SCHOOL
OF
INFORMATION AND COMMUNICATION TECHNOLOGY

COURSE STURCTURE AND DETAILED SYLLABUS

3 YEARS M. TECH. ICT FOR SCIENCE GRADUATES

SPECIALIZATION:

WIRELESS COMMUNICATION &NETWORKS

GAUTAM BUDDHA UNIVERSITY
GAUTAM BUDH NAGAR, GREATER NOIDA
2011-2012

SEMESTER – I

S. No.	Course Code	Courses	L	T	P	Credits
1	MA431	Engineering Mathematics	3	1	0	4
2	EC431	Digital Electronics	3	0	0	3
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	1	0	4
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	1	0	4
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	2	1	0	3
6	EC446/EC306	Microelectronics Engineering	3	0	0	3
8	CS484	Object Oriented Programming with Java Lab	0	0	3	2
9	EC480	Design Lab	0	0	3	2
10	GP432	General Proficiency	-	-	-	1
		Total	**17**	**2**	**6**	**24**
		Total Contact Hours	**25**			

SEMESTER – III

S. No.	Course Code	Courses	L	T	P	Credits
1	CS531	Data Structure and Algorithm Design	3	1	0	4
2	CS533	Principles of 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 Structure and Algorithm Design Lab	0	0	3	2
8	EC587/EC384	Microprocessors and Interfacing Lab	0	0	3	2
9	GP531	General Proficiency	-	-	-	1
		Total	**18**	**1**	**6**	**24**
		Total Contact Hours	**25**			

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	EC592	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
16.	EC562	Optical Networks

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

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	EC690	Dissertation Part-II	---	21
2	GP632	General Proficiency	---	1
		Total	**---**	**22**

Total Credits-140

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(SEMESTER - I)

ENGINEERING MATHEMATICS			
Course Code:	**MA431**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**End Sem Exam Hours:**	**3**

UNIT I ORDINARARY DIFFERENTIAL EQUATIONS

First order differential equations: Separable equations, exact differential equations, integrating factors, linear first order differential equations, variation of parameters, existence and uniqueness of solutions, homogenous linear equations of the second order, homogenous second order equations with constant coefficients, general solutions, homogenous linear equations of arbitrary order with constant coefficients, nonhomogenous linear equations.

UNIT II LAPLACE TRASFORM AND ITS APPLICATIONS

Laplace transform, linearity, Laplace transforms of derivatives and integrals, existence theorem, differentiation and integration of transforms, unit step function and Dirac Delta function, Laplace transform of periodic functions, inverse transform, solution of Initi as value problems.

UNIT III MATRICES

Algebra of matrices, rank of a matrices, Cramer's rule, homogeneous and non homogenous system of linear equations, Gauss's elimination method, eigenvalues and eigenvectors, reduction to diagonal form, Quadratic forms.

UNIT IV FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

Periodic functions, Fourier series, Euler's formulas, even and odd functions, functions having arbitrary period, half range expansions, determinations of Fourier coefficients without integration, methods for determining coefficients, Fourier integrals, orthogonal functions, Sturm-Liouville problem, vibrating string, one-dimensional wave equation, Method of separation of variables, D'Alemberts's solution of wave equation, one-dimensional heat flow, vibrating membrane, two-dimensional wave equation, Laplace's equation,

UNIT V COMPLEX VARIABLES

Function of complex variables, analytic functions, Cauchy-Riemann equations, Laplace's equation, line integral in the complex plane, Poles and singularities, Cauchy's integral theorem, Cauchy's integral formula, The derivative of an analytic function, Taylor series, Laurent series and applications, Cauchy residue theorem and its applications to evaluating real integrals..

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley, 2006
2. Complex Variables and Applications, Ruel V.Churchill, James Ward Brown, 8th edition, McGraw Hill, 2008.
3. Applied Complex Variables, John W Dettman, Dover Publications New York, 1984
4. Calculus and Analytic Geometry, George B. Thomas, Ross Finney, 9th edition, Narosa, 2003.

Introduction to Linear Algebra, Strang Gilbert, 4th edition, Wellesley Cambridge Press, 2009.

5.

DIGITAL ELECTRONICS			
Course Code:	**EC431**	**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

Number systems & codes, Binary arithmetic Boolean algebra and switching function. Minimization of switching function, concept of prime implecant etc. Karnaugh's map method, Quine & McCluskey's method, cases with don't care terms and multiple outputs switching function. Logic gates, NAND, NOR realization of switching function; half-adder half-subtractor full-adders full-subtractor circuits. Series & parallel addition and BCD adders, look-ahead carry generator.

UNIT II

Linear wave shaping circuits, Bistable, monostable & astable multivibrators, Schmitt trigger circuits .Introduction to D/A converters. Various types of Analog to Digital & Digital to Analog converters sample & hold circuits and V-F converters.

UNIT III

Logic families: RTL, DTL, all types of TTL circuits, ECL, 12 L and PMOS, NMOS & CMOS logic etc. Gated flip-flops and gated multivibrators etc; Interfacing between TTL to MOS, vice-versa.

UNIT IV

Introduction to shift registers / ring counters synchronous & asynchronous counters and designing of combinational circuits like code converters & counters etc.

UNIT V

Semiconductor memories & designing with ROM and PLA: Decoders Encoders multiplexers & demultiplexers.

Text Books:

1. Tocci, "Digital Systems Principles & Applications".
2. M. Mano, "Digital Logic & Computer Design", (PHI).

Reference Books:

3. John F. Wakerly, Digital Design: Principles & Practices, Pearson Education.2003
4. Richard F.Tinder, Engineering Digital Design, 2/e, Harcourt India Private Ltd., 2001
5. William I. Fletcher, An Engineering Approach to Digital Design, Pearson Education
6. William H.Gothmann, Digital Electronics: An Introduction to Theory and Practice, Eastern Economy Edition, Prentice-Hall of India Private Limited, New Delhi. 2001.
7. Jacob Millman & Herbert Taub,Pulse,Digitaland Switching Waveforms,13th Reprint,Tata McGraw Hill Publishing Company Ltd.,NewDelhi, 1999

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, characteristics 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.
4. Software Engineering: Software Reliability, Testing and Quality Assurance, Nasib S. Gill, Khanna Book Publishing Co (P) Ltd., New Delhi, 2002.

PROBLEM SOLVING USING C			
Course Code:	**CS435**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3 +1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION

Introduction to problem solving, concept of algorithm, design of algorithms, iterative versus recursive style, top down design, program verification, 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, 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:

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

PROGRAMMING LAB			
Course Code:	**CS483**	**Credits:**	**2**
No. of Practical (Hrs/Week):	**3**		
Total No. of Lab Sessions:	**10**	**End Sem. Exam Hours:**	**2**

Programs/Experiments List:

1. Write a C Code to implement each of the following:
   Variable, constant, arithmetic operator, relational operator, logical operator, assignment operator, increment & decrement operator, conditional operator, bitwise operator.

2. Write a C Code to implement each of the following:
   Decision statement, loops statement and branch statements
3. Write a C Code to implement each of the following:
   Array: Single and Two dimensional arrays
4. Write C Code to generate the following output with the help of two dimensional array.

   7 14 21 28 35 42 49 56 63 70 Sum = 385
   5 10 15 20 25 30 35 40 45 50 Sum = 275
   3 6 9 12 15 18 21 24 27 30 Sum = 165

5. Write C Code to implement each of the following.
   Matrix Multiplication, Matrix Addition
6. Write a C Code to implement each of the following:
   Strings, Standard library string functions and array of pointers to strings
7. Write a C Code to implement each of the following sorting:
   Bubble Sort, Selection Sort, Insertion Sort, Merge Sort
8. Write a C Code to implement each of the following searching:
   Linear search, Binary search and Hash searching
9. Write a C Code to implement each of the following:
   Function: Implementation of function with call by values and call by reference
10. Write a C Code to implement each of the following:
    Pointers: Pointers declaration, array of pointers, pointers to pointers, pointers and strings
11. Write a C Code to implement recursion and tower of Hanoi problem using recursion.
12. Write a C Code to implement each of the following:
    Structure, Array of structure
13. Write a C Code to implement each of the following:
    Preprocessor, Macro Expansion and File Inclusion
14. Write a C Code to implement the following:
    File Handling
15 Develop a mini projects in C.

DIGITAL ELECTRONICS LAB			
Course Code:	**EC483/EC281**	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**3**
Total No. of Lab Sessions:	**10**		

List of Experiments

1. Verify the truth table of AND Gate
2. Verify the truth table of OR and NOT gates.
3. Verify the truth table of NAND , NOR Gates.
4. Verify the truth table of and EX-OR Gate.
5. Design a combinational circuit to realize the function f(ABC)=A(B+C) using NAND gates only.
6. Design a half adder using NOR gates only
7. Design full adder
8. Design a given size of Mux using gates.
9. Verify RS and JK flip flops
10. Verify D and T Flip flops
11. Design a up/down 3-bit counter
12. Design a 3 bit shift register.

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(SEMESTER - II)

COMMUNICATION ENGINEERING			
Course Code:	**EC442**	**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 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, 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.

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.

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 Books:

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, 5^{th} edition, 2005.
5. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management, 2009.

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 schemes, 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 $2^{1/2}$ D, 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 Books:

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

SIGNAL AND SYSTEMS			
Course Code:	**EC444/EC205**	**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 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

Laplace transform, region of convergence for Laplace transform, 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 Z-TRANSFORM

Basic principles of z-transform, z-transform definition, region of convergence, properties of ROC, properties of z-transform, Poles and Zeros, inverse z-transform using Contour integration, Residue Theorem, power series expansion and partial fraction expansion, relationship between z-transform and Fourier transform.

Reference 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.

