PONDICHERRY ENGINEERING COLLEGE, PUDUCHERRY – 605 014

CURRICULUM AND SYLLABI FOR AUTONOMOUS STREAM

M.TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING) COURSES

(FOR STUDENTS ADMITTED FROM ACADEMIC YEAR 2015-16 ONWARDS)

CURRICULUM

I SEMESTER

Subject Code	Subjects	Category	Periods			Marks			Credits
			L	T	P	CA	SE	TM	
MA155	Probability and Stochastic Process	TY	3	1	0	40	60	100	4
EC151	Advanced Digital Communication	TY	3	1	0	40	60	100	4
EC152	Advanced Digital Signal Processing	TY	3	1	0	40	60	100	4
EC153	Low Power CMOS VLSI Circuit Design	TY	3	1	0	40	60	100	4
	Elective I	TY	4	-	0	40	60	100	4
	Elective II	TY	4	-	0	40	60	100	4
EC154	Advanced Communication Systems and Networks Laboratory	LB	-	-	3	60	40	100	2
Total Credits									**26**

II SEMESTER

Subject Code	Subjects	Category	Periods			Marks			Credits
			L	T	P	CA	SE	TM	
EC155	RF System Design	TY	3	1	0	40	60	100	4
EC156	Embedded Systems and RTOS	TCM	3	-	2	50	50	100	4
	Elective III	TY	4	-	0	40	60	100	4
	Elective IV	TY	4	-	0	40	60	100	4
	Elective V	TY	4	-	0	40	60	100	4
	Elective VI	TY	4	-	0	40	60	100	4
EC157	Mini-project	PR	-	-	-	60	40	100	2
EC158	Research Methodology	PR	-	-	3	100	-	100	1
Total Credits									**27**

III SEMESTER

Subject Code	Subjects	Category	Periods			Marks			Credits
			L	T	P	CA	SE	TM	
EC159	Project Phase I	PR	-	-	-	150	150	300	9
Total Credits									**9**

IV SEMESTER

Subject Code	Subjects	Category	Periods			Marks			Credits
			L	T	P	CA	SE	TM	
EC160	Project Phase II	PR	-	-	-	200	200	400	14
	Professional Development Courses	PR	-	-	-	200	-	200	2
Total Credits									**16**

A representative list of *professional development courses* is given below:

a) Industrial Training(Limited to one credit)
b) Specific Field Knowledge Training (Limited to a maximum of two credits)
c) Seminar related with directed study(Limited to a maximum of two credits)
d) Paper Publication in SCI Journals(Limited to one credit)

CA- Continuous Assessment, **SE**-Semester Examination, **TM**- Total Marks

TY-Theory, **TCM**-Theory with a Mini Project**, LB**-Laboratory, **PR**- Practice

LIST OF ELECTIVES

Sl.No.	Subject Code	Subjects	Category
1.	**ECE51**	Cryptography and Wireless Security	TY
2.	**ECE52**	Wireless Sensor Networks	TY
3.	**ECE53**	Ubiquitous Computing	TY
4.	**ECE54**	Soft Computing	TY
5.	**ECE55**	Communication Networks Modelling and Simulation	TY
6.	**ECE56**	Computer Aided Design of VLSI Circuits	TY
7.	**ECE57**	Advanced Image Processing	TY
8.	**ECE58**	Advanced Microprocessor and Microcontroller	TY
9.	**ECE59**	Mobile Satellite Communication	TY
10.	**ECE60**	Speech and Audio Signal Processing	TY
11.	**ECE61**	Advanced Radiating Systems	TY
12.	**ECE62**	High Speed Networks	TY
13.	**ECE63**	MEMS and NEMS	TY
14.	**ECE64**	Multimedia Networking	TY
15.	**ECE65**	Wavelet Transforms and Applications	TY
16.	**ECE66**	RADAR Signal Processing	TY
17.	**ECE67**	Detection and Estimation Theory	TY
18.	**ECE68**	DSP Integrated Circuits	TY
19.	**ECE69**	Automotive Electronics	TY
20.	**ECE70**	Free Space Optical Communication	TY

