M.Tech. (ICT) for Science Graduate (3-Years)

SEMESTER – I

S. No.	Course Code	Courses	L	T	P	Credits
1	MA431	Engineering Mathematics	3	1	0	4
2	EC431/EC201	Digital Electronics	3	1	0	4
3	CS431/CS203	Operating Systems	3	0	0	3
4	CS433/CS202	Software Engineering	3	0	0	3
5	CS435	Problem Solving using C	3	0	0	3
6	SS431	Technical Communication	2	0	0	2
7	EC483/EC281	Digital Electronics Lab	0	0	3	2
8	CS483	Programming Lab	0	0	3	2
9	GP431	General Proficiency	-	-	-	1
		Total	**17**	**2**	**6**	**24**
		Total Contact Hours	**25**			

SEMESTER – II

S. No.	Course Code	Courses	L	T	P	Credits
1	EC442	Communication Engineering	3	0	0	3
2	CS434	Object-Oriented Programming with JAVA	3	0	0	3
3	CS436/CS206	Data Base Management System	3	0	0	3
4	CS438/CS309	Computer Organization and Architecture	3	0	0	3
5	EC444/EC205	Signal and Systems	3	1	0	4
6	EC446/EC306	Microelectronics Engineering	3	0	0	3
8	CS484/CS283	Object-Oriented Programming with JAVA Lab	0	0	3	2
9	EC480	Design Lab	0	0	3	2
10	GP432	General Proficiency	-	-	-	1
		Total	**18**	**1**	**6**	**24**
		Total Contact Hours	**25**			

SEMESTER – III

S. No.	Course Code	Courses	L	T	P	Credits
1	CS531	Data Structures and Algorithm Design	3	1	0	4
2	CS533/CS401	Compiler Design	3	0	0	3
3	EC553	Data Communication	3	0	0	3
4	EC555/EC465	Principles of VLSI Design	3	0	0	3
5	EC557	Cellular Mobile Communication	3	0	0	3
6	EC559/EC304	Microprocessors and Interfacing	3	0	0	3
7	CS583	Data Structures and Algorithms Design Lab	0	0	3	2
8	EC587/EC384	Microprocessor and Interfacing Lab	0	0	3	2
9	GP531	General Proficiency	-	-	-	1
		Total	**18**	**1**	**6**	**24**
		Total Contact Hours	**25**			

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SEMESTER -IV

Sr. No.	Course Code	Courses	L-T-P	Credits
		THEORY		
1	MA402	Simulation and Modeling	3-1-0	4
2	EC532	Advanced Communication Networks	3-0-0	3
3	EC534	Wireless System Design	3-0-0	3
4		Elective-3	3-0-0	3
5		Elective-4	3-0-0	3
		PRACTICALS		
6	EC584	Design Lab-I	0-0-3	2
7	EC590	Major Project	0-0-10	5
8	GP532	General Proficiency	---	1
		Total	**15-1-13**	**24**
		Total Contact Hours	29	

Electives (3 & 4)

Sr.No	Course Code	Courses
1.	EC542	Quality of Services in Networks
2.	EC566	VLSI for Wireless Communication
3.	EC536	VLSI Technology
4.	EC544	Advanced RF Engineering
5.	EC548	Probability and Stochastic Processes
6.	EC550	Advanced Microwave Communication
7.	EC552	Networking Protocols
8.	EC554	Mobile Computing
9.	EC556	Image Processing and Biometrics
10.	EC558	Network Programming
11.	EC576	CMOS RF Circuit Design
12.	EC570	Principles of MEMS Design
13.	CS447/CS547	Multimedia Techniques
14.	CS449/CS561	Soft Computing
15.	CS404/CS534	Open Source Software System

SEMESTER- V

Sr. No.	Course Code	Courses	L-T-P	Credits
		THEORY		
1	EC631	Security in Wireless Networks	3-0-0	3
2	CS633	Research Techniques in ICT	3-0-0	3
3		Elective-5	3-0-0	3
4		Elective-6	3-0-0	3
		PRACTICALS		
5	EC681	Computing Lab	0-0-3	2
7	EC691	Dissertation Part-I	0-0-14	7
8	GP631	General Proficiency	---	1
		Total	**12-0-17**	**22**
		Total Contact Hours	29	

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Electives (5 & 6)

Sr.No	Course Code	Courses
1	EC641	Network Reliability
2	EC643	Smart Antenna Systems
3	EC645	Broadband Wireless Networks
4	EC647	Sensor Networks
5	EC649	Ad-hoc Wireless Networks
6	EC651	Multicast Communication
7	EC671	Modern Optimization Techniques
8	EC675	Mixed Signal VLSI Design
9	EC677	DSP Integrated Circuits