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 Book:

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

References Books:

3. Fundamentals of Microelectronics, Behzad Razavi, John Wiley, 2008

OBJECT-ORIENTED PROGRAMMING WITH JAVA LAB			
Course Code:	**CS484**	**Credits:**	**2**
No. of Practical (Hrs/Week):	**3**		
Total No. of Lab Sessions:	**10**	**End Sem. Exam Hours:**	**2**

Programs/Experiments List:

1. Write a separate Java Code to implement each of the following:
   Class, Command Line Argument, how to enter value through keyboard

2. Write a separate Java Code to implement each of the following data types:
   Variable, Constant, Arrays, Strings, Vectors, Wrappers Classes, Type Casting

3. Write a separate Java Code to implement each of the following operators:
   Arithmetic operator, Relational operator, Logical operator, Assignment operator, Increment & Decrement operator, Conditional operator, Bitwise operator, ?: operator

4. Write a separate Java Code to implement each of the following control statements:
   Decision statement, Loops statement and Branch statements

5. Write a separate Java Code to implement each of the following sorting:
   Bubble Sort, Selection Sort, Insertion Sort, Merge Sort

6. Write a separate Java Code to implement each of the following:
   Class, Object, Constructors, Method, Method Overloading and Method Overriding

7. Write a separate Java Code to implement each of the following:
   Final variable, final class, final method, abstract class, abstract method and concrete method

8. Write a separate Java Code to implement each of the following OOPs concepts:
   Abstraction, Polymorphism, Encapsulation, Inheritance
9. Write a separate Java Code to implement each of the following:
   Exception handling with Try, Catch, Throw, Throws, Finally
   Multiple catch statement with the following exceptions :
   ArithmeticException, ArrayOutOfBoundsException and ArrayStoreException

10. Write a separate Java Code to implement each of the following:
    Visibility Controls: Private, Public and Protected

11. Write a separate Java Code to implement each of the following:
    Interface, extending and implementing interface

12. Write a separate Java Code to implement each of the following:
    Multithreading: Create thread with thread class and runnable interface, thread priorities, synchronization

13. Write a separate Java Code to implement each of the following:

Packages : Create package A with following methods and import this package A into another Java program to show the result of methods of package A.

i) First method: Factorial number with the help of recursion.
ii) Second method: Fibonacci Series
iii) Third Method: Generate first 10 prime numbers and show the sum of first 10 prime numbers.

14. Write Java Code to generate the following output on applet with the help of two dimensional array and show the result with the help of HTML file.

7 14 21 28 35 42 49 56 63 70	Sum = 385
5 10 15 20 25 30 35 40 45 50	Sum = 275
3 6 9 12 15 18 21 24 27 30	Sum = 165

15. Write a Java Code to design the following web page with the help of applet and HTML.

School of Information and Communication Technology
GAUTAM BUDDHA UNIVERSITY
GREATER NOIDA

- **Student Name:**
- **Enrollment Number:**
- **Programme Name:**
- **Semester:**
- **Course Name:**
- **E-Mail ID:**
- **Mobile Number:**
- **Blood Group:**

Design Lab LAB			
Course Code:	**EC480**	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**3**
Total No. of Lab Sessions:	**10**		

List of Experiments

13. Characterization of JFET.
14. Characterization of MOSFET
15. Design of Inverter Using MOSFET.
16. Design of an Inverting Amplifier using OP-AMP.
17. Design of noninverting Amplifier using OP-Amp.
18. Design of an integrater using Op-Amp.
19. Design of Astable Multivibrator using 555 Timer.
20. Design of Schmitt trigger using 555 timer
21. Design an 8-bit A/D Converter.
22. Design an 8-bit D/A Converter.
23. Verify the truth table of AND, OR and NOT gates.
24. Verify the truth table of NAND , NOR and EX-OR Gate.
25. Design a combinational circuit to realize the function f(ABC)=A(B+C) using NAND gates only.
26. Design a half adder using NOR gates only
27. Design full adder
28. Design a given size of Mux using gates.
29. Verify RS and JK flip flops
30. Verify D and T Flip flops
31. Design a up/down 3-bit counter
32. Design a 3 bit shift register.

WCN
(SEMESTER - III)

DATA STRUCTURE AND ALGORITHM DESIGN			
Course Code:	**CS531**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**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

PRINCIPLES OF COMPILER DESIGN			
Course Code:	**CS533**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**2**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION TO COMPILER

Introduction to compiler, Analysis and synthesis model of Compiler, Analysis of Source Program, Lexical Analysis, Syntax Analysis, Semantic Analysis, Phases of Compiler, Symbol table Management, Error Detection and Reporting Preprocessors, Assemblers, Front-End and Back-End, Compiler Construction Tools

UNIT II LEXICAL ANALYSIS

Introduction to Lexical Analysis, Role of Lexical Analyzer, Issues in Lexical Analysis, Tokens, Patterns Lexemes, Specification of Tokens, String and Language, Operations on Languages, Regular Expression, Recognition of tokens Transition Diagram, Finite Automata, Nondeterministic Finite Automata, Deterministic Finite Automata, Conversion of NFA to DFA, Construction of NFA from Regular Expression,

UNIT III SYNTAX ANALYSIS I

Introduction to Syntax Analysis, Role of Parsers, Syntax Error, Error Recovery Strategy, Context Free Grammars, Parse tree and Derivatives, Ambiguity and its elimination, Regular expression Vs Context Free Grammar, Elimination of Left Recursion, Left Factoring, Top-Down Parsing, Recursive-Descent Parsing, Non Recursive Predictive Parsing, FIRST and FOLLOW, Construction of Predictive Parsing

UNIT IV **SYNTAX ANALYSIS II**

Bottom-Up Parsing, Shift reduce parsing, Stack Implementation of Shift Reduce Parsing, Operator-Precedence parsing, Precedence function and Associativity, LR parsers, the canonical collection of LR(0) items, constructing SLR parsing tables, constructing canonical LR parsing tables, constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator.

UNIT V TYPE CHECKING AND CODE GENERATION

Type Checking, Type Expression, Specification of Simple Type Checking, Type Conversion, Symbol table, Intermediate Code Generation, three address code, Assignment statements, input to code generation, Memory Management, Register Allocation, basic blocks and flow graphs, optimization of basic blocks.

Reference Books:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
2. V Raghvan, " Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson

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, Internet, protocols and standards, standards organizations. network models, layered tasks, 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.

PRINCIPLE 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 MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY

NMOS and PMOS transistors, threshold volt age- Body effect- Design equations- second order effects. MOS models and small signal AC characteristics, basic CMOS technology.

UNIT II INVERTERS AND LOGIC GATES

NMOS and CMOS inverters, stick diagram, inverter ratio, DC and transient characteristics , switching times, Super buffers, driving large capacitance loads, CMOS logic structures, transmission gates, static CMOS design, dynamic CMOS design.

UNIT III CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION

Resistance estimation, capacitance estimation, inductance, switching characteristics, transistor sizing, power dissipation and design margining, charge sharing, scaling.

UNIT IV VLSI SYSTEM COMPONENTS CIRCUITS & SYSTEM LEVEL PHYSICAL DESIGN

Multiplexers, decoders, comparators, priority encoders, shift registers, arithmetic circuits, ripple carry adders, carry look ahead adders, high-speed adders, multipliers, physical design, delay modeling ,cross talk, floor planning, power distribution, clock distribution.

UNIT V VERILOG HARDWARE DESCRIPTION LANGUAGE

Overview of digital design with Verilog HDL, hierarchical modeling concepts, modules and port definitions, gate level modelling, data flow modeling, behavioral modeling, task & functions, test bench.

Text Books:

1. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000.
2. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995.

Reference Books:

3. John P.Uyemura "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc., 2002.
4. Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition, 2004.
5. Eugene D.Fabricius, Introduction to VLSI Design McGraw Hill International Editions,1990.
6. J.Bhasker, B.S.Publications, "A Verilog HDL Primer", 2nd Edition, 2001.
7. Wayne Wolf "Modern VLSI Design System on chip. Pearson Education.2002.

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, 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.

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:

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

Data Structure and Algorithm Design Lab			
Course Code:	**CS583**	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**2**
Total No. of Lab Sessions:	**10**		

List of Experiments

1. Write a program that implements tower of hanoii.
2. Write a program that implements insertion sort, Selection Sort.
3. Write a program that implements heap sort.
4. Write a program that implements quick sort.
5. Write a program that implements merge sort.
6. Write a program that implements binary search.
7. Write a program that implements Prim's algorithm.
8. Write a program that implements Kruskal's algorithm.
9. Write a program that implements make a change using greedy.
10. Write a program that implements knapsack using greedy.
11. Write a program that implements Dijkstra's algorithm.
12. Write a program that implements Longest Common Subsequence.
13. Write a program that implements N-queen Problem.
14. Write a program that implements knapsack using backtracking
15. Write a program that implements make a change using dynamic.
16. Write a program that implements All pair shortest path problem

Microprocessor and Interfacing Lab			
Course Code:	EC587 / EC384	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**3**
Total No. of Lab Sessions:	**10**		

List of Experiments

1. Addition of two 8-bit numbers, result 8-bit.
2. Addition of two 8-bit numbers, result 16-bit.
3. Subtraction of two 8-bit numbers.
4. Addition of two 16-bit numbers.
5. Multiplication of two 8-bit numbers.
6. Division of two 8-bit numbers.
7. 2's Compliment of a 8-bit number.
8. Arrange the array in ascending order.
9. Arrange the array in descending order.
10. Moving the block of data from one memory location to another memory location.
11. Largest number in an array.
12. Smallest number in an array.
13. BCD to HEX conversion.
14. HEX to BCD conversion.
15. HEX to ASCII conversion.
16. ASCII to HEX conversion.
17. Square of a number using lookup table method.
18. Interfacing of 8255.
19. Interfacing of 8253/8354.
20. Interfacing of 8237/8257.
21. Interfacing of 8259.
22. Interfacing of 8251.