Department: Mathematics		**Programme:** M.Tech.(Electronics & Communication Engineering)						
Semester : One		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
MA155	Probability and Stochastic Process	3	1	-	4	40	60	100
Prerequisite	Basic Probability and Statistics.							
Objectives	• To introduce moment generating function, probability generating function, characteristic function • To familiarize students with discrete and continuous distributions and stochastic process • To introduce queuing theory							
Outcome	• Knowledgeable in distributions and stochastic processes • Ability to demonstrate the application of stochastic processes and queuing theory							
UNIT – I	**Random Variables-Discrete Random Variables**						**Hours: 9**	
Random Variables and their Probability Distributions Random variables, Probability distribution function, Probability density function, Conditional probability, Statistical Independence, Bayes formula. Discrete Random Variables and their Distributions, Moment Generation Function, Characteristics Function, Cumulants, Probability generating function, Binomial Distribution, Negative Binomial Distribution, Hypergeometric distribution, Multinomial, Poisson Distributions, Relationship between various Discrete-Type distributions.								
UNIT – II	**Continuous Random Variables**						**Hours: 9**	
Continuous Random Variables and their Distributions Normal, Log - Normal, Multivariate Normal, Gamma, Exponential, Chi-square, Weibull, Rayleigh distributions. Relationship between continuous distributions.								
UNIT – III	**Transformation of Random Variables**						**Hours: 9**	
Transformation of Random Variables: Transformation of Single, Several Random Variables, Function of Random Variables, Sum, Differences, Product and Ratio of Two Random Variables, Transformation through characteristic Functions.								
UNIT – IV	**Stochastic Processes**						**Hours: 9**	
Stochastic Processes Introduction- Classification of stochastic process, Stationary process (SSS and WSS) Stationary process, Ergodic Process, Independent increment Process, Markov Process, Counting Process, Narrow- Band Process, Normal Process, Wiener-Levy Process, Poisson, Bernoulli, Shot noise Process, Autocorrelation Function.								
UNIT – V	**Queueing Models**						**Hours: 9**	
Introduction, Little's formula, M/G/1 queueing model, Continuous Parameter Markov Chain: The Birth and Death process: M/M/1, M/M/c, M/M/1/N, M/M/c/N (c<N), M/M/c/c, M/M/∞ models only - derivation of mean number of customer in the system, in the queue and waiting time - Simple applications, Special case of Birth and Death model (Pure Birth and Pure Death Processes).								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			
Text Books:								
1. KishorS.Trivedi ,Probability and Statistics with Reliability, Queueing and Computer Science Application, John Wiley & Sons Inc. Second Edition, 2002 2. D.Gross and C.M.Harris,Fundamentals of Queueing Theory, Wiley Students Edition, Third Edition, 1985.								
Reference Books:								
1. 1 .J.Medhi, Stochastic Processes, New Age International (P) Ltd., Second Edition, 2012. 2. 2. J.Medhi, Stochastic models in Queueing Theory, Academic Press, Second Edition, 2012.								
Website:								
1. www.nptel.ac.in								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : One		**Category** : TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC151	Advanced Digital Communication	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To understand the concept of different digital modulation schemes • To study optimum receivers suitable for communication channels • To understand the concepts of Pulse shaping and equalization • To have an in depth knowledge on concepts and theoretical limits set by Information theory • To learn the various coding schemes in detail							
Outcome	• Ability to select an appropriate modulation scheme when the transmitted signal is corrupted by AWGN in the channel • Knowledgeable in equalization techniques • Ability to set the limit for compression and transmission of information • Ability to use appropriate channel coding scheme to improve the performance of communication system over noisy channel							
UNIT – I	**Information Theory**				**Hours: 9**			
Information Measure and Entropy, Source coding and Shannon's Theorem, Source coding for Discrete Memoryless Sources, Discrete Memoryless Channels, Mutual Information and Channel capacity, Channel Coding Theorem, Continuous Sources and Differential Entropy.								
UNIT – II	**Channel Coding**				**Hours: 9**			
Introduction to linear block codes, Convolution coding,Systematic, Non-recursive and recursive codes, Maximum likelihood decoding, Viterbi algorithm ,Punctured convolutional codes, Dual-k codes, Concatenated codes . MAP and BCJR algorithms, Iterative decoding, Factor graphs, LDPC codes and Trellis coded modulation								
UNIT – III	**Digital Modulation Schemes**				**Hours: 9**			
Elements of digital communication system, Representation of Digitally Modulated Signals, Memory less modulation methods, Signaling Scheme with memory, Power spectrum of digitally modulated signals. Synchronization.								
UNIT – IV	**Receivers for AWGN Channel**				**Hours: 9**			
Waveform and vector Channel models, Waveform and vector AWGN Channel, Optimum detection and error probability for band limited signaling and power limited signaling- Non Coherent detection, A comparison of digital signaling methods, Optimum receiver for CPM.								
UNIT – V	**Band Limited Channels**				**Hours: 9**			
Characterization of Band Limited Channels, ISI, Nyquist Criterion, Controlled ISI channel with ISI and AWGN, Pulse Shaping for optimum transmission and reception, MLSE, Linear Equalization, Decision feedback equalization, ML detectors, Turbo and Blind Equalization methods.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			

Text Books:

1. John G. Proakis and Masoud Salehi, "Digital Communications," 5th edition, Tata McGraw Hill, 2008.

Reference Books:

1. Ian A. Glover and Peter M. Grant, Digital communications, 2nd edition, Pearson education, 2008.
2. Marvin K. Simon, Sami M. Hinedi and William C. Lindsey, Digital Communication Techniques: Signal Design and Detection Prentice Hall of India, 2009.
3. Bernard Sklar, Digital Communications: Fundamentals and Applications, 2nd edition, Pearson Education, 2002.

Website:

1. www.nptel.ac.in

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : One		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC152	Advanced Digital Signal Processing	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To learn about random signals and their processing techniques • To study the parametric and non-parametric methods of spectrum estimation • To understand the concepts of linear prediction and estimation • To design adaptive filters for non-stationary processes • To study and understand the multirate signal processing techniques							
Outcome	• Knowledgeable in random signals, random processes and filtering techniques for random processes • Knowledgeable in spectrum estimation methods • Ability to design predictors and estimators • Knowledgeable in adaptive filtering for non-stationary processes • Knowledgeable in multirate signal processing techniques							
UNIT – I	**Discrete Time Random Signal Processing**					**Hours: 9**		
Discrete Random Processes- Ensemble averages, Stationary processes, Autocorrelation and Autocovariance matrices, Ergodicity. Parseval's Theorem, Wiener-Khintchine Relation- White noise, Power Spectral Density, Filtering random processes, Low Pass Filtering of White Noise, Spectral Factorization, Parameter Estimation: Bias and Consistency.								
UNIT – II	**Spectrum Estimation**					**Hours: 9**		
Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation using Yule-Walker method.								
UNIT – III	**Linear Estimation and Prediction**					**Hours: 9**		
Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean square error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.								
UNIT – IV	**Adaptive Filters**					**Hours: 9**		
FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive (IIR) filters. RLS adaptive filters-Exponentially weighted RLS- Sliding window RLS.								
UNIT – V	**Multirate Digital Signal Processing**					**Hours: 9**		
Mathematical description of sampling rate conversion - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- direct form FIR structures, Polyphase filter structures. Multistage implementation of sampling rate conversion. Applications – Phase shifters – Interfacing of digital systems with different sampling rates - Sub band coding.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		

Reference Books:

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, Wiley India, 2008.
2. Simon Haykin, Adaptive Filter Theory, Fourth Edition, Pearson India, 2002.
3. John G. Proakis, DimitrisG.Manolakis, Digital Signal Processing, Fourth Edition, Prentice Hall of India, New Delhi, 2007.
4. John G. Proakiset.al., Algorithms for Statistical Signal Processing, Pearson Education, 2002.
5. Dimitris G.Manolakiset.al., Statistical and Adaptive Signal Processing, McGraw Hill, Newyork, 2000.

