

# **SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY**

**(Department of Electronics and Communication Engineering)**

## **COURSE STRUCTURE**

**5 YEARS DUAL DEGREE B.TECH. (ECE) + M. TECH.**

**(Specialization in VLSI Design)**



**GAUTAM BUDDHA UNIVERSITY, GREATER NOIDA**

**Effective From Session 2015-2016**

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

## SEMESTER I

Sr. No.	C o u r s e s Code	Courses	L-T-P		Credits
1	CY101	Engineering Chemistry	3-1-0	FC-C1	4
2	MA101	Engineering Mathematics – I	3-1-0	FC-C2	4
3	ES 101	Environment Studies	2-1-0	AECC1	3
4	CS101	Computer Programming – I	2-0-0	FC-C3	2
5	EC101	Basic Electronics	2-1-0	FC-C4	3
6	EN101	English Proficiency	2-0-0	AECC2	2
7	BS101	Human Values & Buddhist Ethics	2-0-0	AECC3	2
8	CY103	Engineering Chemistry Lab	0-0-2	FC-C5	1
9	CS 181	Computer Programming Lab1	0-0-2	FC-C6	1
10	CE103	Engineering Graphics	0-0-3	FC-C7	2
11	EC181	Basic Electronics Lab	0-0-2	FC-C8	1
12	GP	General Proficiency	-----	Non Credit	
<b>Total Credits</b>					<b>25</b>
<b>Total Contact Hours</b>			<b>16-4-9</b>		<b>29</b>

**Ability Enhancement Compulsory Course (AECC):**

1. EN101 English Proficiency
2. ES 101 Environment Studies
3. BS101 Human Values & Buddhist Ethics

## SEMESTER II

Sr. No.	Courses Code	Courses	L-T-P		Credits
1	PH102	Engineering Physics	3-1-0	FC- C9	4

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2	MA102	Engineering Mathematics – II	3-1-0	FC-C10	4
3	ME 101	Engineering Mechanics	2-1-0	FC-C11	3
4	CS102	Computer Programming – II	2-0-0	FC-C12	2
5	EE102	Electrical Technology	2-1-0	FC-C13	3
6	HU102	Professional Communication	2-0-0	AECC4	2
7		Open Elective I	2-0-0	OE1	2
9	PH104	Engineering Physics Lab	0-0-2	FC-C14	1
10	CS182	Computer Programming Lab - II	0-0-2	FC-C15	1
11	EE104	Electrical Technology Lab	0-0-2	FC-C16	1
12	ME102	Engineering Workshop	0-0-3	FC-C17	2
13	GP	General Proficiency	-----	Non Credit	
<b>Total</b>					<b>25</b>
<b>Credits</b>					
<b>Total Contact Hours</b>			<b>16-4-9</b>		<b>29</b>

**Ability Enhancement Compulsory Course (AECC):**

- HU 102 Professional Communication

**Open Elective I (OE) Courses offered from other school/department.****SEMESTER – III**

<b>S r . No.</b>	<b>Course Code</b>	<b>Courses</b>	<b>L-T-P</b>		<b>Credits</b>
1	MA201	Engineering Mathematics III	3-1-0	FC-C18	4
2	EC201	Digital Electronics	3-0-0	FC-C19	3
3	EC203	Network Analysis and Synthesis	3-0-0	C20	3
4	EC205	Signal and Systems	2-1-0	C21	3
5	CS205	Data Structures and Algorithms	2-1-0	SEC1	3
6	EC207	Electronic Devices and Circuits	3-0-0	C22	3
7	EC281	Digital Electronics Lab	0-0-3	FC-C23	2
8	EC283	Electronic Circuits Lab	0-0-3	C24	2

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9	CS283	Data Structures and Algorithms Lab	0-0-3	C25	2
10	GP	General Proficiency		Non Credit	
<b>Total Credits</b>					<b>25</b>
<b>Total Contact Hours</b>			<b>16-3-9</b>		<b>28</b>

**Skill Enhancement Course (SEC):**

1. CS 205 Data Structures and Algorithms

**SEMESTER – IV**

Sr. No.	Course Code	Courses	L-T-P		Credits
1	MA202	Numerical and Statistical Analysis	3-1-0	C26	4
2	EC202	Analog Communication	3-1-0	C27	4
3	EC204	Linear IC Applications	3-0-0	C28	3
4	EE202	Measurements and Instrumentation	2-0-0	FC-C29	2
5	EC206	Digital Signal Processing	3-0-0	C30	3
6	EC208	Electromagnetic Theory	3-0-0	C31	3
7	EE216	Measurements and Instrumentation Lab	0-0-2	FC-C32	1
8	EC282	Analog Communication Lab	0-0-3	C33	2
9	EC284	Digital Signal Processing Lab	0-0-3	C34	2
10	GP	General Proficiency		Non Credit	
<b>Total Credits</b>					<b>24</b>
<b>Total Contact Hours</b>			<b>17-2-8</b>		<b>27</b>

**SEMESTER – V**

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S r . No.	Course Code	Courses	L-T-P		Credit s
1	EC301	Digital Logic Design	3-0-0	C35	3
2	EC303	Digital Communication Systems	3-0-0	C36	3
3	EC305	Antenna and Wave Propagation	2-1-0	C37	3
4	EC307	Introduction to Control Theory	2-1-0	C38	3
5	CS309	Computer Organization and Architecture	3-0-0	C39	3
6		Open Elective II	2-0-0	OE2	2
7	EC381	Logic Design Lab	0-0-3	C40	2
8	EC383	Digital Communication Lab	0-0-3	C41	2
9	EC385	Antenna and Wave propagation Lab	0-0-3	C42	2
10	GP	General Proficiency		Non Credit	
		<b>Total Credits</b>			<b>23</b>
		<b>Total Contact Hours</b>	<b>15-2-9</b>		<b>26</b>

Open Elective II (OE) Courses offered from other school/department.

## SEMESTER – VI

S r . No.	C o u r s e Code	Courses	L-T-P		Credits
1	EC302	Microwave Engineering	3-0-0	C43	3
2	EC304	Microprocessors & Interfacing	2-1-0	C44	3
3	EC306	Microelectronics Engineering	3-0-0	C45	3
4	EC308	Information Theory & Coding	2-1-0	C46	3
5	CS310	Data Networks	3-0-0	C47	3
6	CS312	Management Information System	2-0-0	SEC2	2
7	EC382	Microwave Engineering Lab	0-0-3	C48	2

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8	EC384	Microprocessor and Interfacing Lab	0-0-3	C49	2
9	CS382	Computer Networks Lab	0-0-3	C50	2
10	GP	General Proficiency		Non Credit	
		<b>Total Credits</b>			<b>23</b>
		<b>Total Contact Hours</b>	<b>15-2-9</b>		<b>26</b>

**Skill Enhancement Course (SEC):**

1. CS312 Management Information System

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## SEMESTER – VII

Sr. No.	Courses Code	Courses	L-T-P		Credits
1.		Generic Elective	3-1-0	GE 1	4
2	EC401	Optical Communication	3-0-0	C51	3
3	EC403	Semiconductor Device Modeling and Technology	2-1-0	C52	3
4		Elective 1	3-0-0	DSE1	3
5		Elective 2	3-0-0	DSE2	3
6	EC481	Optical Communication Lab	0-0-3	C53	2
7	EC491	Seminar	0-0-2	DP1	1
8	EC493	Minor Project	0-0-8	DP2	4
9	GP	General Proficiency	-----	Non Credit	
<b>Total Credits</b>					<b>23</b>
<b>Total Contact Hours</b>			<b>14-2-13</b>		<b>29</b>

## Elective: 1 &amp; 2

Sr.No	Course Code	Courses
1	EC441	Design with Microcontrollers
2	EC443	Telecommunication Switching and Networks
3	EC445	Satellite Communication
4	EC447	Digital Image Processing
5	EC449	Communication Networks and Transmission Lines
6	EC465	Principles of VLSI Design
7	EC467	RADAR and TV Engineering
8	CS441	Software Project Management
9	CS443	Object Oriented Software Engineering
10	EC405	Wireless Mobile Communication

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**Generic Elective (GEI)**

1. MA406 Operation Research Techniques
2. MA507 Optimization Techniques
3. MA417 Number Theory



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**SEMESTER VIII**

Sr. No	Subject Code	Courses	L-T-P		Credits
1		Generic Elective	3-1-0	GE2	4
2	EC536	IC- Technology	3-0-0	C54	3
3	EC538	Analog IC Design	3-0-0	C55	3
4	EC578	CMOS VLSI Design	3-0-0	C56	3
5		Elective - 3	3-0-0	DSE2	3
6	EC580	Design Lab I	0-0-3	C57	2
7	EC592	Major Project	0-0-10	DP3	5
8	GP	General Proficiency	---	Non Credit	
		<b>Total Credits</b>			<b>23</b>
		<b>Total Contact Hours</b>	<b>15-1-13</b>		<b>29</b>

**Elective - 3**

S. No	Subject Code	Courses
1	EC574	Integrated Circuit Physical Design
2	EC568	Design of Semiconductor Memories
3	EC576	CMOS RF Circuit Design

**Generic Elective (GE1)**

1. MA 402 Modeling and Simulation
2. MA416 Probability and Stochastic Process

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<b>Summer Semester ( After 8<sup>th</sup> Semester )</b>					
<b>Sr. No.</b>	<b>Courses Code</b>	<b>Courses</b>	<b>L-T-P</b>		<b>Credits</b>
1	EC490	Summer Project / Industrial Training		DP4	5
<b>Total Credits</b>					<b>05</b>
<b>Total Contact Hours</b>					<b>4-6 week</b>