WCN

(SEMESTER - IV)

ADVANCED COMMUNCIATION NETWORKS			
Course Code:	**EC402/EC532**	**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: Digital switching systems-analysis, hierarchy, evolution, SPC, call processing, communication and control- level 1,2,& 3 control, interface control, network control processor, central processor, control architecture, multiplexed highways, switching fabric-space division switching, time division switching, STS, TST, TTT, switching system software-architecture, OS, database management

Unit II: MPLS-label stack and label distribution, traffic engineering, design of switching systems, and routers, switching networks-crossbar switches, multistage switches, shared memory switches, optical networks, DWDM techniques, IP over optical core switches

Unit III: Congestion control: integrated services, differentiated services, congestion control, congestion control in packet switching, frame relay congestion control, flow control at link level, TCP congestion control

Unit IV: Voice over IP: basic IP telephone system, digital voice sampling, compression techniques, protocol for VoIP, session initiation protocol

Unit V: Internetworking-connection mode network service, x.75 internetworking, network through ISDN, internetworking SNA, and x.25, x.300 internetworking standards, personal computer networking, data transmission in PTN, Data network standards, voice-data integration, fast packet switches

Text books:

[1] Syed R. Ali, " Digital Switching Systems, System Reliability and analysis, Tata McGraw-Hill
[2] William Stallings, " High Speed Networks and Internet" 2nd ed. Perason edu, 2005
[3] Bellamy John, " Digital Telephony" Wiley 3rd Ed, 2000
[4] Viswanathan, T, "Telecommunications Switching Systems and Networks, " PH

References:

[1] Andrew S. Tanenbaum: Computer networks, PHI.
[2] W. Stallings: Data and computer communications, MC, Milan.
[3] Alberto Leon-Gercia, India Widjaja: Communication networks, fundamental concepts and key architecture, TATA McGraw Hill.
[4] Bertsekas D. and Gallager R.: Data Networks, PHI.
[5] Keshav S: An Engineering Approach to computer Networking, Addison Weslay.

WIRELESS SYSTEM DESIGN			
Course Code:	**EC404/EC534**	**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: RF system design procedures, methodology, link budget, propagation models, tower-top amplifiers, RF design guidelines, traffic projections, cell site design.

Unit-II: Network design- traffic forecasts, node dimensioning, interface design, placement of network nodes, topology.

Unit-III: Antenna systems,-base station antenna, cross pole antenna, dual band antenna, intelligent antenna, diversity techniques-derivation of selection diversity and maximal ratio combining improvement, polarization diversity, frequency diversity, time diversity, RAKE receiver. Communication sites-types, installation, towers, stealth, in-building and tunnel systems, inter, modulation, collocation.

Unit-IV: UMTS system design-design principles, coverage analysis, capacity analysis, radio access networks, overlaiding UMTS over GSM, CDMA system design-design methodology, deployment guidelines, traffic estimation, radio elements, fixed network d4sign requirements, traffic models, link budget, case studies-CDAM2000 1xRTT, EVDO, CDMA2000 1xRTT with EVDO overlay

Unit-V: Simulation of Wireless network systems-discrete event simulation, simulation models, performance evaluation and analysis of IEEE802.11 WLAN. Study of various network simulators, GloMoSim, ns-2, Opnet, design and performance evaluation of transport and routing protocols of mobile and wireless networks.

Text Books:

[1] Clint Smith, P.E. Daniel Collins, " 3G Wireless Networks" Tata McGraw-Hill, 2nd Edition
[2] Theodore S. Rappaport, " Wireless Communication, Principles and Practice" Pearson
[3] P. Nicopolitidis, M.S. Obaidat, G.I. Papadimitriou, A.S. Pomportsis, " Wireless Networks", John Wiley & Sons,

References:

IEEE Journals and proceedings

DESIGN LAB-1			
Course Code:	**EC584**	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**3**
Total No. of Lab Sessions:	**10**		

List of Experiments

1. Introduction to transmission media(CAT5, OFC, COAXIAL CABLE Wireless)
2. Introduces network interfaces(Wired and Wireless)
3. Configure and installing a Ethernet(10/100)
4. Performance evaluation of Ethernet(10/100)
5. Topology design(Ring, Bus,Star)
6. Generation of data packet and measurement(CBR, VBR, Poison)
7. Router configuration
8. Switch configuration
9. Server configuration
10. Congestion control of network
11. QoS of network
12. Protocols and the configuration
13. Wireless systems
14. Security (WEP, WPA)
15. Study about Qualnet

QUALITY OF SERVICES IN NETWORKS			
Course Code:	**EC406/EC542**	**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: IP Quality Of Service
Level of QoS, IP QoS history, performance measures, QoS functions, layer 2 QoS technologies, multiprotocol label switching, end-to-end QoS.

Unit II: QOS Architectures
Intserv architecture; RSVP, reservation style, service types, RSVP media support, RSVP scalability, along with their case studies. Diffserv architecture; network boundary traffic conditioners, PHB, resource allocation policy, packet classification.

Unit III: Network Boundary Traffic Conditioners and Resource Allocation
Packet classification, packet marking, need of traffic rate management, traffic policing, traffic shaping along with their case studies. Scheduling of QoS support, sequence number computation based WFQ, flow based WFQ, flow based distributed DWFQ, class based WFQ, priority queuing, schedule mechanisms for voice traffic, MWRR, MDRR along with their case studies.

Unit IV: Congestion Avoidance
TCP slow start and congestion avoidance, TCP traffic behavior in a trial drop scenario, REDproactive queue management for congestion avoidance, WRED, flow WRED, ECN, SPD along with their case studies.

Unit V: QOS in MPLS-Based Networks
MPLS, MPLS with ATM, MPLS QoS, MPLS VPN, MPLS VPN QoS along with their case studies. traffic engineering; MPLS traffic engineering, the layer 2 overlay model, RRR, TE trunk definition, TE tunnel attributes, link resource attributes, distribution of link resource information, path selection policy, TE tunnel setup, link admission control, TE path maintenance, TE RSVP, IGP routing protocols, TE approaches along with their case studies.

Text Books:
[1] Srinivas Vegesna, "IP Quality of Service," CISCO PRESS, 2001.
[2] Santiago alvarez, "Qos for IP/MPLS Networks," Cisco Press, Pearson Education, 2006.

References:
1. IETF website: www.ietf.org

VLSI FOR WIRELESS COMMUNICATION			
Course Code:	**EC408/EC566**	**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
Standards, Communication Systems, Overview of Modulation Scheme, QPSK, BPSK, MSK, Classical Channel, Wireless Channel Description, Path Environment, Path Loss, Friss Equation, Time Varying Channel Models, Envelope Fading, Frequency Selective Fading, Fast Fading.

Unit II: Receiver Architectures
Introduction, Receiver Front: Motivations, Heterodyne and other Architecture, Filter Design: Band Selection Filter, Image Rejection Filter, Channel Filter, Nonidealities and Design Parameters: Nonlinearity, Noise, Derivation of NF, IIP_3 of receiver Front end.

Unit III: Low Noise Amplifier (LNA)
Introduction, Matching Networks, Wideband LNA Design, DC bias, Gain and Frequency Response, Noise Figure, Narrowband LNA, Impedance Matching, Interpretation of Power Matching, Quality Factor, Core Amplifier, Noise Figure, Power Dissipation, Noise Contribution from other sources.

Unit IV: Active Mixers
Unbalanced Mixers, Single Balanced Mixers, Qualitative Description of Gilbert Mixer, Conversion Gain, Distortion analysis of Gilbert Mixer, Comparison of Sample and Hold Circuit and Sampling Mixer.

Unit V: Passive Mixers
Switching Mixers, Distortion in Unbalanced Switching Mixer, Conversion Gain in Unbalanced Switching Mixer, Noise in Unbalanced Switching Mixer, Sampling Mixer, Conversion Gain in Single Ended Sampling Mixer, Distortion in single ended sampling mixer, Intrinsic and Extrinsic noise.

Text Books:
[1] Bosco Leung, "VLSI for Wireless Communication", PHI.
[2] David Tsee, Pramod Viswanath," Fundamentals of Wireless Communication", Cambridge Univ Press.

References:
[1] Emad N Farag, M.I Elmasry, "Mixed Signal VLSI Wireless Design Circuits and Systems", Kluwer Publication.

VLSI TECHNOLOGY			
Course Code:	**EC410/EC536**	**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: Crystal Growth, Wafer Preparation, Epitaxy and Oxidation
Electronic Grade Silicon, Czochralski crystal growing, Silicon Shaping, processing consideration, Vapor phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation, Growth Mechanism and kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxide properties, Redistribution of Dopants at interface, Oxidation of Poly Silicon, Oxidation induced Defects.

Unit II: Lithography and Relative Plasma Etching
Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography, Plasma properties, Feature Size control and Anisotropic Etch mechanism, relative Plasma Etching techniques and Equipments

Unit III: Deposition, Diffusion, Ion Implantation and Metallization
Deposition process, Polysilicon, plasma assisted Deposition, Models of Diffusion in Solids, Flick's one dimensional Diffusion Equation – Atomic Diffusion Mechanism –Measurement techniques - Range theory- Implant equipment. Annealing Shallow junction – High energy implantation – Physical vapour deposition – Patterning.

Unit IV: Process Simulation and VLSI Process Integration
Ion implantation – Diffusion and oxidation – Epitaxy – Lithography – Etching and Deposition- NMOS IC Technology – CMOS IC Technology – MOS Memory IC technology - Bipolar IC Technology – IC Fabrication.