Website:

1. www.nptel.ac.in

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : One		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC153	Low Power CMOS VLSI Circuit Design	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To identify the sources of power consumption in a given VLSI Circuit • To understand the basic principle of low power • To gain knowledge on low power circuit design styles for VLSI circuits • To understand software power estimation and optimization methods for VLSI circuits							
Outcome	• Ability to design Low power CMOS digital circuits • Ability to examine different types of SRAMs/DRAMs for low power applications • Ability to design and implement low power arithmetic circuits and systems • Ability to demonstrate the level of abstract at which it is advantageous to implement low power techniques in a VLSI system design							
UNIT – I	**Introduction to Low Power VLSI Design and Analysis**					**Hours: 9**		
Introduction to low power VLSI design-Need for low power-CMOS leakage current-static current- Basic principles of low power design-probabilistic power analysis-random logic signal-probability and frequency-power analysis techniques-signal entropy.								
UNIT – II	**Circuit Level and Logic Level Design Techniques**					**Hours: 9**		
Circuit - transistor and gate sizing - pin ordering - network restructuring and reorganization - adjustable threshold voltages – logicsignal gating - logic encoding. Pre-computation logic.								
UNIT – III	**Special Low Power VLSI Design Techniques**					**Hours: 9**		
Power reduction in clock networks - CMOS floating node - low power bus - delay balancing Switching activity reduction - parallel voltage reduction - operator reduction -Adiabatic computation - pass transistor logic								
UNIT – IV	**Low Voltage Low Power Memories**					**Hours: 9**		
Basics of SRAM- Memory cell –Pre-charge and equalization circuit decoder-ATD Sense amplifier-Output latch-Low power SRAM technologies-types of DRAM –Basics of DRAM-Cell refresh circuit-HVG-BBG-BVG-RVG-VDC								
UNIT – V	**Software Design and Power Estimation**					**Hours: 9**		
Low power circuit design style - Software power estimation – Co-design for low power.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Reference Books:								
1. Gary YeapPractical Low Power Digital VLSI Design, Springer US, Kluwer Academic Publishers, 2002. 2. Kaushik Roy, Sharat C. Prasad, Low power CMOS VLSI circuit design, Wiley Inter science Publications,1987. 3. Kiat-Seng Yeo, Kaushik Roy, Low Voltage Low Power VLSI Subsystems, Tata Mc-Graw Hill, 2009.								
Website: 1. www.nptel.ac.in								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : One		**Category :** LB						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC154	Advanced Communication Systems and Networks Laboratory	-	-	3	2	60	40	100
Prerequisite								
Objectives	• To understand the working of communication system models • To understand and implement application using embedded development board • To simulate the different coding techniques suitable wireless scenario							
Outcome	• Ability to demonstrate the design of modulator and antenna used for wireless communication • Ability to simulate the GSM network suing Qualnet software and study the different parameters of the network • Ability to develop code to execute display and encoder using Spartan6 FPGA board • Ability to design filters suitable for wireless channel							

List of Experiments

1. Design of GMSK modulator for GSM system.
2. Design of Direct sequence spread spectrum system and study the spectrum of spreaded and despreaded signals.
3. Design of a Yagi antenna and study of the Return loss magnitude and phase characteristics.
4. BER Performance analysis of Convolutional, Turbo and LDPC codes.
5. Call establishment using different entities of GSM network using Qualnet.
6. Simulation of OFDM transmitter and receiver using Matlab.
7. Study of Spartan6 FPGA to perform the following operations
   i. Activating the traffic light controller interface
   ii. Enabling the Keypad Matrix interface with LEDs.
   iii. Enabling the graphic LCD interface in Spartan6 FPGA.
   iv Design and implementation of Manchester encoder.
8. Implementation of FIR filter (LP,HP,BP) using DSP trainer kit.
9. Implementation of IIR filter (LP,HP,BP) using DSP trainer kit.
10. Development of any one network topology, establish a routing protocol and analyse using NS2.
11. Modeling the 802.11 environment and study of the performance at network level and link level

Total contact Hours: -	**Total Tutorials: -**	**Total Practical Classes: 45**	**Total Hours: 45**