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**SEMESTER – IX**

Sr. No	Subject Code	Courses	L-T-P		Credits
1	EC633	Low Power VLSI Design	3-0-0	C58	3
2	EC675	Mixed Signal VLSI Design	3-0-0	C59	3
3		Elective - 4	3-0-0	DSE3	3
4		Elective - 5	3-0-0	DSE4	3
5	EC683	Design Lab II	0-0-3	C60	2
6	EC691	Dissertation Phase - I	0-0-14	DP2	7
7	GP	General Proficiency	---	Non Credit	
		<b>Total Credits</b>			<b>21</b>
		<b>Total Contact Hours</b>	<b>12-0-17</b>		<b>29</b>

**Elective - 4 & 5**

Sr.No	Subject Code	Courses
1	EC665	VLSI ASIC Design
2	EC667	RF MEMS Design and Technology
3	EC673	VLSI-Reliability Engineering
4	EC677	DSP Integrated Circuits
5	EC679	Test and Verification of VLSI Circuits
6	EC669	Algorithm for VLSI Design Automation

**SEMESTER – X**

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<b>Sr. No</b>	<b>Subject Code</b>	<b>Courses</b>	<b>L-T-P</b>		<b>Credits</b>
1	EC690	Dissertation Phase-II	---	DP3	23
2	GP	General Proficiency	---	Non Credit	0
		<b>Total</b>	---		<b>23</b>

**Grand Total Credits = 240****Open Elective I (OE) Courses offered from other school**

1. SS102 History of Science & Technology
2. BSC 201 Introduction to Buddhist Meditation: Theories & Practises
3. BSCU305 Buddhist Art & Architect

**Open Elective II (OE) Courses offered from other school**

1. CS311 Ecommerce
2. CE311 Engineering Economics

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**(SEMESTER - I)**

<b>COMPUTER PROGRAMMING – I</b>			
<b>Course Code:</b>	<b>CS101</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>2</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>30</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**UNIT I INTRODUCTION TO COMPUTER**

Definition, characteristic, generation of computers, basic components of a computer system, memory, input, output and storage units, hard copy devices, high level language and low level language, software, system software, application software, hardware, firmware, compiler, interpreter and assembler.

**UNIT II INTRODUCTION TO PROGRAMMING CONCEPT**

Introduction to algorithm and flow chart; representation of algorithm using flow chart symbol, pseudo code, basic algorithm design, characteristics of good algorithm, development of algorithm.

**UNIT III INTRODUCTION TO C PROGRAMMING LANGUAGE**

declaring variables, preprocessor statements, arithmetic operators, programming style, keyboard input, relational operators, introduction, feature of C language, concepts, uses, basic program structure, simple

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data types, variables, constants, operators, comments, control flow statement :if, while, for, do-while, switch .

**UNIT IV**

User defined data types, arrays, declaration and operations on arrays, structure, member accessing, structure and union, array of structures, functions, declaration and use of functions, parameter passing, dynamic memory allocation.

**UNIT V FUNDAMENTALS OF POINTERS**

Declaration and usages of pointers, operations that can be performed on computers, use of pointers in programming exercises, parameter passing in pointers, call by value, call by references, Introduction to LINUX: LINUX structure, directory, LINUX commands.

**Text Books:**

1. C Programming, Herbert Shield
2. Programming in ANSI C by E. Balagurusamy, Tata Mgraw Hill,

**Reference Books:**

3. C Programming Language 2nd Edition by Brian, W Kernighan Pearson Education.
4. C. Puzzle Book: Puzzles For The C. Programming Language by Alan R Feuer Prentice Hall- Gale
5. Expert C Programming: Deep C Secrets (s) by Peter Van Der Linden Dorling Kindersley India.
6. Introduction To UNIX System by Morgan Rachel Tata Mcgraw Hill Education.
7. C: A Reference Manual (5th Edition) by Samuel P. Harbison & Samuel P. Harbison.
8. Programming Using the C Language by Hutchison, R.C, Mcgraw Hill Book Company, New York

<b>BASIC ELECTRONICS</b>			
<b>Course Code:</b>	<b>EC101</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>2+1</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>30+15</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:****Passive Components**

Resistances, Capacitors and Inductors, Component Specifications, Applications, Response to dc and sinusoidal voltage/current excitations

**Semiconductor Theory**

Metals, Insulators and Semiconductor materials, energy band diagram, Intrinsic and Extrinsic Semiconductors, Doping, Fermi level, Fermi level of P-type and N-type materials, Mobility, Drift Current and Diffusion Current. Current conduction in Semiconductors, Generation and Recombination of Charges

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**Unit II: Semiconductor Diodes**

Theory of P-N Junction, Ideal & Practical diode, Concept of AC and DC Resistances, V-I Characteristics, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Reverse Recovery Time, Zener and Avalanche breakdown, Tunnel Diodes, Varactor Diode, Light Emitting Diode

**Unit III: Diode Applications and Wave Shaping Circuits**

Load line analysis, series and parallel combinations, Half wave & Full wave Rectifiers, Clippers & Clampers.

**Unit IV: Transistors**

Bipolar Junction Transistor- Construction, Operation, Transistor Configurations, Input and Output Characteristics, AC and DC Load line, operating point, Effect of shifting the operating point. Biasing, Thermal Runaway, Effect of temperature on the characteristics, Early effect, introduction to JFET and MOSFET

**Unit V: Logic Gates and Operational Amplifiers**

Binary number, Digital systems, Boolean algebra, logic gates, logic functions, realization of logic gates by electronic devices, Positive and negative logic, representation of binary numbers, half adder, full adder, flip-flops, Op-Amp, Practical Op-Amp, Open loop and closed loop configurations, Applications of Op-Amps as inverting and non-inverting amplifier

**Text Books:**

- [1] Boyelasted an Nashlsky: Electronics Devices and circuit Theory, TMH.
- [2] Gayakwad :Op-Amps and Linear Inegrated Circuits , PHI.

**References:**

- [1] Millman & Halkias :Integrated Electronics ,TMH.
- [2] Morris Mano: Digital Design ,PHI.
- [3] Malvino :Electronics Principles,TMH.

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BASIC ELECTRONICS LAB			
<b>Course Code:</b>	<b>EC181</b>	<b>Credits:</b>	<b>1</b>
<b>No. of Lab (Hrs/Week):</b>	<b>2</b>	<b>End Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lab Sessions:</b>	<b>15</b>		

**List of Experiments**

1. Study of Multimeter and Function Generator /Counter.
2. Study of Cathode-Ray Oscilloscope.
3. To calculate the Equivalent Resistance of the Series and parallel resistive network.
4. To calculate the Equivalent Capacitance of the Series and parallel capacitive network.
5. To Plot the V-I Characteristics of P-N Junction Diode in forward bias and reverse bias.
6. To study the working of a P-N Junction Diode as a switch.
7. To plot the V-I Characteristics of a Zener Diode.
8. To plot the input and output waveforms of clipper circuits.
9. Study the Half wave rectifier.
10. Study of Full wave Bridge Rectifier.
11. Study of Centre Tapped Full Wave Rectifier.
12. To plot the input and output characteristic of transistor's Common Base configuration.
13. To plot the input and output characteristic of transistor's Common Emitter configuration.
14. To plot the input and output characteristic of transistor's Common Collector configuration.
15. To verify the truth table of various logic gates.



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COMPUTER PROGRAMMING LAB – I			
<b>Course Code:</b>	<b>CS181</b>	<b>Credits:</b>	<b>1</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>2</b>		
<b>Total No. of Lab Sessions:</b>	<b>10</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**EXPERIMENTS:**

1. Write a C program to reverse a given number, find the sum of digits of the number.
2. Write a C program to concatenate two strings.
3. Write a C program to take marks of a student as input and print the his/her grade bases on following criteria using if – else statements
 

Marks <40	FAIL
40<= Marks <59	GOOD
59 <= Marks < 80	Excellent
80 <= Marks	Outstanding
4. Perform experiment 3 using switch case statement.
5. Write a C program to compute the length of a string using while loop.
6. Write a C program to convert all the lowercase letter to uppercase letter and all uppercase letters to lower case letter given a string as input.
7. Write a C program to compute the roots of a quadratic equation.
8. Write a C program to check whether a given number is prime or not, also check whether it is divisible by a number k or not.
9. Write a C program to check whether a given year is leap year or not.
10. Write a C program to take two matrixes as input and print the sum of two matrixes.
11. Write a C program to display the address of a variable using pointer.
12. Write a C program to compute the length of a string using pointer.
13. Create a structure called STUDENT having name, registration number, class, session as its field. Compute the size of structure STUDENT.

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14. Write a C program to check whether a given string is palindrome or not.
15. Write a C program to generate following patterns.

```
    1
  2  2
3  3  3
4  4  4  4
```

```
    A
  B  B
C  C  C
D  D  D  D
```

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**(SEMESTER - II)**

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<b>COMPUTER PROGRAMMING – II</b>			
<b>Course Code:</b>	<b>CS102</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>2</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>30</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 APPLLET 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

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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.

**Reference Books:**

1. Programming with JAVA, E. Balagurusawamy, Tata McGraw Hill, 1998.
2. JAVA Beginner's guide, Herbert Schildt, Tata McGraw Hill, 2007.
3. Java How to Program, Deitel & Deitel, Prentice-Hall, 1999.
4. The Complete Reference JAVA 2, Herbert Schildt, 5<sup>th</sup> Edition, Tata McGraw Hill, 2002.
5. The Complete Reference JAVA 2, Herbert Schildt, 7<sup>th</sup> Edition, Tata McGraw Hill, 2009.
6. The Java Programming Language, Ken Arnold, James Gosling, Addison-Wesley, 1996.
7. How to Program Java, Peter Coffee, Ziff-Davis Press, 1996.