Unit V: Assembly Techniques and packaging of VLSI Devices
Analytical Beams – Beams Specimen interactions - Chemical methods – Package types – banking design consideration – VLSI assembly technology – Package fabrication technology.

Text Books:
[1] S.M.Sze, "VLSI Technology", Mc.Graw.Hill Second Edition. 2002.
[2] Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", Prentice Hall India, 2003.

References:
[1] Amar Mukherjee, "Introduction to NMOS and CMOS VLSI System design, Prentice Hall India, 2000.
[2] Wayne Wolf ,"Modern VLSI Design", Prentice Hall India.1998.

ADVANCED RF ENGINEERING			
Course Code:	**EC412/EC544**	**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 RF ELECTRONICS

Introduction to RF Design and Wireless Technology: Design and Applications,

Unit II: COMPLEXITY AND CHOICE OF TECHNOLOGY

Basic concepts in RF design: Nonlinearly and Time Variance, Inter symbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion

Unit III: RF MODULATION

Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, direct conversion and two-step transmitters. RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers.

Unit IV: BJT AND MOSFET BEHAVIOR AT RF FREQUENCIES

BJT and MOSFET behavior at RF frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation Overview of RF Filter design, Active RF components & modeling,

Unit V: RF CIRCUITS DESIGN

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

Text Books :

[1] B. Razavi, “RF Microelectronics” PHI 1998
[2] R. Jacob Baker, H.W. Li, D.E. Boyce “CMOS Circuit Design, layout and Simulation”, PHI 1998.

References:

[1] Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press 1998.
[2] Y.P. Tsividis, “Mixed Analog and Digital Devices and Technology”, TMH 1996
[3] David M. POZAR: Microwave Engineering. - John Wiley & Sons - 2nd Edition (2003).

PROBABILITY AND STOCHASTIC PROCESSES			
Course Code:	**EC424/EC548**	**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:
Probability models, Algebra of events, probability axioms, conditional probability, Baye's rules, Bernoulli traits. **Discrete Random Variables**: Discrete random variables, probability mass functions, discrete distribution functions-Bernoulli, Binomial, geometric, Poisson, hyper geometric & uniform distributions, probability generating function.

Unit II:
Continuous Random variable: Exponential distribution, memory less property, application to reliability, hypo exponential, Erlang, Gamma, hyper exponential & Normal distributions ,order statistics, distribution of sums.

Unit III:
Stochastic Process, Classification, Discrete and continuous time markov chain, Poisson process, renewal process, littles's formula, Erlang Loss Model, M/M/1 Queue, M/M/m Queue Multidimensional Queue.

Unit IV:
Solution Techniques: Steady-State Solutions of Markov Chains, Solution for a Birth Death Process, Matrix-Geometric Method: Quasi-Birth-Death Process, Heisenberg Matrix: Non-Markovian Queues, Transient analysis, stochastic Petri nets, Numerical Solution: Direct Methods, Numerical Solution: Iterative Methods, Comparison of Numerical Solution Methods, Performance Measures,

Unit V:
Queueing Networks. Definitions and Notation. Performance Measures. Product-Form Queueing Networks. Algorithms for Product-Form Networks, priority Networks.

Text Books:

Reference Books:

[1] Research Methodologies, R. Panneerselvam, Prentice Hall, 2007.
[2] Research in Education, Best John V. and James V Kahn, Wiley eastern, 2005.
[3] Elements of Educational Research, Sukhia, S.P., P.V. Mehrotra, and R.N. Mehrotra, PHI publication, 2003.
[4] Methodology of Research Education, K. Setia, IEEE publication, 2004.
[5] Research methodology, Methods and Techniques, Kothari, C.R., 2000.

ADVANCED MICROWAVE COMMUNICATION			
Course Code:	**EC426/EC550**	**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: Microwave And Millimeter Wave Devices
Overview of microwave and millimeter wave vacuum tube devices, limitations of microwave vacuum tubes, gyratron vacuum tube devices. Advances in microwave and millimeter wave solid state devices, Gunn devices, oscillator using, Gunn diode, and injection locked oscillators, IMPATT devices, and microwave and mm wave performance of IMPATT. Other solid state devices like Tunnel diode, BARITT and TRAPAT. Microwave and mm wave circuits:

Unit II: Microwave and MM Wave Circuits
Review of scattering matrix concept in the light of vector network analyzer, impedance matching network, couplers, power dividers, resonators and filters. Detectors, mixers, attenuators, phase shifters, amplifier and oscillator, Ferrite based circuits.

Unit III: Antennas
Hertzian dipole, loop antenna, helical antenna, frequency independent antenna: Du0Hamel principle, log spiral and log periodic dipole antenna array. Babinet principle, waveguide slot antenna, microstrip antenna, horn antenna, parabolic reflector. Antenna arrays and phased array antenna.

Unit IV: Satellite Communication
Orbital parameters, satellite trajectory, period, geostationary satellites, non-geostationary constellations. Communication satellites – Space craft subsystems, payload – repeater, antenna, attitude and control systems, telemetry, tracking and command, power sub system and thermal control. Earth stations antenna and feed systems, satellite tracking system, amplifiers, fixed and mobile satellite service earth stations. Terrestrial: line of sight transmission, relay towers and distance considerations. Communication link design: Frequency bands used, antenna parameters, transmission equations, noise considerations, link design, propagation characteristics of fixed and mobile satellite links, channel modeling, very small aperture terminals (VSAT), VSAT design issues.

Unit V: Microwave and MM Wave Propagation.
Overview of basic radio wave propagation mechanisms, Friis transmission formula, plane earth propagation model, troposcatter systems, ionosphere propagation, duct propagation, microwave radio link and calculation of link budget. Effect on radio wave propagation due to rain, fog, snow, ice, atmospheric gases, Earth's magnetic field.

Text Books:
[1] David M Pozar, Microwave Engineering, John Wiley & Sons
[2] R E Collin, Antenna & Radio wave Propagation, McGraw Hill Book Co.

References:
[1] M Richharia: 'Satellite Communication Systems'.(Second Ed.),Macmillan Press Ltd.
[2] Ferdo Ivanek (Editor): 'Terrestrial Digital Microwave Communications', Artech House
[3] E. Hund: 'Microwave Communications', IEEE Press
[4] Jordan & Balman, Electromagnetic waves & Radiating System
[5] R E Collin, Microwave Engineering, McGraw Hill CO.

NETWORKING PROTOCOLS			
Course Code:	**EC414/EC552**	**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: Protocols of Physical Layer
Overview of physical layer operations of wired and wireless networks, Protocol Architecture: IEEE 802.3 Local Area Network Protocols, VLAN- Virtual Local Area Network, WLAN-Wireless LAN by IEEE 802.11 Protocols, FDDI-Fiber Distributed Data Interface, Token Ring- IEEE 802.5 LAN Protocol, DQDB-Distributed Queue Dual Bus(IEEE 802.6), SMDS- Switched Multimegabit Data Service, WiMAX- Broadband Wireless MAN (IEEE802.16).

Unit II:Protocols of Data Link Layer
Overview of data link layer operations of wired and wireless networks, medium access control protocols including CSMA, collision free protocols, WDMA protocols, wireless LAN protocols, ARP, RARP, X.25.

Unit III: Protocols of Network Layer
Overview of network layer operations of wired and wireless networks, IP-Internet Protocol (IPv4), IPv6-Internet Protocol version 6, ICMP & ICMPv6-Internet Message Control Protocol and ICMP version 6,BGP (BGP-4)-Border Gateway Protocol, EGP- Exterior Gateway Protocol, IRDP- ICMP Router Discovery Protocol, Mobile IP-IP Mobility Support Protocol for IPv4 & IPv6, NHRP- Next Hop Resolution Protocol, OSPF- Open Shortest Path First Protocol, RIP- Routing Information Protocol (RIP2), RIPng- Routing Information Protocol next generation for IPv6,RSVP- Resource ReSerVation Protocol, VRRP- Virtual Router Redundancy Protocol, BGMP-Border Gateway Multicast Protocol, DVMRP-Distance Vector Multicast Routing Protocol, IGMP- Internet Group Management Protocol, MARS-Multicast Address Resolution Server, MBGP-Multiprotocol BGP, MOSPF- Multicast Extensions to OSPF MSDP-Multicast Source Discovery Protocol, PGM-Pragmatic General Multicast Protocol, PIM-DM-Protocol Independent Multicast-Dense Mode, PIM-SM-Protocol Independent Multicast - Sparse Mode, MPLS-Multiprotocol Label Switching, RSVP-TE-Resource Reservation Protocol.

Unit IV: Protocols of Transport Layer
Overview of transport layer operations, Protocols: TCP-Transmission Control Protocol, UDP -User Datagram Protocol, RUDP- Reliable User Datagram Protocol, SCTP- Stream Control Transmission Protocol, CUDP-Cyclic UDP, DCCP-Datagram Congestion Control Protocol, FCP-Fiber Channel Protocol, IL-IL Protocol, NBF- NetBIOS Frames protocol, µTP-Micro Transport Protocol, RSVP , ECN, H.323, H.261- Video CODEC for Low Quality Videoconferencing,H.263: Video CODEC for Medium Quality Videoconferencing, H.264 / MPEG-4: Video CODEC For High Quality Video Streaming wireless TCP and UDP.

Unit V: Protocols of Application Layer
Overview of application layer operations, Protocols: DNS, SMTP, HTTP, BGP, DHCP , FTP , LDAP, MGCP, NNTP , NTP, POP, RIP, RPC, RTP , SIP ,SNMP, SSH, Telnet , XMPP, security protocols.