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Two		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC155	RF System Design	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To understand the different components of RF • To make RF system level design decisions • To understand real time applications in the field of RF system • To explain various methodologies in the RF active and passive circuits							
Outcome	• Knowledgeable in various types of RF filters, Mixers and Oscillators • Ability to demonstrate the design of RF transistor amplifiers • Ability to examine the performance of PLL and frequency synthesizers							
UNIT – I	**Transceiver Specifications and Architectures**					**Hours: 9**		
Transceiver Specifications-Two port Noise theory-Noise Figure-Phase noise- Specification distribution over a communication link-Transceiver Architectures: Receiver: Homodyne-Heterodyne-Image reject-Low IF Architectures–Transmitter: Direct upconversion-Two step upconversion.								
UNIT – II	**Impedance Matching and RF Transistor Amplifiers**					**Hours: 9**		
Passive IC components-Impedance matching networks Amplifiers: Common Gate-Common Source Amplifiers–Open circuit time constants in bandwidth estimation and enhancement–High frequency amplifier design-Low Noise Amplifiers: Power match and Noise match–Single ended and Differential LNAs–Terminated with Resistors and Source Degeneration LNAs								
UNIT – III	**RF Filter Design**					**Hours: 9**		
Modern filter design-Normalization and Low pass prototype-Filter types-Frequency and impedance scaling-High pass filter design-Dual Network-Band pass filter design-Band rejection filter design-Effect of finite Q.								
UNIT – IV	**PLL and Frequency Synthesizers**					**Hours: 9**		
PLL: Linearised Model–Noise properties–Phase detectors–Loop filters and Charge pumps-Frequency Synthesizers: Integer-N frequency synthesizers–Direct Digital Frequency synthesizers.								
UNIT – V	**Mixers and Oscillators**					**Hours: 9**		
Mixer: characteristics–Non-linear based mixers: Quadratic mixers–Multiplier based mixers-Single balanced and double balanced mixers–sub sampling mixers-Oscillators: Colpitts oscillators-Tuned Oscillators–Negative resistance oscillators-Resonators								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Text Books:								
1. Reinhold Ludwig, RF circuit design theory and applications, Pearson Asia Education, Edition 2001. 2. B. Razavi, RF Microelectronics, Pearson Education, 1997 3. Jan Crols, MichielSteyaert, CMOS Wireless Transceiver Design, Kluwer Academic Publishers, 1997.								
Reference Books:								
1. 1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill 2001 2. 2. D. Pozar, Microwave Engineering, John Wiley & Sons, New York 1998. 3. 3. Bahil and P. Bhartia, Microwave Solid State Circuit Design, John Willey & Sons, New York 1998								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Two		**Category :** TCM						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC156	Embedded Systems and RTOS	3	-	2	4	50	50	100
Prerequisite	.							
Objectives	• To give an overview on embedded system architecture and the various communication interfaces • To gain knowledge on software architectures and the services offered by RTOS • To study simple design using RTOS • To understand the steps involved in the embedded software development tool • To understand the programming concepts in embedded system design							
Outcome	• Knowledgeable in communication interfaces, basic concepts involved in RTOS and the services supported by RTOS • Ability to analyze the steps involved in software development tool • Ability to implement an RTOS based system by considering hard real time scheduling constraints • Ability to program a simple embedded system							
UNIT – I	**Introduction to Embedded Systems**					**Hours: 9**		
Categories of embedded systems, Overview of embedded system architecture, Recent trends in embedded systems, Communication interfaces: RS232/UART RS 422/RS485, USB, IEEE1394, Bluetooth, Zigbee, Wifi, I2C, SPI, CAN, IDE, PCI, and Networking.								
UNIT – II	**Survey of Software Architectures**					**Hours: 9**		
Round Robin, Round Robin with interrupts, Function Queue scheduling Architecture, RTOS Architecture, Architecture selection, Introduction to RTOS,- Task and task states, Task and data, Semaphore and shared data, More operating system services, - Message Queues, Mail boxes and pipes, Timer functions , events, Memory Management, Interrupt routine in an RTOS environment.								
UNIT – III	**Basic Design Using an RTOS**					**Hours: 9**		
Principle, Encapsulating Semaphores and Queues, Hard Real Time scheduling considerations, Saving memory space, Saving power.								
UNIT – IV	**Embedded Software Development Tools**					**Hours: 9**		
Host and Target Machines, Linker/ Locator for Embedded Software , Getting Embedded Software into the target system, Debugging Techniques, Testing on your host machine, Instruction Set Simulators, The Assert Macro, Using Laboratory tools.								
UNIT – V	**Writing Software for Embedded Systems**					**Hours: 9**		
The compilation process, Native versus cross compilers, Run time libraries, Writing a library, Using alternative libraries, Using a standard library, Porting Kernels, C extensions for Embedded Systems, Downloading, Emulation and Debugging Techniques, Buffering and other data structures, Linear buffer, Directional buffer, Double buffering, Buffer exchanging, Linked lists, FIFO, Circular buffers, Buffer under run and overrun, Allocating buffer memory, memory leakage, Memory and performance trade- offs.								
MINI PROJECT								
Mini Project using HC9S12 • Design and test an unsigned 10-bit digital filter (0 to 1023). Simulate the given input and display the data using SCI. • Design and test a signed 10-bit digital filter (0 to 1023). Simulate the given input and display the data using SCI. • Design and analyze IIR digital filter with up to 8 poles and 8 zeros. • Design a system to interface a 2 by 2 matrix keyboard by capturing the interrupts using input capture. De-bounce the keyboard using output compare interrupts. • Design a system to detect the digital waveform using an IR detector. Also measure the rising edge interrupts using input capture. • Design a real-time thread scheduler for fixed-time periodic threads. One task is low priority but the remaining three tasks are high priority threads. The high priority threads are run at fixed (but unequal)								

rates

- Using Port T and Port P on the 9S12 design a system to generate waves with a fixed period, but with a user programmable duty cycle.

Total contact Hours: 45	Total Tutorials: -	Total Practical Classes: 30	Total Hours: 75

Text Books:

1. Dr. K V K K Prasad, Embedded / Real time systems: Concepts, Design and Programming, Dream Tech press, New Delhi, 2003.
2. David Simon, Embedded Software Primer, Addison- Wesley, 1999.

Reference Books:

1. Raj Kamal, Introduction to Embedded Systems, Tata McGraw Hill Publications

Websites:

1. www.tik.ee.ethz.ch/education/lectures/ES/slides/6_RTOS.pdf
2. www.en.wikibooks.org/.../Embedded_Systems/Real-Time_Operating_Systems
3. www.rtos.com
4. www.cse.iitd.ernet.in/~suban/csl373/rtos.ppt

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Two		**Category :** PR						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC157	Mini project	-	-	-	2	60	40	100
Prerequisite	-							
Objectives	• To apply engineering concepts in order to come out with a technical solution • To analyze the outcomes and present the results in an appropriate way • To prepare a technical report of the project • To move from competitive learning to collaborative learning							
Outcome	• Ability to undertake a piece of research work • Ability to extend the project to find an application for society							

Mini Project

In the course of the degree Programme each group of not more than three students has to identify a mini project work in the area of their specialization and the mini project will be implemented under the supervision of a faculty. The progress of the work will be monitored and assessed internally. A project report has to be submitted at the end of the semester after completion of the project work. The semester examination will be evaluated by a panel of examiners.

Total contact Hours: -	**Total Tutorials: -**	**Total Practical Classes: -**	**Total Hours: -**

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Two		**Category :** PR						
Subject code	**Subject**	**Hours/week**			**Credit**	**Maximum marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC158	Research Methodology	-	-	3	1	100	-	100
Prerequisite	-							
Objectives	• To educate students to methods of selection of research problems • To expose students to different research methods							
Outcomes	• Students will be capable to identify and narrow down to the area of research on the basis the requirements of industrial and global requirements • Students will exhibit the domain skill to choose suitable research methods to execute research effectively • Students will possess knowledge to further their academic program, namely, Ph.D program.							