<b>COMPUTER PROGRAMMING-II LAB</b>			
<b>Course Code:</b>	<b>CS182</b>	<b>Credits:</b>	<b>1</b>
<b>No. of Practical (Hrs/Week):</b>	<b>2</b>		
	<b>15</b>	<b>End Sem. Exam Hours:</b>	<b>2</b>
<b>Total No. of Lab Sessions:</b>			

**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:

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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:

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**Effective from 2015-2016**

**(SEMESTER - III)**

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**Effective from 2015-2016**



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DIGITAL ELECTRONICS			
<b>Course Code:</b>	<b>EC201</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exams Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exams Hours:</b>	<b>3</b>

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

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

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

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

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

**Text Books:**

- [1] M. Mano :Digital Logic and Computer Design, Pearson Education
- [2] William I. Fletcher :An Engineering Approach to Digital Design, Pearson Education
- [3] R.P. Jain: Digital Electronics, TMH

**References:**

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

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NETWORK ANALYSIS AND SYNTHESIS			
<b>Course Code:</b>	<b>EC203</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction to Circuits**

Voltage, Ideal Voltage Source, Current Ideal Current Sources, Classification of Circuits, Ohm's Law, Resistively, Temperature Effect, Resistors, Resistor Power Absorption, Nominal Values and Tolerances, Color Codes, Open and Short Circuits, Internal Resistance. Operational Amplifiers, Capacitance, Inductance, Transformers.

**Unit II: Network Theorems for DC applications**

DC Circuits: Series and Parallel Circuits, Kirchhoff's Voltage and Current Law, Mesh Analysis, Loop Analysis, Nodal Analysis, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem, Superposition Theorem, Millman's Theorem, Tellegen's Theorem, Star - Delta and Delta -Star Transformation, Bridge Circuits.

**Unit III: Network Theorems for AC applications**

AC Circuits: Circuits containing Capacitors and Inductors, Transient Response, Alternating Current and Voltages, Phasors, Impedances and Admittance, Mesh Analysis, Loop Analysis, Nodal Analysis, Thevenin's and Norton's Theorem, Star-Delta and Delta-Star Transformation, Bridge Circuits. Resonant Circuits, Complex Frequency and Network Function, Maximum Power Transfer Theorem, Superposition Theorem.

**Unit IV: Network Function and Two port Networks**

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z, Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters, Interconnection of two ports networks, Terminated two port network.

**Unit V: Network Synthesis**

Hurwitz polynomials, positive real functions. Properties of real immittance functions, synthesis of LC driving point immittances, properties of RC driving point impedances, synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances.

**Text Books:**

- [1] Decarlo Lin: Linear circuit Analysis; Oxford
- [2] Franklin F. Kuo : Network Analysis and synthesis, 2nd Edition, Wiley India Pvt Ltd.

**References:**

- [1] M.E. Van Valkenburg :Network Analysis, (PHI).
- [2] Chakraborti :Circuit theory, Dhanpat Rai.
- [3] Sudhakar Shyam Mohan: Network Analysis and Synthesis

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SIGNAL AND SYSTEMS			
<b>Course Code:</b>	<b>EC205</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: LTI Systems**

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

**Unit III: Analysis of Aperiodic Signals**

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

**Unit IV: Laplace Transform**

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

**Unit V: Convolution and Correlation of Signals**

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

**Text Books:**

- [1] Oppenheim Willsky and Nawab, :Signals and Systems, PHI.
- [2] Simon Haykin: Signals and Systems, John Wiley.

**Reference Books:**

- [1] Taub and Schilling: Principles of Communication Systems, TMH.
- [2] Dungan F R: Electronic Communication Systems, Thomas-Delmar.

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DATA STRUCTURES AND ALGORITHMS			
<b>Course Code:</b>	<b>CS205</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>2+1</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>30+15</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, Polynomial Representation and Addition, Generalized Linked List

**Unit II: Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion

**Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, 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.

**Search Trees:** 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

**Unit IV: Graphs:** 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 Dijkstra Algorithm.

**Unit V: 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.

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**Hashing:** Hash Function, Collision Resolution Strategies Storage Management: Garbage Collection and Compaction.

**Text books:**

- [1] Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein :Data Structures Using C and C++ , PHI
- [2] R. Kruse etal: Data Structures and Program Design in C, Pearson Education
- [3] Lipschutz: Data Structures, Schaum's Outline Series, TMH

**References Books:**

- [1] Horowitz and Sahani: Fundamentals of Data Structures", Galgotia Publication
- [2] Jean Paul Trembley and Paul G. Sorenson: An Introduction to Data Structures with applications, McGraw Hill

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ELECTRONIC DEVICES AND CIRCUITS			
<b>Course Code:</b>	<b>EC207</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Review: p-n junction diode, spice model, diode as a switch, BJT-parameters, transistor biasing and stabilization, biasing circuits-analysis and design, equivalent circuits, DC model, h-parameters model,  $r_e$  model and hybrid  $\pi$  model, spice model, single stage RC coupled amplifier-load line, gain bandwidth product, emitter follower, BJT as a switch, Power amplifiers

**Unit II:** JFET: Structure, operating principle, amplifier, biasing analysis, small signal model of JFET, MOSFET-enhancement and depletion type, I-V characteristics, MOSFET amplifiers, introduction to SCR and UJT

**Unit III:** Multistage BJT amplifiers: classification, distortion, frequency response, RC-coupled amplifier and its low frequency response, high frequency response of an RC-coupled amplifier, multistage CE amplifier cascade at high frequency, Tuned amplifiers-single tuned, double tuned, and staggered tuned amplifiers

**Unit IV:** Feedback Amplifier: Concept of feedback, classification, transfer gain, general characteristics, effect of feedback on input and output characteristics, analysis of feedback amplifier, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback

**Unit V:** Oscillators: Positive feedback amplifier, Barkhausen Criterion, sinusoidal oscillators, phase shift oscillator, resonant circuit oscillator, general form of oscillator circuit, crystal oscillator, regulated power supplies, series regulators, three terminal IC regulators, switched mode power supplies

**Text Books:**

- [1] J.Millman, C.C.Halkias, and Satyabratha Jit : Electronic Devices and Circuits ,Tata McGraw Hill, 2nd Ed., 2007.  
 [2] R.L. Boylestad and Louis Nashelsky :Electronic Devices and Circuits , Pearson/Prentice Hall,9th Edition,2006.

**References:**

- [1] T.F. Bogart Jr., J.S.Beasley and G.Rico: Electronic Devices and Circuits, Pearson Education.  
 [2] S.G.Burns and P.R.Bond: Principles of Electronic Circuits, Galgotia Publications.  
 [3] Millman and Grabel: Microelectronics, Tata McGraw Hill.  
 [4] David Bell: Electronic Devices and Circuits, TMH

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DIGITAL ELECTRONICS LAB			
<b>Course Code:</b>	<b>EC281</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Practical (Hrs/Week):</b>	<b>3 15</b>	<b>End Sem. Exam Hours:</b>	<b>2</b>
<b>Total No. of Lab Sessions:</b>			

**Programs/Experiments List:**

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.
6. Design a half adder using NOR gates only
7. Design full adder using
8. Design a given size of Multiplexer 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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INTERNET TECHNOLOGY LAB			
<b>Course Code:</b>	<b>CS281</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>End Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>10</b>		

**List of Experiments**

1. Design a web page using XHTML which shows the Hyperlinks, List, Tables.
2. Design a web page in which users insert the username and password using XHTML form.
3. Design a web page using XHTML to insert an image and adding a marquee.
4. Write XML schema document for Book domain.
5. Design a website using HTML, XHTML and JavaScript.
6. Using Java Script display a line of text in a web page.
7. Using Java Script display a text in an alert Dialog box.
8. Using Java Script , take input of two integer from the user and display the result in the web page.
9. Using Java Script, Show the equality and relational operators.
10. Write a script that reads integers and determines the square root of the integer using square root method of Math object.
11. Write a script which uses the control statements.
12. Write a script that reads five integers and determines the largest and the smallest integers in the group.
13. Write a code to show connectivity between SQL server and ASP.net.
14. Introduction to different types of tools using in ASP.net Technology.
15. Design a web page using ASP.net.



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<b>ELECTRONICS CIRCUITS LAB</b>			
<b>Course Code:</b>	<b>EC283</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Lab (Hrs/Week):</b>	<b>3</b>	<b>End Sem Exam Hours:</b>	<b>3</b>
<b>Total No. of Lab Sessions:</b>	<b>10</b>		

**List of Experiments**

1. To study the switching action of a transistor as a switch.
2. To calculate the h-parameter of transistor in CE mode.
3. To draw the input and output waveforms of power amplifier.
4. To draw the input and output waveforms of single stage R-C coupled amplifier.
5. To draw the input & output characteristics of JFET.
6. To draw the input & output characteristics of MOSFET.
7. To study the transistor as an amplifier in CE mode.
8. To study the transistor as an amplifier in CC mode.
9. To plot the characteristics of SCR.
10. To plot the characteristics of UJT.
11. To study of OP-amp as inverting amplifier.
12. To study of OP-amp as non- inverting amplifier.
13. To study the Hartley oscillator.
14. To study the Phase –Shift oscillator.
15. To study the Wien Bridge oscillator.