Text Books:

References:
[1] Internetworking with TCP/IP Volume 1: Principles Protocols, and Architecture, Douglas *Comer* and Prentice Hall, fifth edition, 2006.
[2] TCP/IP Protocol Suite, B.A. Forouzan, TMH, 3rd edition, 2006.
[3] Computer Networks, S. Tanenbaum, 4th edition, Prentice Hall, 2003.
[4] Network Protocols: Signature Edition, Matthew G. Naugle. Mcgraw-Hill Signature Series.
[5] Network Protocols Handbook, Javlin, 4th edition, Javvin Technologies, Inc.

MOBILE COMPUTING			
Course Code:	**EC416/EC554**	**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: Mobile Computing Architecture
Introduction to Mobile Communications and Computing : novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

Unit II: Client Programming
Desktop vs. mobile, hardware overview, mobile phones, PDA, design constraints in applications for handheld devices.

Unit III: Programming For the Palm OS
History of palm OS, palm OS architecture, application development, communication in palm OS, multimedia, and enhancements in the current release. Wireless devices with symbian OS; Introduction to Symbian OS, Symbian OS architecture, application for Symbian, control and compounds controls, active objects, localization, security on the Symbian OS, different flavors of windows CE, windows CE architecture, windows CE development environment.

Unit IV: Wireless Application Protocol (WAP)
Overview of the WAP, component of the WAP standards, protocol architecture, and treatment of protocols of all layers, services supporting WAP client, WAP architecture design principle, Bluetooth,J2ME.

Unit V: Special Topics in Mobile Computing
Mobile agent & its application, mobile data management, security framework for mobile environment, m-commerce: emerging applications, different players in m-commerce, m-commerce life cycle, mobile financial services, mobile entertainment services, and proactive service management.

Text Books:
[1] Mobile Computing, Asoke. K Talukder and Roopa R. Yavagal, TMH, 2005
[2] Mobile Communication, Jachan Schiller, Adison-Wesley, 2nd edition, 2003.

References:

[1]Wireless Communication: T. S. Rappapost, Peasson Education, New Delhi, 2001
[2] Wireless Networks: Kareh Pallavan & P. Krishnamurthy, Peasson Education, New Delhi, 2nd edition, 2004.
[3] Mobile Commerce and Applications, Upkar Varshney, A tutorial at IEEE International Conference on Wireless Communications (WCNC), 1999.

IMAGE PROCESSING AND BIOMETRICS			
Course Code:	**EC418/EC556**	**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: Image Processing and Image Enhancement

Introduction, An image model, sampling & quantization, Basic relationships between Pixels, imaging geometry, Properties of 2 – D Fourier transform, FFT algorithm and other separable image transforms, Components of an image processing System., Digital Image Fundamentals-elements of visual perception, image sensing and acquisition, Basic relationships between pixels Fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear).

Unit II: Pattern Recognition

Fundamentals of Pattern Recognition , Recognition Measurement, Errors, and Statistics, Recognition measurement and testing, Identification System Errors and Performance Testing, Computer Security, Bayesian decision theory, Multilayer neural networks, Unsupervised Learning and Clustering.

Unit III: Biometrics

Introduction to Biometrics, Fingerprints: Ridges, Furrows, Types of Fingerprints, Image and Signal Processing, Biometric Signal Processing, Other Biometric Modalities, Comparing Biometrics, Passwords, and Tokens, Multimodal Biometrics, Biometric Resources and Standards, Large Scale Biometrics and Systems Case Studies.

Unit IV: Analysis in Biometrics

Large-Scale Biometric Identification: Challenges and Solutions, Issues Involving the Human Biometric Sensor Interface, Fundamentals of Biometric-Based Training System Design, Biometric Systems and Applications, Force Field Feature Extraction for Fingerprint Biometrics, Behavioral Biometrics for Online Computer User Monitoring.

Unit V: Synthesis in Biometrics:

Introduction to Synthesis in Biometrics, Local B-Spline Multiresolution with Example in Iris Synthesis and Volumetric Rendering, image smoothing filters (Butterworth and Guassian low pass filters), image sharpening filters (Butterworth and Guassian high pass filters), selective filtering, Computational Geometry and Image Processing in Biometrics: On the Path to Convergence, **,** A Statistical Model for Biometric Verification.

Text Books:

[1] Practical Algorithms for Image Analysis: Description, Examples, and Code, Seul, O'Gorman, Sammon, 2000.

[2] S. Annadurai and R. Shanmugalakshmi: Fundamentals of Digital Image Processing, Pearson Education.

[3] R. C. Gonzalez and R. E. Woods: Digital Image Processing, 3rd Edition, Pearson Education.

[4] A. K. Jain: Fundamentals of Digital Image Processing, PHI Learning.

References:

[1] M. Sonka, V. Hlavac and R. Boyle: Digital Image Processing and Computer Vision: Cengage Learning.

[2] B. Chanda and D. D. Majumder: Digital Image Processing and Analysis, PHI Learning.

[3] S. Jayaraman, S. Esakkirajan and T. Veerakumar: Digital Image Processing, TMH.

AD-HOC WIRELESS NETWORKS			
Course Code:	**EC513/EC649**	**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 Wireless Communication

Electromagnetic spectrum, radio propagation mechanisms, characteristics of the wireless channel, modulation techniques, multiple access techniques, voice coding, error control, computer network software, computer network architecture, IEEE 802 networking standards, wireless networks, issues in ad hoc wireless networks, Ad Hoc, wireless Internet.

Unit II: MAC Protocols For Wireless Networks

Issues in designing a MAC protocol for ad hoc wireless networks, design goals of a MAC protocol for ad hoc wireless networks, classifications of MAC protocols, contention-based protocols, contention-based protocols with reservation mechanisms, contention-based MAC protocols with scheduling mechanisms.

Routing Protocols for Ad Hoc Wireless Network

Issues in designing a routing protocol for ad hoc wireless networks, classifications of routing protocols, table-driven routing protocols, on-demand routing protocols, hybrid routing protocols, routing protocols with efficient flooding mechanisms, hierarchical routing protocols, power-aware routing protocols.

Unit III: Multicast Routing In Ad Hoc Wireless Networks

Issues in designing a multicast routing protocol, operation of multicast routing protocol, an architecture reference model for multicast routing protocol, classifications of multicast routing protocol, tree based multicast routing protocol, mesh-based multicast routing protocol, energy-efficient multicasting, multicasting with QoS guarantees, application- dependent multicast routing.

Unit IV: Transport Layer And Security Protocols For Ad Hoc Wireless Networks

issues in designing a transport layer protocol for ad hoc wireless networks, design goals of a transport layer protocol, classification of transport layer solutions, TCP over ad hoc wireless networks, other transport layer protocol for ad hoc wireless networks, security in ad hoc wireless networks, network security requirements, issues and challenges in security provisioning, network security attacks, key management, secure routing in ad hoc wireless networks.

Unit V: Quality of Service In Ad Hoc Wireless Networks

Issues and challenges in providing QoS in ad hoc wireless networks, classifications of QoS solutions, MAC layer solutions, network layer solutions, QoS frameworks for ad hoc wireless networks. energy management in ad hoc wireless networks, need for energy management in ad hoc wireless networks, classification of energy management schemes, battery management schemes, transmission power management schemes, system power management schemes.

Text Books:

[1] C. Siva Ram Murthy, B.S. Anoj, "Ad Hoc Wireless Networks, Architectures and Protocols", Prentice Hall, 2004.

[2] C. K. Toh, "Ad Hoc Mobile Wireless Networks 1/e: Protocols and Systems, "PH PTR, 2001.

References:

[1] Hekmat Ramin,"Ad-hoc Networks: Fundamental Properties and Network Topologies", Springer Publication.

[2] Mohammad IIyas, "The Handbook of Ad Hoc Wireless Networks", CRC Press

CMOS RF CIRCUIT DESIGN			
Course Code:	**EC428/EC576**	**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 RF design and Wireless Technology

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

Unit II: RF Modulation

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

Unit III: RF Testing

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

Unit IV: BJT and MOSFET Behavior at RF Frequencies

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

Unit V: RF Circuits Design

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

Text Books:

[1] Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press 1998.
[2] Y.P. Tsividis “Mixed Analog and Digital Devices and Technology” TMH 1996

References:

[1] B. Razavi “RF Microelectronics” PHI 1998
[2] R. Jacob Baker, H.W. Li, D.E. Boyce “ CMOS Circiut Design, layout and Simulation” PHI 1998

PRINCIPLES OF MEMS DESIGN			
Course Code:	**EC422/EC570**	**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 MEMS
MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro-accelerometers and Micro fluidics, MEMS materials, Micro fabrication

Unit II: Mechanics for MEMS Design
Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

Unit III: Electrostatic Design
Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators.

Unit IV: Circuit and System Issues
Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Capacitive Accelerometer, Piezoelectric pressure sensor, Modeling of MEMS systems, CAD for MEMS.

Unit V: Introduction to Optical and RF MEMS
Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes – design basics, case study – Capacitive RF MEMS switch, performance issues.

Text Books:
[1] Stephen Santuria," Microsystems Design", Kluwer publishers, 2000.
[2] Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.

References:
[1] Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
[2] Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

MULTIMEDIA TECHNIQUES			
Course Code:	**CS447/CS547**	**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
Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment products
Stages of Multimedia Projects
Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit II: Multimedia Building Blocks
Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Unit III: Data Compression
Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Unit IV: Speech Compression & Synthesis
Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

Unit V: Images
Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formatting animations Images standards, JPEG Compression, Zig Zag Coding, Multimedia Database .Content based retrieval for text and images, **Video:** Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent development in Multimedia.

Text Books:

Reference:
[1] Tay Vaughan “Multimedia, Making IT Work” Osborne McGraw Hill.
[2] Buford “Multimedia Systems” Addison Wesley.
[3] Agrawal & Tiwari “Multimedia Systems” Excel.
[4] Mark Nelson “Data Compression Book” BPB.
[5] David Hillman “Multimedia technology and Applications” Galgotia Publications.
[6] Rosch “Multimedia Bible” Sams Publishing.
[7] Sleinreitz “Multimedia System” Addison Wesley.
[8] James E Skuman “Multimedia in Action” Vikas.