SEMESTER- VI

Sr. No	Course Code	Courses	L-T-P	Credits
1	EC696	Dissertation Part-II	---	21
2	GP632	General Proficiency	---	1
		Total	**---**	**22**

Total Credits-140

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DIGITAL ELECTRONICS			
Course Code:	**EC431/EC201**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3 +1T**	**Mid Sem Exams Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exams Hours:**	**3**

Unit I: Review of Number systems and Binary codes, Binary arithmetic: addition, subtraction, multiplication and division algorithms. Boolean algebra: theorems and functions, Simplification of Boolean functions, minimization techniques, Karnaugh's map method,Quine and McCluskey's method, realization of various binary functions using AND ,OR,NOT,XOR logic gates.

Unit II: Universal gates: NAND, NOR, realization of boolean function using universal gates. Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, look-ahead Carry generator. Decoders, Encoders, multiplexers and de-multiplexers. Analysis and design of combination circuits, realization of various Boolean functions using NAND,NOR gates and multiplexers.

Unit III: Flip-Flops: R-S, Clocked R-S, T, D, J-K, race around problem, Master-slave J-K., State and Excitation Tables Multivibrators- Astable, Monostable and bistable multivibrators, 555 timer chip and its application in multivibrators

Unit IV: Shift registers and counters, synchronous and asynchronous counters, Binary ripple counter, up-down counter, Johnson and ring counter, Analysis and Design of Sequential Circuits.

Unit V: Logic families: RTL, DTL, TTL, ECL, IIL, PMOS, NMOS and CMOS logic

Text Books:

[1] M. Mano :Digital Logic and Computer Design, Pearson Education
[2] William I. Fletcher :An Engineering Approach to Digital Design, Pearson Education

References:

[1] M. Mano : Digital Design, Pearson Education
[2] W.H. Gothman : Digital Electronics, PHI.
[3] Millman and Taub : Pulse, Digital and Switching Waveforms, MGH
[4] Anand Kumar : Pulse and Digital Circuits , PHI
[5] Leach and Malvino : Digital Principles and Applications, TMH
[6] R.P. Jain: Digital Electronics

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OPERATING SYSTEMS			
Course Code:	**CS431/CS203**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Introduction to Operating System

Importance of operating systems, basic concepts and terminology about operating system, memory management functions, processor management functions, device management functions, information management functions.

Unit II: Process Management

Elementary concept of process, job scheduler, process scheduling, operation on process, threads, overview, 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.

Unit III: Memory Management

Memory management, logical versus physical address space, swapping, contiguous allocation, paging, segmentation, demand paging, page replacement, page replacement algorithms, allocation of frames, thrashing, demand segmentation.

Unit IV: Storage Management

File concept, directory structure, protection, file-system structure, allocation method, free-space management, directory implementation.

Unit V: I/O Systems

I/O hardware, Application of I/O interface, Overview of Kernel I/O subsystem, three types of I/O systems, memory based I/O, I/O based I/O, Peripheral based I/O.

Reference Books:

[1] Galvin, Wiley, Operating Systems Concepts, 8th edition, 2009.
[2] James L Peterson, Operating Systems Concept, John Wiley & Sons Inc, the 6Rev edition, 2007.
[3] Deitel H. M., An Introduction to Operating Systems, Addison-Wesley, 1990.
[4] Stallings William, Operating Systems, PHI, New Delhi, 1997.
[5] Madnick and Donavon, Operating Systems, McGraw Hill, International edition, 1978.
[6] S. Tanenbaum Modern Operating Systems, , Pearson Education, 3rd edition, 2007.
[7] Nutt, Operating System, Pearson Education, 2009.
[8] S. Tanenbaum, Distributed Operating Systems, Prentice Hall, 2nd edition, 2007.
[9] M. Singhal & N. Shivaratri, Advanced Concepts in Operating Systems, McGraw Hill, 2003.

SOFTWARE ENGINEERING			
Course Code:	**CS433/CS202**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Software Engineering

Introduction to software engineering: definitions, Role of Software Engineering, planning a software project, defining the problem, developing a solution strategy, planning the development process, software engineering process paradigms, principles of software engineering, Software Engineering activities.

Unit II:Requirement Analysis and Design

Software Requirement Specification(SRS): Introduction, need of SRS, significance, characterstics of SRS, Structure of SRS, IEEE standards for SRS design, functional and non-functional requirements, Requirement gathering and analysis, requirement engineering and management.