- **Definition of research:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Definition and Dimension of a Theory, Functions and Characteristics; Types of Theory: General Theory and Particular/ Empirical Theory. Cases and their Limitations; Causal Relations. Philosophy and validity of research. Objective of research.
- **Characteristics of research:** Various functions that describe characteristics of research such as systematic, valid, verifiable, empirical and critical approach.
- **Types of research:** Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches.
- **Research procedure:** Formulating the Research Problem, Literature Review, Developing the objectives, Preparing the research design including sample. Design, Sample size.
- **Considerations in selecting research problem:** Relevance, interest, available data, choice of data, Analysis of data, Generalization and interpretation of analysis.
- **Outcome of research:** Significance of report writing – Layouts of the research report – Types of reports – Oral presentation – Mechanics of writing research report – Precautions for writing research reports – Plagiarism and copy right violation – Patent writing and filing.

Total contact hours: -	**Total tutorials: -**	**Total practical classes:15**	**Total hours: 15**

Reference books:

1. Dawson, Catherine, Practical Research Methods, UBS Publishers and Distributors, New Delhi, 2002
2. Kothari, C.R., Research Methodology-Methods and Techniques, Wiley Eastern Limited, New Delhi, 1985.
3. Kumar, Ranjit, Research Methodology, A Step-by-Step Guide for Beginners, (2nd.ed), Pearson Education, Singapore, 2005.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Three		**Category** : PR						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC159	Project Phase I	-	-	-	9	150	150	300
Prerequisite	-							
Objectives	• To identify a research problem • To develop an abstract model that addresses the research problem • Build a prototype system or constrained implementation of the system that acts as a proof • Understanding the evaluation of the system • To present a critical analysis and present it as a report							
Outcome	• Ability to transform knowledge into an experimental process • Ability to demonstrate the motivation to extend the work to a research • Ability to identify and apply appropriate tools to solve a problem • Ability to examine hypotheses							
Each student will do an exhaustive literature survey and identify an experimental and / or a theoretical project to be carried out under a supervision of a guide. The phase I of the project work has to be completed by the end of third semester. The progress of the work will be monitored and assessed internally for 150 marks by a committee comprising departmental faculty members and project guide. A project report has to be submitted at the end of the semester after completion of the phase I of the project work. The external assessment will be carried out for 150 marks as per regulations.								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester : Four		**Category** : PR						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
EC160	Project Phase II	-	-	-	14	200	200	400
Prerequisite	-							
Objectives	• To identify a research problem • To develop an abstract model that addresses the research problem • Build a prototype system or constrained implementation of the system that acts as a proof • Understanding the evaluation of the system • To present a critical analysis and present it as a report							
Outcome	• Ability to transform knowledge into an experimental process • Ability to demonstrate the motivation to extend the work to a research • Ability to identify and apply appropriate tools to solve a problem							

The phase II of the project work has to be completed by the end of the fourth semester. The progress of the work will be monitored and assessed internally for 200 marks by a committee comprising departmental faculty members and project guide. A project report summarizing the entire project work has to be submitted at the end of the semester after completion of the phase II of the project work. The external evaluation will be carried out as per regulations for 200 marks.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE51	Cryptography and Wireless Security	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To understand Security Services, Attacks and Mechanisms as well as Symmetric Key Cryptographic techniques • To gain knowledge on number theory and public key management schemes • To understand the various Authentication Techniques • To study about system security and security blueprint • To analyze the basic concepts on wireless security and threats							
Outcome	• Ability to develop different symmetric key algorithms • Ability to develop application oriented PKC protocols • Ability todevelop authentication schemes pertaining to system requirements • Ability to demonstrate the evaluation of security among different network configurations by implementing security mechanisms and meeting out efficient security standards • Ability to implement efficient cryptosystems for wireless systems							
UNIT – I	**Introduction and Symmetric Key Encryption**					**Hours: 9**		
Attacks-Services-Mechanisms-OSI Security architecture-Model for Network Security- Symmetric Cipher Model-Substitution and Transposition Techniques- Simplified DES-DES Block Cipher Principles-The Strength of DES-Differential and Linear Cryptanalysis-Block Cipher Design Principles- Block Cipher Modes of Operation- Groups, Rings and Fields-Modular Arithmetic- Euclids Algorithm- Finite Fields of the Form GF(p)- Polynomial Arithmetic-Finite Fields of the Form GF(2n)-AES cipher- Triple DES								
UNIT – II	**Number Theory and Public Key Encryption and Authentication Schemes**					**Hours: 9**		
Prime Numbers-Fermats and Eulers Theorems-Testing of Primality-The Chinese Remainder Theorem-Discrete Logarithms-Principles of Public Key Cryptosystems-The RSA Algorithm-Key Management-Diffie-Hellman Key Exchange-Elliptic Curve Arithmetic- Elliptic Curve Cryptography. Authentication Requirements- Authentication functions-message Authentication Codes- Hash Functions- Security of Hash Functions and MACs-MD5 Message Digest Algorithm-Digital Signatures- Authentication Protocols-Digital Signature Standard.								
UNIT – III	**Network Security**					**Hours: 9**		
Authentication Application-Kerberos-Electronic Mail Security-Pretty Good Privacy-S/MIME-IP-Security Overview-IP Security Architecture-Authentication Header Encapsulation Security Payload- Web Security Considerations-Secure Sockets Layer and Transport Layer Security-Secure Electronic Transaction.								
UNIT – IV	**System Security and its Blueprint**					**Hours: 9**		
Intruders- Intrusion Detection-Password Management-Viruses and Related Threats- Viruses Counter Measures-Firewall Design Principles-Types of Firewalls-Firewalls Configurations-Trusted Systems- Blue Print for Security-Security Policy-Systems Specific Policy-NIST Security Models-VISA -International Security Model-Hybrid Framework.								
UNIT – V	**Wireless Threats and Security**					**Hours: 9**		
Kinds of security breaches - Eavesdropping - Communication Jamming - RF interference – Covert wireless channels - DOS attack – Spoofing - Theft of services - Traffic Analysis – Cryptographic threats - Wireless security Standards-Wireless Device security issues - CDPD security (Cellular Digital Packet Data)-GPRS security-(General Packet Radio Service) - GSM (Global System for Mobile Communication) security-– Security at the baseband layer and link layer-Security in heterogeneous wireless networks.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			
Text Books:								
1. William Stallings, Cryptography and Network Security-Principles and practice, 4th Edition, Prentice Hall of India, 2007. 2. Nichols and Lekka, Wireless Security-Models, Threats and Solutions, Tata McGraw – Hill, New Delhi, 2006.								