SOFT COMPUTING			
Course Code:	**CS449/CS561**	**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: Fuzzy Logic
Introduction to fuzzy logic, classical and fuzzy sets, overview of fuzzy sets, membership function, fuzzy rule generation, operations on fuzzy sets: compliment, intersection, union, combinations on operations, aggregation operation.

Unit II: Fuzzy Arithmetic
Fuzzy numbers, linguistic variables, arithmetic operations on intervals & numbers, uncertainty based information, information and uncertainty, no specificity of fuzzy and crisp sets, fuzziness of fuzzy sets.

Unit III: Neural Network
Overview of biological neurons, computational neuron, mathematical model of neurons, ANN architecture, single layer and multilayer architectures, activation function, threshold value, self learning and forced learning algorithms, feed forward and feedback architectures.

Unit IV: Learning Fundamentals
Learning paradigms, supervised and unsupervised learning, reinforced learning, ANN
training, algorithms perceptions, training rules, delta, back propagation algorithm, multilayer perception model, Hopfield networks, associative memories, applications of artificial neural networks,

Unit V: Genetic Algorithms
History of genetic algorithm, terminology of genetic algorithm, biological background, creation of offspring, working principles of genetic algorithms, fitness function, reproduction: Roulette wheel selection, Boltzmann selection, cross over mutation, inversion, deletion, and duplication, generation cycle. Concept of Uncertainty**:** Presence of uncertainty in real world problems, handling uncertain knowledge, degree of belief, degree of disbelief, uncertainty and rational decisions, decision theory, utility theory, concept of independent events, Bay's rule, using Bay's rule for combining events.

Text Books:

References:
[1] Artificial Neural Networks: An introduction to ANN Theory and Practice, Peteus J. Braspenning, PHI publication, 2005.
[2] Fuzzy Logic: A spectrum of Theoretical and Practical issues, Paul P. Wang, pearson publication 2004.
[3] Fuzzy Sets, Fuzzy logic, and Fuzzy Systems: Selected Papers- Lotfi Asker Zadeh, George J. Kilr, Bo yuan, 2005.
[4] Foundations of Fuzzy logic and Soft Computing: 12th International Fuzzy conference proceeding, 2005.
[5] Neural Networks Theory, Particia Melin, Oxford University press, 2003
[6] Neural Networks Theory and Application, Oscar Castillo, Wiley Eastern publication 2003.

OPTICAL NETWORKS			
Course Code:	**EC562**	**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: FIBER OPTIC GUIDES
Light wave generation systems, system components, optical fibers, SI, GI fibers, modes, Dispersion in fibers, limitations due to dispersion, Fiber loss, non linear effects, Dispersion shifted and Dispersion flattened fibers

UNIT II: OPTICAL SOURCES AND DETECTORS
Basic concepts, LED's structures spectral distribution, semiconductor lasers, gain coefficients, modes, SLM and STM operation, Transmitter design, Receiver PIN and APD diodes design, noise sensitivity and degradation, Receiver amplifier design. Basic concepts, Semiconductor laser amplifiers, Raman - and Brillouin - fiber amplifiers, Erbium doped – fiber amplifiers, pumping phenomenon, LAN and cascaded in-line amplifiers.

UNIT III: POWER LAUNCHING AND COUPLING
Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, LED coupling to single mode fibre, Fiber Splicing techniques, splicing single mode fibers. Multimode fiber joints and single mode fiber joints, Fibre alignment and joint loss.

UNIT IV: OPTICAL NETWORKS
Point-to- point links, System considerations, Link considerations, Overall fiber dispersion in multi mode and single mode fibers, Rise time considerations, Distance consideration in optical transmission system,
Network topologies, SONET/SDH, Protection in SONET/SDH, WDM Principles, WDM networks, DWDM systems

UNIT V: ACCESS NETWORKS
Network Architecture overview, Enhanced HFC, Fiber to the curb, PON Evolution, Optical Code Division Multiplexing, Line coding in Optical links, Soliton communication system, photonics, High Speed Networks.

Text Books:
[1] Rajiv Ramaswami , “Optical Networks” Third Edition , 2008.
[2] Djafar K Mynbaev, Lowell L Scheiner , “Fiber- Optic Communications Technology” , 2000.
[3] Keiser G, “Optical Fiber communications”, Second edition, McGrawhill. Inc., 1993.

REFERENCES:
[1] Biswas Sambhu Nath, “Optoelectronic Engineering”, Dhanpat Rai Publication1994.
[2] Gowar J., Optical Communication Systems, PHI.
[3] Senior, J M, “Optical Communication Principle and Practices”, II edition Pearson Education Ltd, 2006.

SECURITY IN WIRELESS NETWORKS			
Course Code:	**EC501/EC631**	**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: Security goals, attacks, services and mechanisms, cryptography and steganography

Unit II: Symmetric key ciphers-substitution ciphers, transposition ciphers, stream and block ciphers, algebraic structures and GF (2^n) fields in cryptography

Unit III: Modern block ciphers, modern stream ciphers, DES and AES, Elliptic curve cryptosystems

Unit IV: Message integrity, random oracle model, message authentication , Hash function, Integrity authentication , Digital signature- process, services, attacks, schemes, key management-symmetric key distribution, kerbros, symmetric key agreement, public key distribution

Unit V: Security in wireless LAN, IEEE802.11 security, eavesdropping, unauthorized access, interference and jamming, physical threats, counter majors, WEP, encryption, authentication, WPA, authorization, non repudiation, authentication and secure session, security architecture, VPN, wireless access to the Internet

Text book

[1] Behrouz A. Forouzan, " Cryptography & Network Security" Tata McGraw Hill

References:

RESEARCH TECHNIQUES IN ICT			
Course Code:	**CS503/CS633**	**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 Research Techniques
Meaning of research, objectives of research, motivation in research, types of research-Introduction to experimental test bed, algorithmic research, simulation research, mathematical modeling approach, characteristics and prerequisites of research, significance of research, research process, Sources of research problem, criteria of identifying the problem, necessity of defining the problem, errors in selecting research problem, technique involved in defining the problem, Report and paper writing

Unit II: Data Analysis and Statistical Techniques
Data and their analyses, quantitative methods and techniques, Measure of central tendency, measures of variation, frequency distribution, analysis of variance methods, identifying the distribution with data, parameter estimation, Goodness-of-Fit tests-Chi-Square test, K-S Goodness-of-Fit test.
Correlation analysis, Regression analysis, time series and forecasting, Introduction to discriminant analysis, factor analysis, cluster analysis, conjoint analysis. Sampling methods, test of hypothesis.

Unit III: Random Numbers and Variates

Properties of random numbers, generation, tests for random numbers, random-variate generation-inverse Transform technique, direct transformation, convolution method, acceptance-rejection technique
Probability distributions functions, Moments, moment generating functions, joint distributions, marginal and conditional distributions, functions of two dimensional random variables
Poisson process-Markovian queues, single and multi server models, Little's formula, steady state analysis

Unit IV: Algorithmic Research
Algorithmic research problems, types of algorithmic research, types of solution procedure, steps of development of algorithm, steps of algorithmic research, design of experiments,

Unit V: Simulation and Soft Computing Techniques
Introduction to soft computing, Artificial neural network, Genetic algorithm, Fuzzy logic and their applications, Tools of soft computing, Need for simulation, types of simulation, simulation language, fitting the problem to simulation study, simulation models, verification of simulation models, calibration and validation of models, Output analysis, introduction to MATLAB, NS2, ANSYS, Cadence

Text Books:
[1] R. Panneerselvam, " Research Methodologies," PHI
[2] Jerry Banks, John S. Carson, Barry.L. Nelson David. M. Nicol, " Discrete-Event System Simulation", Prentice-Hall India
[3] Donald Gross, Carl M. Harris, " Fundamentals of Queueing Theory", 2nd Ed. John Wiley and Sons, New York,

References:
[1] Best John V. and James V Kahn: Research in Education, Wiley eastern, 2005.
[2] Sukhia, S.P., P.V. Mehrotra, and R.N. Mehrotra: Elements of Educational Research, PHI publication, 2003.
[3] K. Setia: Methodology of Research Education, IEEE publication, 2004.
[4] Kothari, C.R.: Research methodology, Methods and Techniques, 2000.

COMPUTING LAB			
Course Code:	**EC681**	**Credits:**	**2**
No. of Lab (Hrs/Week):	**3**	**End Sem Exam Hours:**	**2**
Total No. of Lab Sessions:	**10**		

List of Experiments

1. Study and Analysis of Network Simulator-2
   a. Location of different Protocols.
   b. Simulate a Network.
   c. Modify a C++ code in NS-2
   d. Use a trace file

2. Study and Analysis of QualNet.
   a. Location of different Protocols.
   b. Simulate a Network.
   c. Modify a C++ code.
   d. Create the results for analysis.