Unit III: Software Design Process

Software Design: Introduction, Design Process Activities: Architectural design, Abstract specification, Interface design, Component design, Data structure design, Algorithm design Modular approach, Top-down design, Bottom-up design, Design methods: Data-flow model: Data Flow diagram, Entity-relation-attribute model: E-R diagram, Structural model: structure charts, context diagrams, Object models: use case modeling, use case diagrams, sequence diagrams, cohesion and coupling.

Unit IV: Software Life Cycle Models

Software Development Life Cycle (SDLC), SDLC models, waterfall model and its variations, prototype model, iterative enhancement model, spiral model, RAD model, comparison of these models, software development teams, software development environments, validation and traceability, maintenance, prototyping requirements, Software project management.

Unit V:Software Testing and Maintenance

Testing Methods: unit testing, integration testing, system testing, acceptance testing, testing techniques: white box testing, black box testing, thread testing, regression testing, alpha testing, beta testing, static testing, dynamic testing,

Evolution of software products, economics of maintenance, category of software maintenance, Role of product development life cycle, deployment model, adaptive maintenance, corrective maintenance, perfective maintenance, enhancement request, proactive defect prevention, problem reporting, problem resolution, software maintenance from customers' perspective, maintenance standard: IEEE-1219, ISO-12207.

Reference Books:

[1] Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, New Delhi 1997.
[2] Ian Sommerville, Software Engineering, Pearson Education, 2009.
[3] Pressman Roger S., Software Engineering: Practitioner's Approach, McGraw-Hill Inc., 2004.

PROBLEM SOLVING USING C			
Course Code:	**CS435**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Introduction

Definition of Algorithms- Writing algorithms- top down design- Program verification- The efficiency of algorithms- Concept of Recursion- some simple example to illustrate these concepts like finding the GCD of two numbers. Swapping two variables- Summation of n given numbers- generation of Fibonocci sequence-Reversing a given number-Base conversion.

Unit II: Introduction to C

C character set- Delimiters-The C Keywords-Identifiers- Constants-Variables-Rules – Type Conversion-Priority of Operators and their Clubbing-Comma and Conditional Operator-Arithmetic Operators-Relational Operators-Logical Operators-Bitwise Operators-Input in C-Formatted and Unformatted Functions-Library Functions.

Unit III: More about C

if statement- if--- else statement-various forms of if-nested if-break statement-continue statement-go to statement- switch statement- nested switch statement – for statement –while statement do while statement to while statement – arrays – working with string and standard functions.

Unit IV: ADVANCED CONCEPTS OF C

Introduction to pointers – pointer declaration Arithmetic Operations with pointers- pointers and arrays-pointers and two-dimensional arrays-array of pointers – pointers to pointers- pointers and strings – void pointers – function definition and declaration – proto types of functions – call by value and reference – functions returning more values – function as an argument – function with operators – function and decision statements – function and loop statements – function with arrays and pointers – recursion – pointer to function –storage classes.

Unit V: Problem Solving

Reversal of an Array-Removal of duplicates in an ordered array-Partitioning of an array-Finding the Kth smallest of an element of an array-Finding the longest monotone subsequence of an array-Linear search-Binary search- Hash searching- Bubble sort – Merge sort – Quick sort-Insertion sort-selection sort-Text processing- Towers of Hanoi problem using recursion.

ADDITIONALS IN C: preprocessor directives – structures and unions – bit wise operators- files-command line arguments – dynamic memory allegation – graphics in C.

Text Books:

[1] Ashok N.Kamthane, Programming with ANSI and Turbo C, Pearson Education, New Delhi.
[2] R.G. Dromey, How to Solve it by computer, Prentice Hall of India Ltd, New Delhi.

Reference Books:

[1] N.G. Venkateshmurthy, Programming techniques through C, Pearson Education, New Delhi.
[2] Byron s Gottfried, Programming with C, Schaum's Outline series, Tata McGraw Hill Pub. Company, New Delhi.
[3]Jacqueline A.Jones & Keith Harrow, C programming with problem solving, Dreamtech publications, New Delhi.

COMMUNICATION ENGINEERING			
Course Code:	**EC442**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exams Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exams Hours:**	**3**

Unit I: Signals and its Representation
Review of Fourier transform, Convention, Signal transmission though linear systems, signal distortion in transmission, poley wiener criteria, Bandwidth and rise time, energy and power signals, spectral density and persevall's theorem for energy of power signals, Hilbert transform.