3. Merritt Maxim and David Pollino, Wireless Security, Osborne/McGraw Hill, New Delhi, 2005.

Reference Books:

1. Michael E.Whitman and Herbert J.Mattord ,Principles of Information security, 1st edition, 2003.
2. Bruce Schneier, Applied Cryptography, 2nd Edition, John Wiley & Sons, 1996.

Website:

1. www.nptel.ac.in

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE52	Wireless Sensor Networks	4	-	-	4	40	60	100

Prerequisite	
Objectives	• To expose the students to the fundamentals of wireless communication technologies • To introduce the ideas and need for Sensor networks • To study the Architecture and Middleware of WSN • To teach the role of MAC and Routing protocols • To introduce energy management in network protocols • To expose the students to the Applications of WSN • Enable the students to know techniques involved in network management
Outcome	• Knowledgeable in the concept of Sensor network and its Protocols • Ability to implement Wireless Sensor Network for various applications • Ability to examine the challenges in coverage and routing for energy efficiency • Ability to examine the possible node architectures for specific applications • Ability to sense Global Phenomena

UNIT – I	**Introduction**	**Hours: 12**

Cellular and Ad hoc wireless Networks – Mobile Ad-Hoc Networks – Sensor Networks – Comparison - Applications – Categories – Issues and challenges in designing a sensor network - Operating environment- Architecture – Sensor node technology – Hardware and Software – Performance Metrics – Taxonomy

UNIT – II	**Middleware and Transmission Technologies**	**Hours: 12**

Middleware - Functions – Architecture – Data management functions - **Operating Systems** – Design issues – Examples

Available wireless Technologies – WSN Campus Applications - Bluetooth – WLAN – Zigbee – WiMax – 3G and beyond - Performance modelling of WSN - Metrics – Task-driven sensing– **Basic models** –Traffic model – Energy model – Node model - **Network models –** MAC model – Routing model – System model

UNIT – III	**Mac Protocols for WSN**	**Hours: 12**

Fundamentals of MAC – Requirements and design constrains – MAC protocols for WSN - Schedule-based protocols - SMAC – LEACH – TRAMA – Contention-based protocols – CSMA – PAMAS – IEEE 802.15.4 – PHY layer – MAC layer.

Case study: Sensor-MAC

UNIT – IV	**Routing Protocols for WSN**	**Hours: 12**

Challenges and Issues – Data Dissemination and Gathering – Location Discovery - Routing strategies – Flooding and Gossiping – SPIN – PEGASIS **–** Geographical routing – Localised and globalised forwarding – Greedy perimeter stateless routing - GEAR - **Attribute-based routing** – Direct diffusion – Rumor routing – Geographic hash tables.

UNIT – V	**Transport Protocols and Applications of WSN**	**Hours: 12**

Design Issues – Feasibility of using TCP/UDP for WSN – Design Considerations – CODA – GARUDA – Performance of Transport Control Protocols.

Case Study: Sensing Global Phenomena

Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**	**Total Hours: 60**

Text Books:

1. Holger Karl, Andreaswillig, Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.
2. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004
3. Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.

Reference Books:

1. C. K. Toh, Ad Hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, PTR, 2001.
2. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.
3. Carlos de MoraisCordeiro , Dharma PrakashAgarwal, Ad hoc and Sensor Network : Theory and
4. Applications, 2nd Edition, World Scientific Publishing Corporation.

Websites:

1. http://www.ni.com/wsn/
2. http://www.sensor-networks.org/
3. http://www.crcpress.com/
4. Philip Levis, TinyOS Programming, 2006 – www.tinyos.net.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE53	Ubiquitous Computing	4	-	-	4	40	60	100
Prerequisite	-							
Objectives	• To understand the basics and vision of Ubiquitous computing • To study the emerging technologies • To study wireless LAN and security methods • To analyze the performance of Intelligent systems and interworking • To study different Ubiquitous communication networks							
Outcome	• Ability to characterize the wireless LAN in terms of mobility and deployment • Ability to demonstrate the performance of Ad hoc networks in terms of security issues • Ability to examine the performance of IS systems and IN • Knowledgeable in the types of Pervasive communication networks							
UNIT – I	**Ubiquitous Computing Basics and Vision**					**Hours: 12**		
Ubiquitous or Pervasive computing-Types of contexts-Enumeration based-Role based-Middleware and gateways-Core properties of UbiCom systems-Distributed ICT systems-Implicit Human-Computer Interaction- Autonomy-Architectural design for UbiCom systems-Ambient Computing-Elements of Pervasive Architecture-Requirements of Computational infrastructure-Ubiquitous computing applications-Standards								
UNIT – II	**Human-Computer Interaction**					**Hours: 12**		
Introduction- User interfaces and interaction for four widely used devices – Hidden UI via basic smart devices – Hidden UI via wearable and implanted devices – Human-centred design – User models								
UNIT – III	**Context Aware Systems**					**Hours: 12**		
Introduction-Modelling Context aware Systems-Types of Context- Architecture - Mobility awareness-Spatial awareness-Temporal awareness-Coordinating and Scheduling-ICT System awareness								
UNIT – IV	**Intelligent Systems, Networks and Interworking**					**Hours: 12**		
Introduction-Basic concepts-Types of IS-Use of intelligence in Ubiquitous Computing-IS Architectures-Types of IS models -IS Systems operation- Intelligence in Networks-IN Conceptual Model-Soft switch-Programmable Networks-Technologies and interfaces for IN.								
UNIT – V	**Ubiquitous Communications**					**Hours: 12**		
Audio Networks – Data Networks - Wireless data networks - Universal and Transparent Audio, Video and Alphanumeric Data Network Access-Ubiquitous Networks-Further Network Design Issues-Service Oriented Networks								
Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**				**Total Hours: 60**		
Text Books:								
1. Stefan Poslad, Ubiquitous Computing, John Wiley & Sons, 2010. 2. Frank Adelstein, Sandeep K.S. Gupta,Golden G. Richard III, Loren Schweibert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw-Hill, 2009								
Reference Books:								
1. AsokeTalkuder, Roopa R Yavagal, Mobile Computing- Technology, Applications and Service Creation, Tata McGraw Hill, 2007.								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject Name**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE54	Soft Computing	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To acquire knowledge about the fundamentals of fuzzy logic • To learn about neural networks and to gain thorough knowledge in NN algorithms • To study about Neuro-Fuzzy systems • To gain knowledge about genetic algorithms for adaptive systems							
Outcome	• Knowledgeable in Fuzzy set theory • Ability to characterize artificial neuron and biological neuron • Knowledgeable in BPN, RBF networks and genetic algorithm							
UNIT – I	**Introduction to Soft Computing**					**Hours: 9**		
Evolution of Computing - Soft Computing Constituents – Conventional AI to Computational Intelligence - Machine Learning Basic**.**								
UNIT – II	**Fuzzy Logic**					**Hours: 9**		
Crisp sets – Fuzzy sets – Operation and properties. Fuzzy relations – Equivalence and tolerance relations. Fuzzy membership functions- Types and definitions. Membership value assignments – Rule based systems. Fuzzy clustering- Types of fuzzy inference- Defuzzification.								
UNIT – III	**Artificial Neural Networks**					**Hours: 9**		
Introduction – Biological neuron – Artificial neuron – Neuron model – Supervised and unsupervised learning- Single layer – Multi layer feed forward network – Learning algorithm- Back propagation network.- RBF network								
UNIT – IV	**Neuro -Fuzzy Modeling**					**Hours: 9**		
Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks								
UNIT – V	**Genetic Algorithms**					**Hours: 9**		
Introduction to Genetic Algorithms – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition – Reproduction – Crossover – Mutation								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			