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**(SEMESTER - IV)**

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ANALOG COMMUNICATION			
<b>Course Code:</b>	<b>EC202</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1 T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Spectral Analysis: overview of Fourier Series and Fourier Transform, their Properties, Transform of Gate Signal, Impulse Function and Unit Step Function, Fourier Transform Technique for Periodic Signal, Transform of Train of Pulses and Impulses, Sine and Cosine wave. Signal Energy and Power, Spectral Density of various types of signals, Spectra (Parseval's Theorem), Density Spectra of Periodic Gate. Linear Time Invariant (LTI) Systems, Impulse Response, Convolution, Convolution with Impulse Function, Casual and Non Casual System, Distortion less System, Conditions for Distortion less Transmission. Ideal Filters and Practical Filters

**Unit II:** Modulation Techniques: Need and types of modulation techniques, Amplitude Modulation, Frequency Spectrum, Power Distribution, AM Modulators, Suppressed Carrier Generation- Balance/Chopper and Square Law Modulation, SSB Generator-Phase and Frequency Discrimination Method, VSB Transmission and Application. Detection of AM signals: Envelope Detector Circuit, RC Time Constant, Synchronous Detection Technique, SSB signal detection, PLL, FDM

**Unit III:** Angle Modulation: Frequency and Phase Modulation, Frequency spectrum, Bandwidth requirement, Frequency and Phase Deviation, Modulation Index, Narrowband FM, Wide Band FM & their Spectrum . FM Modulators: Direct and Indirect Methods of frequency modulation. FM Detector: Slope Detector, Foster-Seely Discriminator, Ratio Detector, PLL detectors, Pre-Emphasis & De-Emphasis, Capture Effect

**Unit IV :**AM Transmitter Block Diagram, TRF Receiver & Its Limitations, Necessity of Heterodyning, Super Heterodyne Radio Receivers, IF Amplifiers & Selection of Intermediate Frequency, FM Transmitters, FM Receivers, AGC, AVC, AFC, Dynamic Range of Receivers

**Unit V:**Classifications of noise, sources of noise, methods of noise calculation in networks, addition of noise due to several sources, noise voltage, noise temperature, noise figure-its calculation and measurement, mathematical representation of random noise, signal to noise ratio, noise bandwidth,

**Text Books:**

- [1] Lathi B.P.: Analog and Digital Communication systems, 3/E Oxford Press, 2007
- [2] Kennedy Davis "Electronic Communication Systems" Tata McGraw
- [3] Haykin Simon: Communication Systems,4/E John Willey & Sons, 2006.

**Reference Books:**

- [1] Singh R.P. & Sapre: Communication systems Analog & Digital, 2/E TMH, 2007
- [2] Bruce Carlson: Communication Systems, 5/E McGraw Hill, 2004.

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[3] Proakis and Salehi: Fundamentals of Communication Systems, 1/E Pearson Education, 2005.

[4] Hwei P Hsu: Analog and Digital Communication Schaum Series TMH, 2 Edition.

[5] Taub &amp; Schilling: Principles of communication systems, 3/E McGraw Hill, 2000.

LINEAR IC APPLICATIONS			
<b>Course Code:</b>	<b>EC204</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Differential and Cascade Amplifier**

Balanced, unbalanced output differential amplifiers, FET differential amplifier, current mirrors, level Translators, cascade configuration of amplifier, operational amplifiers, Introduction to ideal OP-AMP, characteristic parameters, Interpretation of data sheets, Practical OP-AMP, its equivalent circuit and op-amp circuit configuration.

**Unit II: Op-Amp with Negative Feedback and Frequency Response**

Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback differential amplifier, frequency response compensating network, frequency response of internally compensative op-amp and non compensating op-amp. High frequency op-amp equivalent circuit, open loop gain Vs frequency, closed loop frequency response, circuit stability, and slew rate.

**Unit III: Op-Amp Applications**

DC, AC amplifier, peaking amplifier, summing ,stealing ,averaging and instrumentation amplifier differential input amplifier, voltage to current converter, current to voltage converter, very high input impedance circuit, integration and differential circuit, wave shaping circuit, active filters, oscillators.

**UNIT IV: Linear IC Applications**

Log–Anti Log Amplifiers, Multiplier and divider. Precision Rectifiers, Peak Detectors, Sample and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multi-vibrator, Mono-stable multi-vibrator, Generation of Triangular Waveforms

**Unit V: Data Converters and PLL**

A/D and D/A converters. Phase locked loop, Ex-OR Gates and multipliers as phase detectors, Block Diagram of IC PLL, Working of PLL and Applications of PLL.

**Text Books:**

[1] R.A. Gayakwaed: OP-amps and Linear Integrated circuits.

[2] K.R. Botkar, Integrated circuits.

[3] Roy Choudhury D, Jain Shail: Linear Integrated circuit”, New Age International (P) Limited Publisher, 2008.

**References:**

[1] Michael Jacob: Applications and Design with Analog Integrated Circuits’, PHI, 2nd Edn, 2006

[2] Jacob Milliman and Arvin Grabel: Microelectronics”, 2nd Edition, TMH, 2008.

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DIGITAL SIGNAL PROCESSING			
<b>Course Code:</b>	<b>EC206</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Discrete Time Signals and Systems**

Characterization & classification of signals, Typical Signal Processing operations, Discrete-Time Signals, Discrete-Time Systems, Analysis and Implementation of Discrete-Time Linear Time-Invariant Systems, Discrete Time systems described by Difference Equation, Signal flow Graph representation of digital network.

**Unit II: The Z-Transform**

The Direct z-transform, Properties of the z-transform, ROC, Rational z-transforms, Inversion of the z-transform, analysis of Linear Time-Invariant systems in the z- domain.

**Unit III: Finite Fourier Transform**

Introduction to DFT - Efficient computation of DFT Properties of DFT - FFT algorithms - Radix-2 FFT algorithms - Decimation in Time - Decimation in Frequency algorithms -Use of FFT algorithms in Linear Filtering and correlation.

**Unit IV: Digital Filters Design**

Amplitude and phase responses of FIR filters - Linear phase filters - Windowing techniques for design of Linear phase FIR filters - Rectangular, Hamming, Kaiser windows - frequency sampling techniques - IIR Filters - Magnitude response - Phase response - group delay - Design of Low Pass Butterworth filters (low pass) - Bilinear transformation - prewarping, impulse invariant transformation.

**Unit V: Finite Word Length Effects**

Quantization noise - derivation for quantization noise power - Fixed point and binary floating point number representation - comparison - over flow error - truncation error - co-efficient quantization error - limit cycle oscillation - signal scaling - analytical model of sample and hold operations.

**Text Books:**

- [1] John G Proakis, Dimtris G Manolakis: Digital Signal Processing Principles, Algorithms and Application, PHI, 3rd Edition, 2000.
- [2] Johny R. Johnson : Introduction to Digital Signal Processing, Prentice Hall, 1984.

**References:**

- [1] Alan V Oppenheim, Ronald W Schafer, John R Back: Discrete Time Signal Processing, PHI, 2nd Edition 2000.
- [2] Avtar singh, S.Srinivasan DSP Implementation using DSP microprocessor with Examples from TMS32C54XX -Thamson / Brooks cole Publishers, 2003.
- [3] S.K.Mitra: Digital Signal Processing - A Computer based approach, Tata McGraw-Hill, 1998, New Delhi

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ENGINEERING ELECTROMAGNETICS			
<b>Course Code:</b>	<b>EC208</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction**

Co-ordinate System, Vector Calculus: gradient, divergence, curl, Laplacians of scalar and vector fields. Vector identities.

**Unit II: Electrostatics**

Coulomb's law – electric field intensity – field due to continuous volume charge, line charge, sheet of charge – stream lines and sketches of fields – electric flux density – gauss's law – application of gauss law – divergence theorem – energy expended in moving a charge in an electric field – potential – potential gradient – dipole – energy density in a electrostatic field. Current and current density – metallic conductors – properties and boundary conditions – method of images – semiconductors – dielectrics – properties and boundary conditions – capacitance – Poisson's and Laplace's equation – uniqueness theorem.

**Unit III: Magnetostatics**

Biot-Savart law – Ampere's circuital law – curl – Stokes theorem – magnetic flux and flux density – scalar and vector magnetic potentials – steady state magnetic field laws – nature of magnetic materials – magnetization and permeability – boundary conditions – inductance and mutual inductance.

**Unit IV: Time Varying Electromagnetic Fields**

Lorenz Force, Faraday's law – displacement current – Maxwell's equation in point form and integral form – retarded potentials – wave motion in free space, perfect dielectrics, lossy dielectrics – poynting vector and power calculations – propagation in good conductors – reflection of uniform plane waves – standing wave ratio.

**Unit V: Transmission Line Theory**

Lumped circuit model for transmission line and general solutions. Characteristic impedance, propagation constant, attenuation and phase constants. Open circuited and short circuited lines. Reflection coefficient, transmission coefficient, standing wave pattern, standing wave ratio, return loss and insertion loss. Generator mismatches, distortion in transmission lines. Smith Chart. Impedance matching: single and double stub, quarter wave transformer.

**Text book:**

- [1] William H Hayt: Engineering Electromagnetics, Tata McGraw Hill, New Delhi, 2002.
- [2] Surinder P.Seth: Elements of Electromagnetic fields, Dhanpat Rai Publications.

**References:**

- [1] Mathew O Sadiku: Elements of Electromagnetics, Oxford University press, New York, 2003.
- [2] David J Griffith: Introduction to Electrodynamics, Pearson Education, 3/e, 2002.
- [3] John D Kraus: Electromagnetics, McGraw Hill, New York, 2003
- [4] D K Cheng: Field and wave Electromagnetics, Addison Wesley, 2001

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

**Effective from 2015-2016**

**(SEMESTER - V)**



## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

DIGITAL LOGIC DESIGN			
<b>Course Code:</b>	<b>EC301</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction**

Variables and functions, inversion, truth table, logic gates and networks, Boolean algebra, synthesis using basic gates ,SOP and POS ,NAND and NOR logic networks. Introduction to the CAD tools: Design entry, synthesis, functional simulation, physical design, timing simulation and chip configuration.