Unit II: Linear Modulation and Exponential Modulation
Linear Modulation: Definition, Necessity of modulation, Principle of amplitude modulation, Generation and detection of AM, Side bands, The generation and detection of side bands, Comparison of various AM systems, FDM, Synchronous detection.
Exponential Modulation: Definitions and relationship between PM and FM frequency deviation, Bessells function, spectrum and transmission BW of FM signals, NBFM, WBFM, phaser diagram of FM signal, multi tone FM, Generation and detection of FM Non linear effects in FM systems, comparison of AM and FM systems, TDM.

Unit III: Radio Transmitter and Receivers
Different types of AM and FM transmitters and receivers, AM and FM standard broadcast transmitter and receivers, image rejection, mixer.**Noise:**Classification and sources of noise, Noise calculations for single and cascaded stages, SNR, SNR in DSB, SSB, VSB, AM and FM systems, pre-emphasis and De-emphasis Sampling theorem, quantization, PCM, Companding intesymbol interface, Eye patterns, Delta modulation, Adaptive delta modulation, DPCM, SIN performance of PCM and delta modulation, bandwidth of PCM and delta modulation.

Unit IV: Digital Modulation Techniques
ASK, BPSK, QPSK, M-ray PSK, DPSK, BFSK, M-ray FSK, Duobinary signalling baseband signal receiver, Probability of error, Optimum filter, Matched filter, Coherent and non-coherent detection, bit error rate.Random signals, random variables and processes, cumnlative distribution function, probability density function, average value, variance, standard deviation moment and moment,] generating function, characteristics function, Tchebycheffs inequality, Binary, Poisson and Gaussian distributions, other distributions, central limit theorem.

Unit V: Information Theory and Coding
Unit of information, average information, joint and conditional entropy, mutual information, channel capacity efficiency, BBS and BEC, Shannon's Theorem, Shannon-Hartely theorem, bandwidth - SIN ratio trade-off. Coding separable codes, Prefix property, Coding efficiency, Source coding, Shannon - Fano code, Huffman code, Error connection codes, FEC and ARQ, Hamming distance, Minimum distance, Channel coding, Block code, Cyclic code, Convolutional code.

Text Books:
[1] S Haykin, Communication System, John Willey and Sons.
[2] Taub Schilling, Principle of Communication, TMH.
[3] B.P. Lathi, Modern Digital and Analog Communication System, Oxford Press.

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OBJECT ORIENTED PROGRAMMING WITH JAVA			
Course Code:	**CS434**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I OBJECT-ORIENTED PROGRAMMING

Concept of object-oriented programming (OOP), benefits of OOP, application of OOP, Java history, Java features, Java streaming, Java and Internet, Java contribution to Internet: Java applets, security, portability; Java environment, Java library, Java program structure, Java program, Java Virtual Machine (JVM) architecture, Just In Time compiler (JIT), data type, variables and arrays, operators, control statements, object-oriented paradigms; abstraction, encapsulation, inheritance, polymorphism, Java class and OOP implementation

UNIT II DATA TYPE, OPERATORS AND CONTROL STATEMENT

Data types, Java key words, identifiers, constants, variables, declaration and scope of the variable, symbolic constant, type casting, arithmetic operator, relational operator, logical operator, assignment operator, increment and decrement operator, conditional operator, bitwise operator, ?: operator, arithmetic expressions, expressions, type conversions in expressions, mathematical functions, more data types: arrays, strings, vectors, wrappers classes, program control statements: decision making and branching: if, if….else, else….if, else if ladder, switch, decision making and looping: while, do….while, for.

UNIT III CLASSES, OBJECTS AND METHODS

Java class libraries, class fundamentals, object, methods, adding variables, add methods, creating objects, accessing class members, constructors, methods overloading, static members, nesting of methods, inheritance: extending a class, overriding methods, final variables and methods, final classes, finalizer methods, abstract methods and classes, visibility control, exception handling fundamental.

UNIT IV INTERFACES AND PACKAGES

Interfaces, extending interfaces, implementing interfaces, interfaces references, accessing interface variable, creating queue interface, variable in interfaces, packages, finding a packages and classpath, package and member access, Java API package, system package, naming conventions, creating package, accessing a package, adding a class to a package, hiding classes,

UNIT V MULTITHREADING AND APPLET PROGRAMMING

Multithreading programming: creating threads, thread class and runnable interface extending the thread class, stopping and blocking a thread, life cycle of a thread, thread methods, thread exceptions, thread priority, synchronization, thread communication using notify(), wait(), and notify all(), applet programming : applet basic, applets architecture, a complete applet skeleton, building applets code, applets life cycle, creating a executable applet, designing a web page, applets tag, passing parameters to applets, applets and HTML.