Text Books:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill, 1997.
2. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013.
3. S.Rajasekaran and G.A. VijayalakshmiPai, Neural Networks- Fuzzy Logic- and Genetic Algorithms Synthesis and Applications, Prentice Hall India, 2003.
4. Eiji Mizutani, Chuen Tsai Sun, JyhShing Roger Jang,Neuro-Fuzzy and Soft Computing : A Computational approach to learning and machine intelligence, Pearson Education, 2008

Reference Books:

1. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
2. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning,Addison Wesley, 1997.
3. S.N.Sivanandam · S.N.Deepa, Introduction to Genetic Algorithms, Springer, 2007

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE55	Communication Networks Modeling and Simulation	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To understand the concept of modeling • To generate and perform the parameter estimation • To analyze the source coding theorem • To analyze the performance of wireless communication system • To analyze the performance of CDMA cellular radio system							
Outcome	• Knowledgeable in steps involved in simulation study • Ability to demonstrate the methodology for simulating communication system operating over fading channels • Ability to demonstrate the cellular concept of Wireless Communication Systems							
UNIT – I	**Modeling and Simulation Approach**					**Hours: 9**		
Review of stochastic process and their properties. Methods of performance evaluation-simulation approach-Advantages and limitations. System model steps and its types involved in simulation study. Basic concepts of modeling – modeling of systems, devices, random process and hypothetical systems. Error sources in simulation. Validation, simulation environment and software issues.Role of simulation in communication system and random process. Steps involved in simulation study.								
UNIT – II	**Generation and Parameter Estimation**					**Hours: 9**		
Monte Carlo simulation, properties, random number Generation, Generating independent andcorrelated random sequences . Testing of random number generators.Parameter estimation: Estimating mean, variance, confidence interval, Estimating the Average Level of a Waveform, Estimating the Average power of a waveform, Power Spectral Density of a process, Delay and Phase.								
UNIT – III	**Modeling of Communication Systems**					**Hours: 9**		
Information sources, source coding, base band modulation, channel coding, RF and opticalmodulation, filtering, multiplexing, detection/demodulation- carrier and timing recovery for BPSK and QPSK. Modeling considerations for PLL.								
UNIT – IV	**Communication Channel Models**					**Hours: 9**		
Fading and multipath channels- statistical characterization of multipath channels and time-varying channels with Doppler effects, models for multipath fading channels. Finite state channel models – channels with and without memory. Methodology for simulating communication systems operating over fading channels.								
UNIT – V	**Performance Estimation and Evaluation**					**Hours: 9**		
Estimation of Performance Measures - Estimation of SNR, Performance Measures for Digital Systems, Importance sampling method, Efficient Simulation using Importance Sampling, Quasi analytical Estimation. Case Studies: (1) Performance of 16-QAM equalized Line of Sight Digital Radio Link, (2) performance evaluation of CDMA Cellular Radio System.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Text Books:								
1. M.C. Jeruchim, Philip Balaban and K.Samshanmugam, Simulation of communication systems, Plemum press, New York, 2007. 2. M.Law and W.DavidKelton , Simulation Modellingand analysis ,Tata McGraw Hill, New York, 2008.								
Reference Books:								
1. K.Hayes, Modelling and Analysis of computer communication networks, Plenum press, NewYork,1984. 2. Banks, J.S.Carson, Nelson and D.M.Nicol, Discrete –Event system simulation, 4th Edition, PrenticeHall of India, 2005 . 3. Z.Peebles ,Probability, Random Variable and Random Signal Principles, 4th edition, Tata McGraw Hill, 2002.								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE56	Computer Aided Design of VLSI Circuits	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To provide an overview of the VLSI physical design automation field • To introduce data structures that are used to model different problems in VLSI design • To introduce the basic algorithms used in VLSI physical design automation • To present the algorithms used for partitioning, floor planning, pin assignment • To introduce the physical design automation problem and algorithms for FPGA and MCM							
Outcome	• Knowledgeable in the trends in VLSI physical design automation field • Ability to apply data structures to model different problems in VLSI design • Ability to apply the basic algorithms for VLSI physical design automation • Ability to analyze and apply the algorithms used for partitioning, floor planning and pin assignment • Ability to formulate the physical design automation problem for FPGA and MCM and select the appropriate algorithms							
UNIT – I	**VLSI Physical Design Automation**						**Hours: 9**	
VLSI Design Cycle, Trends in VLSI Design Cycle and Physical Design Cycle, Design Styles - Full-Custom, Standard Cell, Field Programmable Gate Arrays, Comparison of Different Design Styles, System Packaging Styles, Die Packaging and Attachment Styles, Printed Circuit Boards, Multichip Modules, Wafer Scale Integration, Comparison of Different Packaging Styles, Existing Design Tools								
UNIT – II	**Data Structures and Algorithms for VLSI Physical Design**						**Hours: 9**	
Basic Data Structures- Atomic Operations for Layout Editors, Linked List of Blocks, Bin-Based Method, Neighbor Pointers, Corner Stitching, Multi-layer Operations, Limitations of Existing Data Structures, Layout Specification Languages, **Algorithms for Physical design**-Basic Terminology, Complexity Issues and NP-hardness, Classes of Graphs in Physical Design, Relationship Between Graph Classes, Graph Problems in Physical Design, Algorithms for Interval Graphs, Algorithms for Permutation Graphs, Algorithms for Circle Graphs								
UNIT – III	**Partitioning**						**Hours: 9**	
Introduction to Partitioning, Problem Formulation - Design Style Specific Partitioning Problems, Classification of Partitioning Algorithms, Group Migration Algorithms- Kernighan-Lin Algorithm, Extensions of Kernighan-Lin Algorithm, Fiduccia-Mattheyses Algorithm, Goldberg and Burstein Algorithm, Component Replication, Ratio Cut, Simulated Annealing and Evolution- Simulated Annealing, Simulated Evolution, Other Partitioning Algorithms- Metric Allocation Method, Performance Driven Partitioning								
UNIT – IV	**Floor Planning, Pin Assignment and Placement**						**Hours: 9**	
Placement - Problem Formulation, Classification of Placement Algorithms, Simulation Based Placement Algorithms, Partitioning Based Placement Algorithms, Other Placement Algorithms, Performance Driven Placement, Recent Trends **Floorplanning**- Problem Formulation, Classification of Floorplanning Algorithms, Constraint Based Floorplanning, Integer Programming Based Floorplanning, Rectangular Dualization, Hierarchical Tree Based Methods, Floorplanning Algorithms for Mixed Block and Cell Designs **Pin Assignment**- Problem Formulation, Design Style Specific Pin Assignment Problems, Classification of Pin Assignment Algorithms, General Pin Assignment,Channel Pin Assignment, Integrated Approach								
UNIT – V	**Physical Design Automation**						**Hours: 9**	
FPGAs - FPGA Technologies, Physical Design Cycle for FPGAs, Partitioning, Routing- Routing Algorithm for the Non-Segmented Model, Routing Algorithms for the Segmented Model, Basic Algorithm, Routing Algorithm for Staggered Model **MCM -** MCM Technologies, MCM Physical Design Cycle, Partitioning, Placement - Chip Array Based Approach, Full Custom Approach, Routing - Classification of MCM Routing Algorithms, Maze Routing, Multiple Stage Routing, Pin Redistribution Problem, Layer Assignment, Detailed Routing, Topological Routing, Integrated Pin Distribution and								