3. Simulate a research Paper related to MANET using NS-2/Qualnet.

4. Simulate a research Paper related to Sensor using NS-2/Qualnet.

5. Simulate a research Paper related to Multicast Network using NS-2/Qualnet.

6. Simulate a research Paper related to Security using NS-2/Qualnet.

7. Simulate a research Paper related to Congestion Control in Wireless using NS-2/Qualnet.

8. Simulate a research Paper related to V-Network using NS-2/Qualnet.

9. Simulate a research Paper related to Routing Protocol of wired Network using NS-2/Qualnet.

10. Simulate a research Paper related to Routing Protocol of Wireless Network using NS-2/Qualnet.

11. Performance Evolution of firewall in Networking (If resource available).

12. Performance Evolution of IP cameras in Networking. (If resource available)

13. Performance Evolution of Phone in Networking (If resource available).

14. Performance Evolution of Network Server(If resource available).

15. Mini Project (Network Driver, Network Performance Analysis Tool, etc.)

NETWORK RELIABILITY			
Course Code:	**EC505/EC641**	**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: Reliability Fundamentals

Causes of Failures, Useful Life of Components, Hazard Functions, Bathtub Curve, Characteristic Type of Failures: Early Failures, Constant Failure Rate, Wear-Out Failures, Failure Data Analysis, Mean Time to Failure (MTTF), Mean Residual Life (MRL), Reliability Measures

Unit II: Reliability Mathematics

Classical Set Theory, Boolean algebra, Sample Space, Probability Theory, Bayes Theorem, Probability Distributions, Cumulative Distributions, Variance, Moments, Estimation Theory, Laplace Transform, Markov Processes, Random Number Generation, Probability Plots

Unit III: System Reliability Analysis

Reliability Block Diagrams, Series Systems, Series Parallel Systems, Open and short Circuit Failures, Standby Systems, System Modeling, Assumptions for Modeling, Two State Modeling, Three State Models, Statistical Estimation of Failure Data, Interval Estimates, Hazard Models.

Unit IV: Reliability Modeling

Stress-Strength Model, System Modeling, Assumptions for Modeling, Two State Modeling, Three-state Modeling, Graphical Approach, Path Set/Cut Set Approach: Inclusion-Exclusion Method, Calculation of Bounds Method, Monte Carlo Simulation Method, Domination Theory, Sum of Disjoint Product Method, Non-path Set/cut Set approach: State Enumeration Method Transformation Method Topological Method BDD/OBDD/ROBDD Method, Reliability Measures: Connectivity Measures, Multicommdity Flow Measures, Maximum Flow (Capacity) Measures, Performability Measures.

Unit V: Maintability and Availablity Analysis

Availability Prediction, Effects of Repair Strategies, Fault Trees, Event Tree Analysis, FMEA, FMECA, Theoretical and Analytical Overview of Availability and Maintainability in Communication System Design: Prediction in Assessment, Preliminary in Design, Evaluation in Detail Design. Application Modeling of Availability and Maintainability in Engineering Design

Text Books:

[1] Aggarwal K. K., Reliability Engineering, Kluwer Academic Publishers, Boston Publication
[2] Ramakumar R., Reliability Engineering: Fundamentals and Applications, Prentice Hall

Reference Books:

[1] Misra K. B., Reliability Analysis and Prediction: A Methodology Oriented Treatment, Elsevier Publication
[2] Kapur K. C. and L. R. Lamberson, Reliability in Engineering Design, John Wiley & Sons,
[3] Martin L Shooman, Reliability of Computer Systems and Networks, Johan Wiley Sons
[4] Naikan V.N.A., Reliability Engineering and life testing, PHI 2010.

SMART ANTENNA SYSTEMS			
Course Code:	**EC507/EC643**	**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 Concepts of Radiation

Radiation mechanism: Basic sources of Radiation- Current distribution on antennas, Basic antenna parameters.

Unit II: Analysis And Synthesis of Antennas

Vector potential, Antenna theorems and definitions, dipole, loop, reflector, slot antennas. Types of linear arrays, current distribution in linear arrays, Antenna array synthesis techniques.

Unit III: Smart Antennas

Spatial processing for wireless systems: Introduction, Vector channel impulse response & the spatial signature. Spatial processing receivers, fixed beam forming Networks, switched beam systems, Adaptive antenna systems, Wide band smart antennas, Digital radio receiver & software radio for smart antennas.

Unit IV: Smart Antenna Techniques for CDMA

Non-coherent & coherent CDMA spatial processors, spatial processing rake receiver, Multi-user spatial processing, dynamic resectoring, down link beam forming for CDMA, MIMO.

Unit V: Micro Strip Antenna

Radiation Mechanism and Excitation techniques : Microstrip dipole; Patch ,Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna.

Text Books:

[1] Balanis A., "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.

[2] Joseph C. Liberti, Theodore S. Rappaport – "Smart Antennas for Wireless Communications: IS95 and third generation CDMA Applications", Prentice Hall, Communications Engineering and Emerging Technologies Series.

References:

[1] Kraus J.D., "Antennas", II edition, John Wiley and Sons, New York, 1977.

[2] Collin R.E. and Zucker F. – "Antenna theory" Part I, Tata Mc Graw Hill, New York, 1969.

[3] I.J. Bahl and P. Bhartia," Microstrip Antennas",Artech House,Inc.,1980

[4] W.L.Stutzman and G.A.Thiele,"Antenna Theory and Design", 2nd edition,John Wiley& Sons Inc.,1998.

BRAODBAND WIRELESS NETWORKS			
Course Code:	**EC509/EC645**	**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 broadband wireless, fixed broadband wireless, mobile broadband wireless, 3G cellular systems, spectrum options for BW, BW channels, fading, modeling of broadband fading channels, mitigation of fading

Unit II:OFDM-basics, timing and frequency synchronization, PAR computational complexity, simulation of OFDM systems, , MAC layer, performance enhancement, architecture, performance characterization, Multiple antenna techniques-spatial diversity, receiver diversity, transmit diversity, beam foaming, spatial multiplexing, channel estimation for MIMO-OFDM, advanced techniques for MIMO,OFDMA in WiMAX

Unit III: WiMAX, Physical layer- channel coding, hybrid ARQ, interleaving, symbol mapping, symbol structure, sub channel and subcarrier permutations, slot and frame structure, ranging power control, channel quality measurements, MAC layer-convergence SL, MAC PDU, bandwidth request, and allocation, QoS, network entry, an initialization, power saving, mobility management

Unit IV: WiMAX network architecture- design principle, reference model, protocol layering, network discovery and selection, IP address assignment, authentication and security, QoS architecture, mobility management, radio resource management, link level performance-methodology, AWGN channel performance, fading channel performance, advanced receiver architecture, system level architecture-channel modeling, methodology, system level simulation,

Unit V: Ultrawideband, Unlicensed wireless access, IEEE 802.20 MBWA, FOMA, iMODE, WiBRO, FWA, AWS, Multimedia-MedaiFLO, T-DBM, DVB-H, MVNO

Text Books:

[1] Jeffrey G. Andrews, Arunabha Ghosh, Rias Muhamed, " Fundamentals of WiMAX, Understanding Broadband Wireless Networking", Pearson
[2] Clint Smith, P.E. Daniel Collins, " 3G Wireless Networks" Tata McGraw-Hill, 2nd Edition

References:

SENSOR NETWORKS			
Course Code:	**EC511/EC647**	**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: Sensor Network Operations
Overview of mission-oriented sensor networks, trends in sensor development, mission oriented sensor networks, dynamic systems perspective, Dense sensor networks, robust sensor positioning in wireless ad hoc sensor networks, trigonometric k clustering (TKC) for censored distance estimation, sensing coverage and breach paths in surveillance wireless sensor networks.

Unit II: Lower Layer Issues-Mac, Scheduling, And Transmission
Medium access control for sensor networks, comprehensive performance study of IEEE 802.15.4, providing energy efficiency for wireless sensor networks, link adaptation techniques.

Unit III: Network Routing
Load balanced query protocols for wireless sensor networks, energy efficient and MAC aware routing for data aggregation in sensor networks, ESS low energy security solution for large-scale sensor networks based on tree ripple zone routing scheme.

Unit IV: Sensor Network Applications
Evader centric program, Pursuer centric program, hybrid pursuer evader program, efficient version of hybrid program, Implementation and simulation results

Unit V: Embedded Soft Sensing For Anomaly Detection
Mobile robot simulation setup, software anomalies in mobile robotic networks, soft sensor, software anomaly detection architecture, anomaly detection mechanisms, test bed for software anomaly detection in mobile robot application, multisensor network-based framework; Basic model of distributed multi sensor surveillance system, super resolution imaging, optical flow computation, super resolution image reconstruction, experimental results.

Text Books:
[1] Shashi Phoha, Thomas F. La Porta , Chrisher Griffin, “Sensor Network Operations”, Wiley-IEEE Press March 2006.
[2] Jr. Edger H. Callaway, “Wireless sensor networks”, CRC Press.

References:
[1] I. F. Akyildiz and M. C. Vuran, “Wireless Sensor Networks”, John Wiley and Sons Publ. Company
[2] Feng Zho, Morgan Kaufmann ,”Wireless Sensor Networks: An Information Processing Approach”.

NETWORK PROGRAMMING			
Course Code:	**EC420/EC558**	**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 Network Programming
OSI model, LINUX/UNIX standards, TCP and UDP & TCP connection establishment and format, buffer sizes and limitation, standard internet services, protocol usage by common internet application.

Unit II: Sockets
Address structures, value result arguments, byte ordering and manipulation function and related functions, elementary TCP sockets, connect, bind, listen, accept, fork and exec function, concurrent servers, close function and related function.

Unit III: TCP Client Server
TCP echo server functions, normal startup, terminate and signal handling server process termination, crashing and rebooting of server host shutdown of server host.

Unit IV: I/O Multiplexing and Socket Options
I/O models, select function, batch input, shutdown function, poll function, TCP echo server, getsockopt and stockpot functions. socket states, generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.
Elementary UDP Sockets
UDP echo server function, lost datagram, summary of UDP example, lack of flow control with UDP, determining outgoing interface with UDP, elementary name and address conversions, DNS, get host by name function, resolver option, function and IPV6 support, unnamed function, other networking information.

Unit V: IPC and Remote Login
File and record locking, Pipes, FIFOs streams and messages, Name spaces, system IPC, Message queues, Semaphores, Seminal line disciplines, Pseudo-terminals, terminal modes, Control-Terminals, login, RPC Transparency Issues.