Test Books:

1. E. Balagurusawamy, Programming with JAVA, Tata McGraw Hill, 1998.

Reference Books:

2. Herbert Schildt, JAVA Beginner's guide, Tata McGraw Hill, 2007.
3. Deitel & Deitel, Java How to Program, Prentice-Hall, 1999.
4. Herbert Schildt, The Complete Reference JAVA 2, 7th Edition, Tata McGraw Hill, 2009.
5. Ken Arnold, James Gosling, The Java Programming Language, Addison-Wesley, 1996.
6. Peter Coffee, How to Program Java, Ziff-Davis Press, 1996.

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DATABASE MANAGEMENT SYSTEM			
Course Code:	**CS436/CS206**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Data Base System

Data base system vs. file system, view of data, data abstraction, instances and schemas, data models, ER model, relational model, database languages, DDL, DML, database access for applications programs, data base users and administrator, transaction management, data base system structure, storage manager, query processor, history of data base systems, data base design and ER diagrams, beyond ER design entities, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model, and conceptual design for large enterprises.

Unit II:Relational Model

Introduction to the relational model, integrity constraint over relations, enforcing integrity constraints, querying relational data, and logical data base design, destroying /altering tables and views. relational algebra and calculus: relational algebra, selection and projection set operations, renaming, joins, division, relational calculus, tuple relational calculus, domain relational calculus, expressive power of algebra and calculus.

Unit III: Basic SQL Query

Examples of basic SQL queries, nested queries, correlated nested queries set, comparison operators, aggregative operators, NULL values, comparison using null values, logical connectivity's, AND, OR and NOTR, impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL triggers and active data bases.

Unit IV: Schema Refinement

Problems caused by redundancy, decompositions, problem related to decomposition, reasoning about FDS, FIRST, SECOND, THIRD normal form, BCNF, forth normal form, lossless join decomposition, dependency preserving decomposition, schema refinement in data base design, multi valued dependencies.

Unit V:Overview of Transaction Management

ACID properties, transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions, dealing with dead locks, specialized locking techniques, concurrency without locking, crash recovery: ARIES, log, other recovery related structures, the write, ahead log protocol, check pointing, recovering from a system crash, media recovery, other approaches and interaction with concurrency control.

References:

[1] Elmasri Navrate, Data Base Management System, Pearson Education, 2008.
[2] Raghurama Krishnan, Johannes Gehrke, Data Base Management Systems, TMH, 3rd edition, 2008.
[3] C. J. Date, Introduction to Database Systems, Pearson Education, 2009.
[4] Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.
[5] Rob, Coronel & Thomson, Database Systems Design: Implementation and Management, 5th edition, 2009.

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COMPUTER ORGANIZATION AND ARCHITECTURE			
Course Code:	**CS438/CS309**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Computer Arithmetic and Number System
Number representation, Number System, fixed and floating point number representation, Arithmetic Algorithms (addition, subtraction, Booth Multiplication).

Unit II: Register Transfer and Microoperation
Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Bus Arbitration, Arithmetic Logic, Shift Microoperation, Arithmetic Logic Shift Unit, Design of Fast address

Unit III: Processor Design
Processor Organization: General register organization, Stack organization, Addressing mode, Instruction format, Data transfer & manipulations, Program Control, Reduced Instruction Set Computer.

Unit IV: Input-Output Organization
I/O Interface, Synchronous and Asynchronous Data Transfer, strobe, handshaking scheems Modes of transfer, Interrupts & Interrupt handling, Direct Memory access, Input-Output processor.

Unit V: Memory Organization
Memory Hierarchy, Main Memory (RAM and ROM Chips), organization of 2D and 21/2D, Auxiliary memory, Cache memory, Virtual Memory, Memory management hardware.

Text Books:
[1] Patterson, Computer Organisation and Design, Elsevier Pub. 2009
[2] John P Hays, " Computer Organization", McGraw Hill

References:
[3] William Stalling, " Computer Organization", PHI
[4] Vravice,Hamacher & Zaky, "Computer Organization", TMH
[5] Mano," Computer System Architecture", PHI
[6] Tannenbaum," Structured Computer Organization', PHI
[7] P Pal chaudhry, ' Computer Organization & Design', PHI

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SIGNAL AND SYSTEMS			
Course Code:	**EC444/EC205**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1T**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: LTI Systems

Continuous time and discrete time signals, Even and Odd signals. Elementary continuous time and discrete time signals, Classification of signals, causality; stability, time invariance, linearity, Continuous time and Discrete time LTI Systems, convolution Integral and convolution sum, Properties of LTI Systems, Differential and Difference equations. Singularity functions.