**Unit II: Logic circuits**

Transistor switches, NMOS and CMOS logic gates, Negative logic system,. Fabrication, behavior and on resistance of MOSFET, voltage levels , noise margin, power dissipation, Fan-in, Fan-out and dynamic operation of logic gates.

**Unit III: VHDL**

Digital system design process , Hardware simulation , Levels of abstraction , VHDL requirements ,Elements of VHDL Top down design, VHDL operators, Timing, Concurrency, Objects and classes , Signal assignments ,Concurrent and sequential assignments.

**Unit IV: Modeling Techniques**

Entity Declaration, Architecture Body, Process statement, Loop control statements, Multiple Processes, Delay Models, Signal Drivers, Block statements, Component declaration and Instantiation, Concurrent Assignment statements, Generics and Configuration, Subprogram, Overloading, Packages and Libraries, Design Libraries,

**Unit V: Advance Topics**

Introduction to FPGA, CPLD and ASIC Design, Programmable logic devices: PLA and PAL, Hardware Modeling Examples: Modeling of digital modulator and demodulators, digital filters,

**Text Book:**

- [1] J. Bhasker: A VHDL Primer, 3rd Edition, PHI.
- [2] Brown and Vranesic :Fundamentals of Digital Logic Design, TMH Publication.

**References Books:**

- [1] P.K. Chan & S. Mourad: Digital Design sing Field Programmable Gate Array, PHI.
- [2] J. V. Old Field & R.C. Dorf: Field Programmable Gate Array, John Wiley, 1995.
- [3] M. Bolton: Digital System Design with Programmable Logic, Addison Wesley, 1990.
- [4] Sudhakar Yalamanchili: Introductory VHDL- From Simulation to Synthesis", 3rd Indian Reprint. Pearson Education,
- [5] Douglas Perry: VHDL, 3rd Edition, McGraw Hill 2001.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

DIGITAL COMMUNICATION SYSTEMS			
<b>Course Code:</b>	<b>EC303</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Sampling of Signal, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Pulse Amplitude Modulation, Time Division Multiplexing, Channel Bandwidth for PAM-TDM Signal, Types of Sampling, Instantaneous, Natural and Flat Top-Mathematical and Spectral Analysis, Aperture Effect, Introduction to Pulse Position and Pulse Duration Modulation.

**Unit II:** Pulse Code Modulation: Quantization, Quantization Error, Pulse Code Modulation, Signal-to-Noise Ratio in PCM, Companding, Data Rate and Bandwidth of Multiplexed PCM Signal, Inter-symbol Interference, Eye Diagram, Line Coding, Differential PCM, Delta Modulation, Adaptive Delta Modulation Slope Overload Error, Granular Noise, Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio.

**Unit III:** Digital Modulation Techniques:- Analysis, Generation and Detection, Spectrum and Bandwidth of Amplitude Shift Keying, Binary Phase Shift Keying, Differential Phase Shift Keying, Quadrature Phase Shift Keying, M-ary PSK, Binary Frequency Shift Keying, M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation,

**Unit IV:** Probability of error, bit error rate, Comparison of digital modulation techniques on the basis of probability of error, Matched Filter.

**Unit V:** Line Coding: Unipolar RZ and NRZ, Bipolar RZ and NRZ, AMI, Split Phase etc. Properties for the selection of Line Codes, HDB Signaling, B8ZS Signaling, Inter-symbol Interference, Nyquist Criteria for Zero ISI, Differential Coding, Regenerative Repeaters, Eye Diagram.

**Text Books:**

- [1] B. Sklar: Digital Communication, Pearson Education
- [2] Haykin Simon: Digital Communication, Wiley Publication.

**References:**

- [1] Taub & Schilling: Principles of Communication system, TMH.
- [2] Lathi B.P.: Modern Analog and Digital Communication systems, Oxford Uni. Press.
- [3] Proakis: Digital communication, McGraw Hill
- [4] Schaum's Outline series: Analog and Digital Communication.
- [5] Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
- [6] Singh and Sapre: Communication System, TMH
- [7] Couch: Digital and Analog Communication, Pearson Education

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>ANTENNA AND WAVE PROPAGATION</b>			
<b>Course Code:</b>	<b>EC305</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Radiation Mechanism**

Retarded magnetic potential. Radiated Fields from a Hertzian dipole, halfwave dipole and quarter wave monopole. Power radiated and radiation resistance.

**Unit II: Antenna Fundamentals**

Radiation intensity, gain, directivity, Power gain, beam width, band width, Reciprocity principle, Effective length and Effective area, Relation between gain effective length and radiation resistance, antenna temperature. FCC Antenna standards A and B. Measurements - radiation pattern- Gain- Directivity and Impedance measurements.

**Unit III: Design of Arrays**

Linear Array - Two element array, N-element linear array- broadside array, End fire array- Directivity, radiation pattern. Planar array – array factor, beam width, directivity, Circular array-array factor

**Unit IV: Design of Antennas**

Long wire, V-Antenna, Rhombic antenna, folded dipole antenna, helical antenna, Spiral antenna, Log periodic antenna, Yagi-Uda antenna, Aperture antennas - Horn antenna, parabolic reflector antenna. Microstrip antenna

**Unit V: Propagation**

Propagation Mechanism- Reflection, refraction and Transmission, Scattering and diffraction. Propagation Model- Path Loss, Free space loss, Plane earth Loss. Noise Modeling, Modes of propagation- Ground wave Propagation, Sky wave Propagation, Space wave, Tropospheric Refraction, Obstruction Loss, Diffraction, Influence of Cluster, Tropospheric effects, Ionospheric Effects, Link budget. Terrestrial fixed Link- Satellite Fixed Link.

**Text Books:**

- [1] E.C.Jordan and Balman: Electro Magnetic Waves and Radiating Systems, PHI, 1968, Reprint 2003.
- [2] John D.Kraus and Ronalatory Marhefka: Antennas for all application, Tata McGraw-Hill Book Company, 2002.

**References:**

- [1] R.E.Collins: Antennas and Radio Propagation , McGraw-Hill, 1987.
- [2] C A Ballanis : Antenna Theory , John Wiley & Sons, second edition , 2003.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

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

**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 Micro operation**

Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Bus Arbitration, Arithmetic Logic, Shift Micro operation, 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<sup>1/2</sup> D, Auxiliary memory, Cache memory, Virtual Memory, Memory management hardware.

**Text Books:**

- [1] Patterson, Computer Organisation and Design, Elsevier Pub. 2009.
- [2] William Stalling, "Computer Organization", PHI

**References:**

- [1] Vravice, Hamacher & Zaky, "Computer Organization", TMH
- [2] Mano, "Computer System Architecture", PHI
- [3] John P Hays, "Computer Organization", McGraw Hill
- [4] Tannenbaum, "Structured Computer Organization", PHI
- [5] P Pal chaudhry, 'Computer Organization & Design', PHI

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**Effective from 2015-2016**

**(SEMESTER - VI)**

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>MICROWAVE ENGINEERING</b>			
<b>Course Code:</b>	<b>EC302</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction**

Microwave Frequencies, Microwave Devices, Microwave Systems, Common types of transmission lines- Coaxial, parallel wire, twisted pair, strip line and microstrip lines

**Unit II: Waveguides and waveguide components**

General solutions for TEM, TE and TM waves- parallel plate waveguide. Rectangular waveguide: TE, TM modes, power transmission, losses in rectangular waveguide, Circular waveguide: TE, TM modes, power transmission, Dielectric fiber and rod waveguide, waveguide coupling, attenuation factor and Q of waveguide. Microwave Hybrid Circuits, Waveguide Tees, Magic Tees (Hybrid Tees), Hybrid Rings (Rat-Race Circuits), Waveguide Corners, Bends and Twists, Directional Coupler, Scattering parameters and Scattering Matrix

**Unit III: Microwave Solid State Devices**

Introduction, Gunn diode, Ridley-Watkins-Hilsum Theory, Differential Negative Resistance, Modes of Operation, LSA Diodes, InP Diodes, CdTe Diodes, Microwave Generation and Amplification, AVALANCHE TRANSIT-TIME DEVICES, Read Diode, Physical Description, Avalanche Multiplication, Output Power and Quality Factor, IMPATT, TRAPATT BARITT Diodes, Parametric Devices: Nonlinear Reactance and Manley - Rowe Power Relations, Parametric Amplifiers, Applications.

**Unit IV: Microwave Tubes**

Klystrons, Reentrant Cavities, Velocity-Modulation, Bunching Process, Output Power and Beam Loading, Multicavity Klystron Amplifiers, Beam-Current Density, Output Current Output Power of Two-Cavity Klystron, Output Power of Four-Cavity Klystron, Reflex Klystrons, Velocity Modulation, Power Output and Efficiency, Electronic Admittance, Helix Traveling-Wave Tubes, Slow-Wave structures, Amplification Process, Convection Current, Axial Electric Field, Wave Modes, Gain Consideration, MICROWAVE CROSSED-FIELD TUBES, Magnetron Oscillators, Cylindrical Magnetron, Coaxial Magnetron, Rieke diagram.

**Unit V: Microwave Measurements**

Measurement of unknown impedance using Slotted line, VSWR measurement, attenuation measurements- measurement of scattering parameters, measurement of dielectric constant.