Text Books:

References:
[1] Keir Davis, John Turner, Nathan Yocom, "The Definitive Guide to Linux Network Programming, ,Apress, 2004.
[2] Warren Gay, Linux Socket by Example, Programming 2000.
[3] Graham Glass, King abls, "UNIX for Programmers and Users", 3rd edition, Pearson Education, 1998.
[4] M. J. Rochkind, "Advanced UNIX Programming", 2nd edition, Pearson Education, 2004.

MULTICAST COMMUNICATION			
Course Code:	**EC515/EC651**	**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: Multicast Communication

Types of Communication, Scalability, Applications of Group Communication, Characteristics of Groups - Special Aspects of Group Communication Quality of Service: What is QOS?, Describing a stream, Queuing techniques, Signalling QOS requirements, Integrated Services, RSVP, ST2, Differentiated Services, Differences and Integration Options, Multi Protocol Label Switching, Subnet Bandwidth Manager, Improving QOS in the best effort class - Issues in slow links

Unit II: Multicat Routing

Multicast Routing: Introduction, frame work, Controlling scope, delivery tree, Basic Routing Algorithms, Group Dynamics, Scoping and Multicast Address Allocation, Source-Based Routing, Steiner Trees, Trees with Rendezvous Points, Multicast Routing in the Internet, DVMRP ,MOSPF, PIM ,CBT, Multicast Routing between Domains

Unit III: Multicast in IP

The IP -Host Name Resolution - IP multicast, RTP, RTCP, RSVP, RTSP, Ipv6, IGMP (v1, v2 & v3), IP multicast applications - IP multicast security issues, Switching technology, multicast,Replication, Mirroring and Caching , IP TV.

Unit IV: Multicast in Transport Protocols

UDP , XTP, MTP ,RMP, LBRM, SRM, RMTP, PGM, MFTP Inter-domain multicast routing, Multicast caveats, multicast on non-broadcast media, flooding, address allocation,Multicast in LANs

Unit V: Mbone and Multicast Security

the Multicast Backbone of the Internet, MBone Architecture, MBone Tools, Mbone Applications, Multicast routing and Mobile Systems, Multicast and DiffServ, Active Networks for Supporting Group Communication - Group Management for Large Dynamic Groups - Video conferencing, SDR : session directory, VIC & VAT , Reliable Multicast, Security issue of Source, Security issues of receivers.

Text Books:

[1] Multicast Communication: Protocols, Programming, & Applications, Morgan Kaufmann in Networking, Ralph Wittmann, Martina Zitterbart, Edition 2001, Academic Press, USA.
[2] Multicast Networking And Application, Kennet Miller AW Publication , 1999
[3] IP Telephony, Oliver Hersent, David Gurle, Jean - Pierre Petit, A, Pearson Asia , LPE, 2001
[4] Multicast Sockets: Practical Guide for Programmers by David Makofske, Kevin Almeroth, Edition 2003, Elsevier, USA.
[5] Introduction to Data Multicasting, IP Multicast Streaming for Audio and Video Media Distribution Lawrence Harte, First Edition, 2008, Althos Publishing House.

References:

[1] Multicast Communication: Protocols, Programming, & Applications, Morgan Kaufmann in Networking, Ralph Wittmann, Martina Zitterbart, Edition 2001, Academic Press, USA.
[2] Multicast Networking And Application, Kennet Miller AW Publication , 1999
[3] IP Telephony, Oliver Hersent, David Gurle, Jean - Pierre Petit, A, Pearson Asia , LPE, 2001
[4] Multicast Sockets: Practical Guide for Programmers by David Makofske, Kevin Almeroth, Edition 2003, Elsevier, USA.

MODERN OPTIMIZATION TECHNIQUES			
Course Code:	**EC517/EC671**	**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: Artificial Neural Networks (ANN)
Objectives-History-Biological inspiration, Neuron model, Single input neuron, Multi-input neuron, Network architecture, Single layer of neurons, Multi-layers of Neurons.

Unit II: Perceptron and Learning

Perceptron architecture, Stingle-neuron perceptron, Multi-neuron perceptron- Perceptron Learning Rule, Constructing learning rules, Training multiple neuron perceptrons. Associative Learning: Simple associative network, Unsupervised Hebbrule- Hebb rule with decay, Instar rule, Kohonen rule. Widro-Hoff Learning: Adaline Network, Single Adaline, Mean square Error, LMS algorithm, Analysis of Convergence.

Unit III: Neural Network Roles in VLSI Design
Applications of Artificial Neural Networks to Function Approximation, Regression, Time Series and Forecasting.

Unit IV: Genetic Algorithms and its Mathematical Foundations
Introduction, robustness of traditional optimization and search methods, goals of optimization, difference between genetic algorithms and traditional methods, a simple genetic algorithm, hand simulation, Grist for the search mill, similarity templates, learning the lingo. Foundation theorem, schema processing, the two armed and k-armed bandit problem, schemata processing, building block hypothesis, minimal deceptive problem (MDP), extended schema analysis, MDP results, similarity templates as hyper planes.

Unit V: Advance Topics
Data structures, reproduction, crossover and mutation, a time to reproduce and a time to cross, main program and results, mapping objective functions to fitness form, fitness scaling, codings, a multiparameter mapped fixed point coding, discretization, constraints.

Text Books:
[1] Neural Network Design, PWS publishing company, 1995.
[2] Introduction to Artificial Neural Systems, Jaico Pub.House, Bombay, 1994.
[3] Van Nastrand Reinhold," Neural Computing : Theory and practice", 1989.

References
[1] Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
[2] Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
[3] Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.

MIXED SIGNAL VLSI DESIGN			
Course Code:	**EC519/EC675**	**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: Signals, Filters, and Tools
Sinusoidal Signals, Pendulum Analogy, Amplitude in the x-y Plane, In-Phase and Quadrature Signals, Complex (z-) Plane, Comb Filters, Digital Comb Filter, Digital Differentiator, Intuitive Discussion of the z-Plane, Comb Filters with Multiple Delay Elements, Digital Integrator, Delaying Integrator, Exponential Fourier Series, Fourier Transform, Dirac Delta Function .

Unit II: Sampling and Aliasing
Sampling, Impulse Sampling, Time Domain Description of Reconstruction, Decimation, Sample-and-Hold, S/H Spectral Response, Reconstruction Filter, Circuit Concerns for Implementing the S/H, Track-and-Hold (T/H), Interpolation, Zero Padding, Hold Register, Linear Interpolation, K-Path Sampling, Switched-Capacitor Circuits, Non-Overlapping Clock Generation, Circuits Implementing the S/H, Finite Op-Amp Gain-Bandwidth, Auto zeroing,

Unit III: Analog Filters
Integrator Building Blocks, Lowpass Filters, Active-RC Integrators, Effects of Finite Op-Amp Gain Bandwidth Product, Active-RC SNR, MOSFET-C Integrators, gm-C Integrators, Common-Mode Feedback Considerations, High-Frequency Transconductor, Discrete-Time Integrators, Frequency Response of an Ideal Discrete-Time Filter, Filtering Topologies, Bilinear Transfer Function, Active-RC Implementation, Transconductor-C Implementation.

Unit IV: Digital Filters
Models for DACs and ADCs, Ideal DAC, Modeling of Ideal DAC, Ideal ADC, Number Representation, Increasing Word Size, Adding Numbers and Overflow, Two's Complement Sinc-Shaped Digital Filters, Counter, Aliasing, Accumulate-and-Dump, Lowpass Sinc Filters, Averaging without Decimation, Cascading Sinc Filters, Finite and Infinite Impulse Response Filters, Bandpass and Highpass Sinc Filters, Frequency Sampling Filters.

Unit V: Data Converter SNR
Quantization Noise, Quantization Noise Spectrum, Bennett's Criteria, RMS Quantization Noise Voltage, Quantization Noise as a Random Variable, Quantization Noise Voltage Spectral Density, Power Spectral Density, SNR, Effective Number of Bits, Coherent Sampling, SNDR, Spurious Free Dynamic Range, Dynamic Range, Specifying SNR and SNDR, Clock Jitter.

Text Books:
[1] Jacob Baker, CMOS Mixed Signal Circuit Design.
[2] Yannis Tsividis ,"Mixed Analog-Digital VLSI Device and Technology",.

References:
[1] Roubik Gregorian ,"Introduction to CMOS Opamps and Comparators".

DSP INTEGRATED CIRCUITS			
Course Code:	**EC521/EC677**	**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: DSP Integrated Circuits and VLSI Circuit Technologies
Standard digital signal processors, Application specific IC's for DSP, DSP systems, DSP system design, Integrated circuit design. MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

Unit II: Digital Signal Processing
Digital signal processing, Sampling of analog signals, Selection of sample frequency, Signal- processing systems, Frequency response, Transfer functions, Signal flow graphs, Filter structures, Adaptive DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

Unit III: Digital Filters and Finite Word length Effects
FIR filters, FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures, Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations, Scaling of signal levels, Round-off noise, Measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

Unit IV: DSP Architectures and Synthesis of DSP Architectures
DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PEs.

Unit V: Arithmetic Units and Integrated Circuit Design
Conventional number system, Redundant Number system, Residue Number System, Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift-accumulator. Layout of VLSI circuits, FFT processor, DCT processor and Interpolator as case studies. Cordic algorithm.

Text Books:
[1] Lars Wanhammer, "DSP Integrated Circuits", 1999 Academic press, New York
[2] A.V.Oppenheim et.al, "Discrete-time Signal Processing", Pearson Education, 2000.

References:
[1] Emmanuel C. Ifeachor, Barrie W. Jervis, " Digital signal processing – A practical approach", Second Edition, Pearson Education, Asia.
[2] Keshab K.Parhi, "VLSI Digital Signal Processing Systems design and Implementation", John Wiley & Sons, 1999.