Unit II: Analysis of Periodic Signals

Fourier series representation of CTPS, convergence of FS, Properties of CTFS, Fourier series representation of DTFS. Fourier series and LTI Systems, Filtering, RC low pass and high pass filters. Recursive and Non recursive Discrete Time filters.Sampling theorem, sampling of continuous time signal with impulse train and zero order hold Reconstruction, Aliasing, Discrete-time processing of continuous time signals, Digital differentiator, Sampling of discrete time signals, decimation and Interpolation

Unit III: Analysis of Aperiodic Signals

Continuous Time Fourier Transform (CTFT), Convergence of FT. Properties of CTFT, Discrete time Fourier Transform (DTFT), Properties of DTFT. System characterized by linear constant co-efficient differential equations. Magnitude and phase spectrum, group delay, Time domain and frequency domain aspects of ideal Non-ideal filters. First order and second order continuous time and discrete time systems

Unit IV: Laplace Transform

The Laplace transform, Region of convergence, Inverse Laplace transform. Geometric evaluation of Fourier transform from pole zero plot, First order, second order and all pass systems. Properties of Laplace transform Analysis and characterization of LTI systems using the Laplace transform. Causality, stability, Differential equations, Butterworth and Chebychev filters. Unilateral Laplace transform its properties and uses.

Unit V: Convolution and Correlation of Signals

concept of convolution in time domain and frequency domain, graphical representation of convolution, convolution property of Fourier Transform, cross-correlation and auto-correlation of functions, properties of correlation function, energy density spectrum, Parseval's Theorem, power density spectrum, detection of periodic signals in the presence of noise by correlation

Text Books:

[1] Oppenheim Willsky and Nawab,:Signals and Systems, PHI.
[2] Simon Haykin: Signals and Systems, John Wiley.
[3] Taub and Schilling: Principles of Communication Systems, TMH.
[4] Dungan F R: Electronic Communication Systems, Thomas-Delmar.

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MICROELECTRONICS ENGINEERING			
Course Code:	**EC446/EC306**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: MOSFETS

Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation. MOSFET internal capacitances and high frequency mode, CMOS digital logic inverter, detection type MOSFET.

Unit II: Single Stage IC Amplifier

IC Design philosophy, comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response, CS and CF amplifiers, CG and CB amplifiers, Cascade amplifiers, CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance.

Unit III: Differential and Multistage Amplifiers

MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers, Multistage amplifier.

Unit IV: Feedback and Operational Amplifiers

General Feedback structure, properties of negative feedback, basic feedback topologies, loop gain, Stability problem, effect of feedback on amplifier poles, stability analysis by Bode plots, frequency compensation. Two stage CMOS Op-amp, folded cascade CMOS op-amp, 741 op-amps. Data Converters, A-D and D-A converters.

Unit V: Digital CMOS circuits

Overview. Design and performance analysis of CMOS inverter. Logic Gate Circuits. Pass-transistor logic. Dynamic Logic Circuits.

Text Books:

[1] Adel Sedra and K.C. Smith, Microelectronic Circuits, 5th Edition, Oxford Uni. Press, 2004.
[2] Richard C. Jaeger and Blalock, Microelectronic Circuit Design,3rd Edition, TMH 2007

References:

[1] Behzad Razavi, Fundamentals of Microelectronics, John Wiley, 2008

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DATA STRUCTURES AND ALGORITHM DESIGN			
Course Code:	**CS531**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1T**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I : INTRODUCTION

Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, Time-Space trade-off.

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations.

Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal

UNIT II: STACKS AND QUEUE:

Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Queue, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Dequeue and Priority Queue.

UNIT III : TREES

Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm, Convex hull , Searching. Greedy methods. Binary Search Trees(BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees, Red-Black trees, Binomial Heaps, Fibonacci Heaps, Fast Fourier Transform, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms,

UNIT IV: GRAPH

Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

UNIT V: SEARCHING AND SORTING

Searching : Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting. Dynamic programming with examples such as Kanpsack, All pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem.

Text books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI
2. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.