**Text Books:**

- [1] Samuel Y. Liao: Microwave Devices and Circuits - Prentice Hall of India - 3rd Edition (2003).  
 [2] David M. Pozar: Microwave Engineering. - John Wiley & Sons - 2nd Edition (2003).

**References:**

- [1] R.E. Collin: Foundations for Microwave Engineering - IEEE Press Second Edition (2002).  
 [2] Annapurna Das and Sisir K. Das: Microwave Engineering - Tata McGraw-Hill (2000)

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

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

**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, 2<sup>nd</sup> edition, TMH

[2] Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education

**References:**

[1] B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.

[2] Liu Gibson: Microcomputer Systems: The 8086/8088 Family- Architecture, Programming and Design, PHI

[3] D. V. Hall: Microprocessors and Interfacing, TMH.

[4] Ayala Kenneth: The 8051 microcontroller, Third Edition, Cengage Learning

[5] A. V. Deshmukh: Microcontroller (Theory and Application), TMH.

[6] Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.

[7] V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.

[8] R S Gaonkar, Microprocessor, Architecture, Programming, and Applications with the 8085, Penram International Publication, 5/e

[9] P.K. Ghosh and P. R. Sridhar, 0000 to 8085 Introduction to microprocessor for Engineers and Scientists, PHI, 2/e

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**Effective from 2015-2016**



**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

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

**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, depletion type MOSFET.

**Unit II: Single Stage IC Amplifier**

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

**Unit III: Differential and Multistage Amplifiers**

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

**Unit IV: Feedback and Operational Amplifiers**

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

**Unit V: Digital CMOS circuits**

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

**Text Books:**

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

**References:**

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

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

INFORMATION THEORY AND CODING			
<b>Course Code:</b>	<b>EC308</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Probability, random variables, probability distribution and density functions, joint statistics, conditional statistics, independence, function of random variables and random vectors, expectation, moments, characteristic functions, convergence of a sequence, Central Limit theorem, random processes, mean, autocorrelation, stationary ergodicity, power spectral density, Gaussian, Poisson, and Markovian processes

**Unit II:** Information, Amount of Information, Unit of Information, Average Information or Entropy, Information Rate, Joint and Conditional Entropy, Discrete Memoryless Channel-Channel representation, channel matrix, properties of channel matrix, Special channels-(Lossless, Deterministic, Noiseless, Binary Symmetric Channel, Binary Channel, Binary Erasure Channel

**Unit III:** Mutual Information and Channel Capacity, Mutual Information and Channel Capacity for Special Channels. Coding to increase Average Information per Bit, Shannon's Theorem & Its Application, Capacity of Gaussian Channel, Shannon Hartley Theorem, Bandwidth & S/N Trade off

**Unit IV:** Source coding, Code Length and Code Efficiency, Source Coding Theorem, Fixed Length Codes, Variable Length Codes, Distinct Code, Prefix-free Codes, Uniquely Decodable Codes, Instantaneous Codes, Optimal Codes, Kraft Inequality.

**Unit V:** Source Coding Techniques: Shannon Fano and Huffman Coding Algorithms. Coding Efficiency Error control coding : Linear Block Codes, Systematic Linear Blocks Codes, Parity Check Matrix, Syndrome Testing, Cyclic code, Hamming Code, Error Detection and Correction Codes, Convolution Codes: State Diagram, Tree Diagram and Trellis Diagram, Maximum Likelihood Decoding, Viterbi decoding.

**Text Books:**

- [1] Taub & Schilling, Principles of Communication system, TMH.
- [2] Lathi B.P., Modern Analog and Digital Communication systems, Oxford Uni. Press.

**References:**

- [1] Haykin Simon, Digital Communication, Wiley Publication.
- [2] Proakis, Digital communication, McGraw Hill
- [3] Schaum's Outline series, Analog and Digital Communication.
- [4] B. Sklar, Digital Communication, Pearson Education.
- [5] Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
- [6] Singh and Sapre: Communication System, TMH
- [7] Couch: Digital and Analog Communication, Pearson Education

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

PRINCIPLES OF COMPUTER NETWORKS			
<b>Course Code:</b>	<b>CS310</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**UNIT I INTRODUCTION OF NETWORK MODEL**

Principal of computer Network, Internet, protocols and standards, network models, layered task, internet model, peer-peer processes, functions of layers, OSI model and TCP/IP model.

**UNIT II Physical Layer**

Analog and digital, analog signals, digital signals, analog vs. digital, data rate limit, transmission, digital transmission, line coding, block coding, sampling, transmission mode, modulation and digital data, telephone modem, modulation of analog signals, multiplexing: FDM, WDM, TDM. Guided media, unguided media, radio waves, microwaves, infrared, circuit switching, and telephone network.

**UNIT III DATA LINK LAYER**

Space division switch, time division switch, TDM bus, telephone network, high-speed digital access: DSL, cable modems and SONET, DSL technology, types of errors, detection, error correction. Flow and error control, ARQ, HDLC, point-to-point access, PPP stack, multiple access, ALOHA, random access, controlled access, channelization, LAN, Ethernet, wireless LANs, IEEE 802.11, bluetooth, connecting device, cellular telephone and satellite network circuit switching, frame relay.

**UNIT IV NETWORK LAYER AND TRANSPORT LAYER**

Routing and routing algorithms, addressing, IPv4, ICMP, ARP, IPv6 and ICMPv6 extensions and functionality, mobile IP, service integration and quality of service (QoS) in IP networks. Transport services, element of transport protocols, TCP and UDP, RTP, SCTP, congestion control and congestion avoidance, integrated services.

**Unit V: Application Layer**

Introduction to Application layer, SMTP, HTTP, Remote login, DNS, FTP, DHCP.

**Reference Books:**

1. Data Communications and Networking, Forouzan, 4<sup>th</sup> edition, McGraw Hill, 2007.
2. Data and Computer Communications, W. Stallings, 8<sup>th</sup> edition, Prentice Hall, 2007.
3. Computer Networks, S. Tanenbaum, 4<sup>th</sup> edition, Prentice Hall, 2003.
4. Internetworking With TCP/IP Volume 1: Principles Protocols, and Architecture, Douglas E Comer, 5<sup>th</sup> edition, PHI.
5. TCP/IP Protocol Suite, B.A. Forouzan, TMH, 3<sup>rd</sup> edition, 2006.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

**Effective from 2015-2016**

**(SEMESTER - VII)**

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

OPTICAL COMMUNICATION			
<b>Course Code:</b>	<b>EC401</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction**

Forms of communication system, evolution of fiber optic system, elements of a fiber transmission link, advantages of optical fiber communication

**UNIT II: Optical Fibers**

The nature of light, basic optical Laws, fiber types, electromagnetic theory of propagation of light in optical fibers, waveguide equations for step index fibers, modes in step index fiber, power flow in the step index fibers, graded index fiber, modes in graded index fiber. Fiber fabrication: outside vapor phase oxidation, vapor phase axial deposition, modified chemical vapor deposition, double crucible method, and mechanical properties of fibers. Signal degradation in optical fibers: absorption, scattering losses, bending loss, material dispersion, waveguide dispersion, intermodal distortion, pulse broadening in graded index waveguides. Fiber to fiber joints, fiber end face preparation. Fiber splicing: splicing techniques, optical fiber connectors.

**Unit III: Optical Sources**

Types of optical sources, Lasers: basic concepts, absorption and emission of radiation, population inversion, optical feedback and laser oscillation, p-n junction, spontaneous emission, stimulated emission and lasing, laser modes, single mode operation, non-semiconductor laser, Light emitting diodes: the double heterojunction LED, Planner LED, surface emitter LEDs, edge emitter LEDs, LED characteristics, optical output power, output spectrum, modulation bandwidth, reliability.

**Unit IV: Detectors and Amplifiers**

Device type, optical detection principles, absorption, quantum efficiency, responsivity, long wavelength cutoff, semiconductor photodiodes without internal gain, photodiodes with internal gain, phototransistors, photoconductive detectors, Optical amplifiers: semiconductor amplifiers, fiber amplifiers

**Unit V: Advanced Systems And Applications**

Wavelength Division Multiplexing, local area networks, photonic switching, nonlinear optical effects. Public network applications: trunk network, junction network, local access network, synchronous networks, military applications, optical sensor systems, computer applications

**Text Books:**

- [1] Senior, J M, "Optical Communication Principle and Practices", II edition Pearson Education Ltd, 2006.
- [2] 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] William B. Jones jr., Introduction to optical fiber communication systems, Holt,Rinehart and Winston, Inc

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SEMICONDUCTOR DEVICE MODELLING AND TECHNOLOGY			
<b>Course Code:</b>	<b>EC403</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Introduction**

Semiconductors, Conduction Mechanism, Contact Potentials, PN Junctions, Flat Band voltages, Potential Balance and Charge Balance, Depletion and Inversion Regions, Small Signal Capacitance.

**Unit II: MOS Transistor Models**

Contacting the inversion layer, Body Effect, Pinch Off Voltage, General Charge Sheet Model, Models based on Quasi Fermi potentials, Region of Inversions in terms of terminal voltages, Source Referenced and body referenced modeling, Effective mobility, Temperature effects, Breakdown.

**Unit III: MOS Transistor with Ion Implanted Models**

Charges and Threshold voltages, Drain to Source Current Model for strong inversion, Depletion MOSFets, need for n type implant, Surface Channel Enhancement Mode NMOS and PMOS, channel length Modulation, Punch Through, Barrier Lowering.

**Unit IV: MOS Transistor Large Signal Modeling**

Quasi Static operation, Quasi Static Models and its limitations, Non Quasi Static Modeling, The continuity equation, Non Quasi Static Analysis.

