circuits-data converters, various types of D/A and A/D converters over sampling with without noise shapping – digital decimation filter, multibit oversampling converters, continuous time filter and phases locked loop.s

**Text book** : 1. CMOS Circuit Design, layout and simulation by Baker Li and Boyee; Prentice Hall

**Refereces:** 1. Semiconductor Devices modelling with SPICE by Massobrio and antognehi; McGraw Hill Pub.  
1.Operation and modelling o f the MOS transistor by Yannis Tsvividis; McGraw Hill Pub.  
2. CMOS Analog Circuit Design by Phillips A. Allen and D. R. Holberg; Oxford Univ.

## **ITW – 837    ADVANCED DIGITAL CIRCUITS DESIGN**

### **UNIT I**

Digital design fundamentals: Concept of a logic state – state machine – finite state machine – models for sequential machines – Moore and Mealy machines and memory cells.

### **UNIT II**

Design of simple FSMS: Glitches – glitch analysis – filtering out Glitches – Guidelines for state code assignment – state diagram from specifications – state assignments – next state and output k maps – asynchronous inputs – debouncing circuit and logic diagram.

### **UNIT III**

Alternative design methodologies: Conventional approach – using state decoder – direct and indirect addressed multiplexers – direct and indirect addressed FPLA/FROM – Design using shift registers and counters for memory and programmable FSM architecture.

### **UNIT IV**

Advanced digital concepts: Microinstructions – fixed instruction set – sequencer based design – sequencer with subroutine capability – control sequencer – system level design and functional partition.

### **UNIT V**

Asynchronous sequential circuits: Lumped path delay (LPD) model – problems associated with asynchronous sequential circuits – design of asynchronous circuits – implementation using PLA.

### **References:**

1.     W.I.Fletcher: “An engineering approach to digital design”, PHI-1994.
2.     R.F.Tinder, “Digital engineering design: A modern approach”, PHI-1991.

## **ITW – 839 Mobile Computing**

**Introduction to Personal Communications Services (PCS):** PCS Architecture, Mobility management, Networks signalling.

**Global System for Mobile Communication (GSM) system overview:** GSM Architecture, Mobility management, Network signalling.

**General Packet Radio Services (GPRS):** GPRS Architecture, GPRS Network Nodes.

**Mobile Data Communication:** WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

**Wireless Application Protocol (WAP):** The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML).

**Third Generation (3G) Mobile Services:** Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

**Wireless Local Loop(WLL):** Introduction to WLL Architecture, wireless Local Loop Technologies.

**Global Mobile Satellite Systems ;** case studies of the IRIDIUM and GLOBALSTAR systems.

**Wireless Enterprise Networks:** Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

### **Text Books:**

1. “Wireless and Mobile Networks Architectures”, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.
2. “Mobile and Personal Communication systems and services”, by Raj Pandya, Prentice Hall of India, 2001.

### **Reference Books:**

1. “Guide to Designing and Implementing wireless LANs”, by Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
2. “Wireless Web Development”, Ray Rischpater, Springer Publishing, 2000.
3. “The Wireless Application Protocol”, by Sandeep Singhal, Pearson Education Asia, 2000.
4. “Third Generation Mobile Telecommunication systems”, by P.Stavronlakis, Springer Publishers, 2001

**ITW-851      Lab – IX**

The practicals will be based on the following papers:

- a) Software Verification, Validation & Testing

**ITW- 853      Lab – X**

The practicals will be based on the following papers:

- a) Elective I
- b) Elective II

**ITW – 855      \*Project Work – II**

Minor Project

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