Reference Books:

3. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication
4. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill
5. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
6. Lipschutz, "Data Structures" Schaum's Outline Series, TMH

M.Tech. (ICT) for Science Graduate (3-Years)

DATA COMMUNICATION			
Course Code:	**EC553**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Introduction to Data Communication and Networks

Data Communication, Networks – Physical structures; different topologies, Categories of Networks: LAN, MAN, WAN, Interconnection of networks, The Internet, Protocols and Standards, Standards Organizations. Network Models, Layered tasks, The OSI model, different layers in OSI model. TCP/IP protocol suite ; different layers, addressing, - physical, logical, port and specific addresses, Analog and digital, digital signals-Bit Length, Digital Signal as a Composite Analog Signal, Transmission of Digital Signals, Data Rate Limits-Noiseless Channel, Noisy Channel.

Unit II:Physical Layer

Digital-to-Digital Conversion-Line Coding, Line Coding Scheme, Block Coding, Scrambling. Multiplexing – Frequency Division, Wavelength Division, Synchronous Time Division, Statistical Time Division Multiplexing. Circuit-Switched Networks – Three Phases, Efficiency, Delay. Datagram Networks - Routing Table, Efficiency, Delay, Datagram Networks in the Internet. Virtual Circuit Networks - Addressing, Three Phases, Efficiency, Delay, Circuit Switched Technology in WANs. Structure of Circuit and Packet switches, Dial-up Modems, Digital Subscriber Line - ADSL, ADSL Lite, HDSL, SDSL, VDSL, Cable TV for Data Transfer- Bandwidth, Sharing, CM and CMTS, Data Transmission Schemes.

Unit III: Data Link Layer

Introduction - Types of Errors, Redundancy, Detection Vs Correction, Forward Error Correction Vs Retransmission, Modular Arithmetic. Block Coding - Error Detection, Error Correction, Hamming Distance, Minimum Hamming Distance. Linear Block Codes, Cyclic Codes - Cyclic Redundancy Check, Hardware Implementation, Polynomials, Cyclic Code Analysis, Advantages. Checksum, Framing - Fixed and Variable-Size. Flow and Error Control, Protocols, Noiseless Channels – Simplest and Stop-and-Wait Protocols. Noisy Channels - Stop-and-Wait Automatic Repeat Request, Go-Back-N Automatic Repeat Request, Selective Repeat Automatic Repeat Request.

Unit IV: Medium Access

Random Access- ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). Controlled Access-Reservation, Polling, Token Passing. Channelization- Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA). IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11- Architecture, MAC Sub layer, Addressing Mechanism, Physical Layer. Bluetooth- Architecture, Radio Layer, Baseband Layer, L2CAP.

Unit V: Connecting LANs

Connecting Devices- Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches,Three-Layer Switches, Gateway. Backbone Networks-Bus, Star, Connecting Remote LANs. Virtual LANs - Membership, Configuration, Communication between Switches, Network layer – logical addressing - IPv4Addresses- Address Space, Notation, Classful Addressing, Classless Addressing, Network Address Translation (NAT). IPv6 Addresses - Structure and Address Space. Internetworking - Need for Network Layer, Internet as a Datagram Network, Internet as a Connectionless Network. IPv4- Datagram, Fragmentation, Checksum, Options. IPv6 Advantages, Packet Format, Extension Headers. Transition from IPv4 to IPv6. Address Mapping- Logical to Physical Address, Physical to Logical Address, Routing – Delivery forwarding techniques and processes, routing table,, Unicast routing protocols – Optimization, inter domain, intra domain, distance vector, link state and path vector.

routing, Multicast routing protocol - Unicast, multicast and broadcast, applications, multicast routing and routing protocols.

Text Books:

[1] B. A. Forouzan and Sophia Chung Fegan: Data Communications and Networking, 4th Ed, TMH.
[2] W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
[3] A. S. Tanenbaum: Computer Networks, Pearson Education.
[4] W. Stalling: Data and Computer Communication, Pearson Education.

M.Tech. (ICT) for Science Graduate (3-Years)

PRINCIPLES OF VLSI DESIGN			
Course Code:	**EC555/EC465**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Basic MOS Technology

Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.MOS Device Design Equations, The Complementary CMOS Inverter: DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

Unit II: Circuit Design Processes and CMOS Logic Structures

MOS layers, Stick diagrams, Design rules and layout – lambda-based design and other rules, Layout diagram, Symbolic diagrams, Basic Physical Design of Simple logic gates, CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic.

Unit III: MOS Circuits Concepts

Sheet resistance, Area capacitances, Capacitance calculations, delay unit, Inverter delays, Driving capacitive loads, Propagation delays, Wiring capacitances, Scaling models and factors, Limits on scaling, Limits due to current density and noise.