**Unit V: MOS Small Signal Models**

Low Frequency small signal model: Strong, Weak and Moderate Inversions, Medium Frequency small Signal Models, Intrinsic capacitances, White noise, Flicker Noise, Small Dimensions effects, High Frequency small signal models, High Frequency noise.

**Text Books:**

[1] Operation and Modelling of the MOS Transistor, Yannis Tsividis.

**References:**

[1] Carlos Galup Montoro: CMOS Analog Design using All Region MOSFET Modeling, Cambridge University Press.

[2] Guide Yuhua Cheng, Chenming Hu: MOSEFET Modeling and BSIM3 User's.

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Effective from 2015-2016

WIRELESS MOBILE COMMUNICATION			
<b>Course Code:</b>	<b>EC405</b>	<b>Credits:</b>	<b>4</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3+1T</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Cellular concept, frequency reuse, channel assignment schemes, handoff strategies, interference and system capacity, trunking, grade of service, coverage and capacity enhancement techniques

**Unit II:** Mobile radio propagation-free space propagation model, two ray model, link budget using path loss models, outdoor and indoor propagation models, small scale fading-multipath propagation, IR model, multipath measurements, parameters of multipath channels, small scale fading, statistical models for multipath fading channels

**Unit III:** Modulation techniques-overview of digital modulation, line coding, pulse shaping techniques, spread spectrum modulation-PN sequence, DS-SS, FH-SS, modulation performance in fading and multipath channels, speech coding-vocoder, LPC

**Unit IV:** Multiple access techniques-FDMA, TDMA, spread spectrum multiple access- FHMA, CDMA, SDMA, packet radio-protocols, CSMA protocols, reservation protocols, capacity of cellular systems

**Unit V:** GSM-services and features, architecture, radio sub systems, channels types, frame structure and signal processing, CDMA-specifications, forward and reverse CDMA channels, CT2, DECT, PACS, PDC, PHS

**Text books:**

- [1] Theodore S. Rappaport, “ Wireless Communication, Principles and Practice” Pearson
- [2] Kaveh Pahlavan, Prashant Krishnamurthy, “ Principles of Wireless Networks”, PHI

**References:**

- [1] W.C. Jakes: Microwave Mobile Communication, IEEE Press
- [2] Kaveh Pahlavan & Allen H. Levesque: Wireless Information Networks, Wiley series in Telecommunications and signal processing.
- [3] Kamilo Feher: Wireless Digital communications, Modulation and Spread Spectrum Applications. PHI

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

DESIGN WITH MICROCONTROLLERS			
<b>Course Code:</b>	<b>EC441</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: 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, 8051microcontroller hardware – I/O pins and internal architecture internal RAM, ROM organization, I/O port circuits, connecting external memory

**Unit II: Assembly Language Programming**

Addressing modes, data transfer, arithmetic, logical, branch transfer, stack and bit related instructions  
 Programming 8051for basic operations, connecting 8255 ,Programming tools and techniques

**Unit III: Interrupts**

Timer interrupt, serial port interrupt, external interrupt, reset, interrupt control, interrupt priority Interrupt destinations ,software generated interrupts, connecting A/D and D/A ,application programs using interrupt.

**Unit IV: Counter and timers**

Timer modes of operation ,timer counter interrupt ,counter ,serial data transmission ,reception, Serial data transmission modes , programming based on timer application and serial transmission.

**Unit V: Interfacing and applications**

Scanning programs for small keyboards interrupt driven programs, program for matrix keyboard LCD display, frequency measurement, pulse measurement, multiple interrupts, measurement and control of physical parameter as Temperature, stepper motor control

**Text Books:**

- [1] Mazidi Mazidi McKinley, the 8051 Microcontroller & Embedded system Using Assembly and C, 2/E Pearson Education, 2006
- [2] Kenneth J.Ayala, The 8051 Microcontroller, 3/E Penram International, 2007.

**Reference Books:**

- [1] A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
- [2] Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
- [3] V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.



## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

TELECOMMUNICATION SWITCHING AND NETWORKS			
<b>Course Code:</b>	<b>EC443</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, and WDM 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:** Frame relay, ATM, protocol architecture, logical connections, cells, AAL, High speed LAN, Ethernet, Fiber channel

**Text books:**

- [1] Syed R. Ali, "Digital Switching Systems, System Reliability and analysis, Tata McGraw-Hill  
 [2] William Stallings, "High Speed Networks and Internet" 2<sup>nd</sup> ed. Pearson Ed., 2005

**Reference:**

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SATELLITE COMMUNICATION			
<b>Course Code:</b>	<b>EC445</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit-I**

**Overview of satellite systems:** Introduction, Frequency allocations for satellite systems.

**Orbits and launching methods:** Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

**Unit-II**

**The Geostationary orbit:** Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits.

**Polarization:** antenna polarization, polarization of satellite signals, cross polarization discrimination.

**Depolarization:** ionospheric, rain, ice.

**Unit-III**

**The Space segment:** introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Anik-satellites, Advanced Tiros-N spacecraft.

**The Earth segment:** introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

**Unit-IV**

**The space link:** Introduction, Equivalent isotropic radiated power (EIPR), transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, inter-modulation noise, inter-satellite links. Interference between satellite circuits.

**Unit-V****Satellite services**

**VSAT (very small aperture terminal) systems:** overview, network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network.

**Direct broadcast satellite (DBS) Television and radio:** digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting.

**Text Books:**

- [1] D. Roddy: Satellite Communications, 4th Edition, TMH, New Delhi.
- [2] T. Pratt, C. Bostian and J. Allnut: Satellite Communications, 2nd Edition, Wiley India
- [3] D.C. Agarwal: Satellite Communications, Khanna Publishers.

**References:**

- [1] W. L. Pritchard, H. G. Snyderhoud and R. A. Nelson: Satellite Communication Systems Engineering, 2nd Edition, Pearson Education.
- [2] R. M. Gangliardi: Satellite Communications, CBS Publishers.
- [3] M. R. Chartrand: Satellite Communication, Cengage Learning.
- [4] Raja Rao: Fundamentals of Satellite communications, PHI Learning.
- [5] Monojit Mitra: Satellite Communication: PHI Learning.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

DIGITAL IMAGE PROCESSING			
<b>Course Code:</b>	<b>EC447</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Digital Image Processing (DIP)**

Introduction, examples of fields that use DIP, fundamental Steps in DIP, components of an image processing System., Digital Image Fundamentals- elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels

**Unit II: Image Transforms**

Two-dimensional (2-D) impulse and its shifting properties, 2-D continuous Fourier Transform pair, 2-D sampling and sampling theorem, 2-D Discrete Fourier Transform (DFT), properties of 2-D DFT. Other transforms and their properties: Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

**Unit III: Image Enhancement**

Spatial domain methods- basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and highboost filters), combined spatial enhancement method. Frequency domain methods- basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters), selective filtering.

**Unit IV: Image Restoration**

Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear Position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from Projection.

**Unit V: Image Compression**

Fundamentals of data compression- basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding. Digital Image Watermarking, Representation and Description- minimum perimeter polygons algorithm (MPP).

**Text Books:**

- [1] R. C. Gonzalez and R. E. Woods: Digital Image Processing, 3rd Edition, Pearson Education.
- [2] A. K. Jain: Fundamentals of Digital Image Processing, PHI Learning.
- [3] S. Annadurai and R. Shanmugalakshmi: Fundamentals of Digital Image Processing, Pearson Education.

**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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

COMMUNICATION NETWORKS AND TRANSMISSION LINES			
<b>Course Code:</b>	<b>EC449</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:**

Characteristic Parameters of symmetrical and asymmetrical two port networks and their design: image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfer coefficient, iterative transfer coefficient, Lattice and Bridged-T networks, reactive matching networks, matching techniques, Insertion Loss, symmetrical and asymmetrical attenuators and their design.

**Unit II:**

Passive LC Filters: Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters, composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, elliptic function approximation, frequency transformation.

**Unit III:**

Positive real function, LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function, Brune's method, Bott-Duffin method, Synthesis-Coefficient.

**Unit IV:**

Transmission line fundamentals: Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristic impedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less line, loading, liner reflection on a line, reflection coefficient, input and transfer impedances, open circuit and short circuit line, reflection factors, reflection loss, insertion loss, T and  $\pi$  equivalents of a line, location of line fault. Construction and design of two wire line and coaxial cable.

**Unit V:**

Line at radio frequencies, parameters of line and coaxial cable at radio frequencies, dissipation-less line, voltage and current on a dissipation-less line, standing waves, standing wave ratio, input impedance of open circuit and short circuit, power and impedance measurement on lines, eighth-wave, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching .introduction to micro-strip linesand its analysis.

**Text Book:**

- [1] J.D. Ryder: Networks and Transmission Lines, 2nd edition, PHI
- [2] Umesh Sinha: Networks and Transmission Lines, Satya Prakashan.

**References:**

- [1] M.E. Valkenberg: Introduction to Modern Network synthesis, Wiley Eastern Ltd.
- [2] G.K. Mithal: Network Analysis, Khanna Publishers.
- [3] Suresh: Electric Circuits and Networks, Pearson Education.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

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

**Unit I: Basic MOS Technology**

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

**Unit II: Circuit Design Processes and CMOS Logic Structures**

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

**Unit III: MOS Circuits Concepts**

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

**Unit IV: CMOS Subsystem Design and Processes**

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

**Unit V: Advance Topic**

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

**Text Books:**

- [1] CMOS VLSI Design – A Circuits and Systems Perspective, 3<sup>rd</sup> Edition, N.H. Weste and David Harris. Addison- Wesley, 2005.  
 [2] Basic VLSI Design - Douglas A. Pucknell & Kamran Eshraghian, PHI 3<sup>rd</sup> Edition, 2005.

**Reference Books:**

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

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

RADAR AND TV ENGINEERING			
<b>Course Code:</b>	<b>EC467</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I:** Elements of system of television, scanning sequence, interlacing determination of bandwidth synchronizing pulses, equalizing pulse, composite video signal, television camera tubes, monochrome picture tube.

**Unit-II:** Television transmitter, block diagram of T.V receiver, video detector design and operation of sound signal, transmitting and receiving antennas.

**Unit III:** Basic principle of colour T.V, three colour theory, colour mixing, chromaticity chart, colour picture tube, delta gun, PIL and Trinitron picture tube, PAL, SECAM and NTSE systems, brief introduction of VCP and VCR, introduction of HDTV.

**Unit IV:** Introduction to radar, radar frequencies, radar block diagram, radar equation and its performance factors such as cross section and its fluctuation, transmitter power, pulse repetition frequency. Antenna parameters, system losses and propagation effect.

**Unit V:** Doppler effect, CW radar, frequency modulated and multiple Doppler frequency radar, oving target indication radar, delay line canceller blind speed, duplexer, scanning and racking radar, lobe switching, monopoles, conical scan,Adcock antenna, instrument ending system (ILS) ground controlled approach(CGA) kit port surveillance radar (PSR), precision approach radar(PAR).

**Text Books:**

- [1]. R. R. Gulati: Monochrome and Colour Television, New Age Publication.
- [2]. M. I. Skolnik: Introduction to Radar Systems, TMH, New Delhi.
- [3]. M. Dhake: Television and Video Engineering, 2nd Edition, TMH, New Delhi.

**References:**

- [1]. R. G. Gupta: Television Engineering and Video Systems, TMH, New Delhi.
- [2]. Grob and Herndon: Basic Television and Video Systems, McGraw Hill International.
- [3]. P. Z. Peebles, Jr.: Radar Principles, Wiley India Pvt. LTD.
- [4]. Edde: Radar-Principles, Technology Applications, Pearson Education.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

ADVANCED COMMUNICATION NETWORKS			
<b>Course Code:</b>	<b>EC402/EC532</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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” 2<sup>nd</sup> ed. Pearson edu, 2005
- [3] Bellamy John, “ Digital Telephony” Wiley 3<sup>rd</sup> 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-Garcia, 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 Wesley.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

**Effective from 2015-2016**

**(SEMESTER - VIII)**  
**WCN**



## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

WIRELESS SYSTEM DESIGN			
<b>Course Code:</b>	<b>EC404/EC534</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, overlaid UMTS over GSM, CDMA system design-design methodology, deployment guidelines, traffic estimation, radio elements, fixed network design requirements, traffic models, link budget, case studies-CDMA2000 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, 2<sup>nd</sup> 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

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>DESIGN LAB-1</b>			
<b>Course Code:</b>		<b>Credits:</b>	<b>2</b>
<b>No. of Lab (Hrs/Week):</b>	<b>EC482</b>	<b>End Sem Exam Hours:</b>	<b>3</b>
<b>Total No. of Lab Sessions:</b>	<b>3</b>		
	<b>10</b>		

**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

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

Effective from 2015-2016

QOS IN NETWORKS			
<b>Course Code:</b>	<b>EC406/EC542</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 tail drop scenario, RED proactive 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](http://www.ietf.org)

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

VLSI FOR WIRELESS COMMUNICATION			
<b>Course Code:</b>	<b>EC408/EC566</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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<sub>3</sub> 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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

VLSI TEHCNOLOGY			
<b>Course Code:</b>	<b>EC410/EC536</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>ADVANCED RF ENGINEERING</b>			
<b>Course Code:</b>	<b>EC412/EC544</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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).

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

PROBABILITY AND STOCHASTIC PROCESSES			
<b>Course Code:</b>	<b>EC424/EC548</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, little'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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

ADVANCED MICROWAVE COMMUNICATION			
<b>Course Code:</b>	<b>EC426/EC550</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**Unit I: Microwave And Millimeter Wave Devices**

Overview of microwave and millimeter wave vacuum tube devices, limitations of microwave vacuum tubes, gyatron 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.



## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

NETWORKING PROTOCOLS			
<b>Course Code:</b>	<b>EC414/EC552</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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,  $\mu$ TP-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, 3<sup>rd</sup> edition, 2006.
- [3] Computer Networks, S. Tanenbaum, 4<sup>th</sup> edition, Prentice Hall, 2003.
- [4] Network Protocols: Signature Edition, Matthew G. Naugle. Mcgraw-Hill Signature Series.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

**Effective from 2015-2016**

[5] Network Protocols Handbook, Javlin, 4th edition, Javvin Technologies, Inc.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

MOBILE COMPUTING			
<b>Course Code:</b>	<b>EC416/EC554</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, 2<sup>nd</sup> 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, 2<sup>nd</sup> edition, 2004.
- [3] Mobile Commerce and Applications, Upkar Varshney, A tutorial at IEEE International Conference on Wireless Communications (WCNC), 1999.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

IMAGE PROCESSING AND BIOMETRICS			
<b>Course Code:</b>	<b>EC418/EC556</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>NETWORK PROGRAMMING</b>			
<b>Course Code:</b>	<b>EC420/EC558</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

CMOS RF CIRCUIT DESIGN			
<b>Course Code:</b>	<b>EC428/EC576</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 Circuit Design, layout and Simulation” PHI 1998

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

PRINCIPLES OF MEMS DESIGN			
<b>Course Code:</b>	<b>EC422/EC570</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

MULTIMEDIA TECHNIQUES			
<b>Course Code:</b>	<b>CS447/CS547</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>45</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>		<b>End Sem Exam Hours:</b>	<b>3</b>

**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.



## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SOFT COMPUTING			
<b>Course Code:</b>	<b>CS449/CS561</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, Petrus 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. Kilar, Bo yuan, 2005.
- [4] Foundations of Fuzzy logic and Soft Computing: 12<sup>th</sup> International Fuzzy conference proceeding, 2005.
- [5] Neural Networks Theory, Patricia Melin, Oxford University press, 2003
- [6] Neural Networks Theory and Application, Oscar Castillo, Wiley Eastern publication 2003.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.**

**Effective from 2015-2016**

**(SEMESTER - IX)**

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>OPTICAL NETWORKS</b>			
<b>Course Code:</b>	<b>EC562</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 Publication 1994.
- [2] Gowar J., Optical Communication Systems, PHI.
- [3] Senior, J M, “Optical Communication Principle and Practices”, II edition Pearson Education Ltd, 2006.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SECURITY IN WIRELESS NETWORKS			
<b>Course Code:</b>	<b>EC501/EC631</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, kerberos, 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:**

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

RESEARCH TECHNIQUES IN ICT			
<b>Course Code:</b>	<b>CS503/CS633</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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", 2<sup>nd</sup> 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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

COMPUTING LAB			
<b>Course Code:</b>	<b>EC582</b>	<b>Credits:</b>	<b>2</b>
<b>No. of Lab (Hrs/Week):</b>	<b>3</b>	<b>End Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lab Sessions:</b>	<b>10</b>		

**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.)

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<b>NETWORK RELIABILITY</b>			
<b>Course Code:</b>	<b>EC505/EC641</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, Multicommodity Flow Measures, Maximum Flow (Capacity) Measures, Performability Measures.

**Unit V: Maintability and Availability 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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SMART ANTENNA SYSTEMS			
<b>Course Code:</b>	<b>EC507/EC643</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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”, 2<sup>nd</sup> edition, John Wiley & Sons Inc., 1998.



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Effective from 2015-2016

BRAODBAND WIRELESS NETWORKS			
<b>Course Code:</b>	<b>EC509/EC645</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, 2<sup>nd</sup> Edition

**References:**

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

SENSOR NETWORKS			
<b>Course Code:</b>	<b>EC511/EC647</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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”.

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>AD-HOC WIRELESS NETWORKS</b>			
<b>Course Code:</b>	<b>EC513/EC649</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 Ilyas, "The Handbook of Ad Hoc Wireless Networks", CRC Press

**5 Year Dual Degree B. Tech. (Electronics & Communication Engineering)+ M.Tech.****Effective from 2015-2016**

<b>MULTICAST COMMUNICATION</b>			
<b>Course Code:</b>	<b>EC515/EC651</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

MODERN OPTIMIZATION TECHNIQUES			
<b>Course Code:</b>	<b>EC517/EC671</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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, Single-neuron perceptron, Multi-neuron perceptron- Perceptron Learning Rule, Constructing learning rules, Training multiple neuron perceptrons. Associative Learning: Simple associative network, Unsupervised Hebb rule- Hebb rule with decay, Instar rule, Kohonen rule. Widrow-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.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

MIXED SIGNAL VLSI DESIGN			
<b>Course Code:</b>	<b>EC519/EC675</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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 Tsvividis ,”Mixed Analog-Digital VLSI Device and Technology”.

**References:**

- [1] Roubik Gregorian ,”Introduction to CMOS Opamps and Comparators”.

## 5 Year Dual Degree B. Tech. (Electronics &amp; Communication Engineering)+ M.Tech.

Effective from 2015-2016

DSP INTEGRATED CIRCUITS			
<b>Course Code:</b>	<b>EC521/EC677</b>	<b>Credits:</b>	<b>3</b>
<b>No. of Lectures (Hrs/Week):</b>	<b>3</b>	<b>Mid Sem Exam Hours:</b>	<b>2</b>
<b>Total No. of Lectures:</b>	<b>45</b>	<b>End Sem Exam Hours:</b>	<b>3</b>

**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.