Unit IV: CMOS Subsystem Design and Processes

Architectural issues, Switch logic, Gate logic, Design examples – combinational logic, Clocked circuits, other system considerations, Clocking Strategies, Subsystem design processes: General considerations, Process illustration, ALU subsystem, Adders. Multipliers.

Unit V: Advance Topic

Memory registers and clock: Timing considerations. Memory elements, Memory cell arrays. Testability: Performance parameters. Layout issues. I/O pads, System delays, Ground rules for design, Test and testability.

Text Books:

[1] CMOS VLSI Design – A Circuits and Systems Perspective, 3rd Edition, N.H. Weste and David Harris. Addison- Wesley, 2005.

[2] Principles of CMOS VLSI Design: A Systems Perspective, Neil H. E. Weste, K. Eshragian, Pearson Education (Asia) Pvt. Ltd.

[3] Basic VLSI Design - Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition, 2005.

M.Tech. (ICT) for Science Graduate (3-Years)

CELLULAR MOBILE COMMUNICATION			
Course Code:	**EC557**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I:
Introduction to cellular mobile system A basic cellular system, Performance criteria, Uniqueness of Mobile Radio Environment, Operation of cellular systems, Planning and cellular system.

Elements of Cellular Radio System Design: General description of problem, Concept of frequency channels, Co channel interface reduction factor, Hand off, Cell splitting, Consideration of the components of cellular systems.

Unit II:
Interface: Introduction to co-channel interface, Real time Co-channel interface Co-channel measurement, Design of antenna system, Antenna parameter and their effects, Diversity receiver non co-channel interface different types.

Unit III:
Cell coverage for signal and 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.

Unit IV:
Cell site antennas and mobile antennas: Antennas at cell site, mobile antennas. Frequency management and Channel Assignment: Frequency management, Fixed channels assignment, Non-fixed channel assignment, Traffic and channel assignment.

Unit V:
Digital Cellular System: GSM, Architecture, Layer Modeling, Transmission, GSM channels, Multiple process, CDMA, Terms, Power limits & Control Modulation characteristics, Call processing, Hand off.

Text Books:
[1] Lee, Cellular and Mobile Communication, McGraw Hill.
[2] Faher Kamilo., Wireless Digital Communication, PHI.

M.Tech. (ICT) for Science Graduate (3-Years)

MICROPROCESSORS AND INTERFACING			
Course Code:	**EC559/EC304**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Introduction to 8085 microprocessor: Pin diagram, architecture, programming model, instruction set, and classification of instruction set, instruction and data format, timing diagram of instructions. Basic concept of programming, Addressing Modes of 8085 microprocessors

Unit II: Microprocessor 8086 Architecture - BIU and EU, Registers, Pin Diagram, Memory Addressing, Clock Generator 8284, Buffers and Latches, Maximum and Minimum Modes

Unit III: Addressing Modes, Instruction set of 8086, Assembly Language Programming, Assemblers, Procedures, Macros, Interrupts, 8086 Based Multiprocessor Systems

Unit IV: Interfacing Chips- IC 8155 (Static Ram with I/O Ports and Timer), 8755 (EPROM with I/O Ports), 8251A (USART), 8255A(Programmable Peripheral Interface), 8253/8254 (Programmable Interval Timer/Counter), 8257 (DMA Controller), 8259A (Programmable Interrupt Controller)

Unit V: The 8051 architecture Microprocessor and Microcontroller, Comparison of microprocessors and microcontrollers Microcontroller survey – microcontrollers of different word length, make and features, selection criteria for microcontroller ,8051 microcontroller hardware – I/O pins and internal architecture internal RAM,ROM organization , I/O port circuits ,connecting external memory, addressing modes , Instruction set and assembly language programming.

Text Books:

[1] A K Ray : Advanced Microprocessors and Interfacing, 2nd edition,TMH
[2] Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education

References:

[1] B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
[2] Liu Gibson: Microcomputer Systems: The 8086/8088 Family- Architecture, Programming and Design, PHI
[3] D. V. Hall: Microprocessors and Interfacing, TMH.
[4] Ayala Kenneth:The 8051 microcontroller, Third Edition, Cengage Learning
[5] A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
[6] Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
[7] V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
[8] R S Gaonkar, Microprocessor, Architecture, Programming, and Applications with the 8085, Penram International Publication, 5/e
[9] P.K. Ghosh and P. R. Sridhar, 0000 to 8085 Introduction to microprocessor for Engineers and Scientists, PHI, 2/e