Routing, Routing in Programmable Multichip Modules			
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**	**Total Hours: 60**

Text Books:

1. Naveed A. Sherwani, Algorithms for VLSI physical design automation, Third edition, 2009 Springer Publishers.

Reference Books:

1. Sadiq M Sait, Habib Youssef, VLSI Physical Design Automation-Theory and Practice,World Scientific Publishers.
2. S. H. Gerez, Algorithms for VLSI Design Automation, 1999, Wiley student Edition, John Wiley and Sons (Asia) Pvt. Ltd.
3. Sung Kyu Lim, VLSI Physical Design Automation, Springer International Edition.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE57	Advanced Image Processing	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To introduce the fundamental concepts in digital image processing • To understand the need for transforms and to learn about different 2D transforms • To impart knowledge in image enhancement techniques • To get familiarized with image compression techniques • To learn about different segmentation methods • To get acquainted with the image registration and image fusion topics							
Outcome	• Knowledgeable in the fundamentals of image processing • Ability to analyze different 2D transforms in-depth • Knowledgeable in image enhancement techniques • Ability to examine segmentation and various segmentation techniques and image compression techniques • Ability to examine image registration and image fusion and the related topics							
UNIT – I	**Introduction**							**Hours: 09**
Introduction to Digital Image Processing Components of an Image Processing system-Image sensing and acquisition-Image sampling and quantisation -.Need for Imaging transforms- DFT–DCT-DST-Walsh Transform-Hadamard, Haar, Hough ,Radon, Slant, SVD and KVL transforms.								
UNIT – II	**Image Enhancement**							**Hours: 09**
Need for image enhancement -Point operations-Spatial filtering concepts: smoothing & sharpening filters, Transform domain filtering: smoothing & sharpening filters.								
UNIT – III	**Image Compression**							**Hours: 09**
Image compression model-Types of redundancy, lossless image compression algorithms: RLE, Bit-plane coding, Arithmetic coding, Dictionary based coding, lossless predictive coding - lossy compression algorithms: lossypredictive coding-vector quantization – Block Transform coding-Image compression standards.								
UNIT – IV	**Image Segmentation**							**Hours: 09**
Need for segmentation – Point, line and edge detection techniques – Thresholding- Region based segmentation – Watershed segmentation algorithm.								
UNIT – V	**Image Registration and Image Fusion**							**Hours: 09**
Registration-Block diagram of an image registration system, overview of image registration methods: Correlation and Sequential methods – Fourier method – Feature based methods- Active Contour methods- Point mapping-Mutual information methods. Image Fusion: Introduction to image fusion , Advantages and applications, Image fusion methods: Multiscale decomposition based methods and non-multiscale decomposition based methods.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods , Digital Image Processing, , Pearson Edition, 2013.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2013.
3. Ricks S.Blum, Zheng Liu, Multisensor Image Fusion and its Applicaticons, Taylor &Francis , 2006

Reference Books:

1. S.Jayaraman, Digital Image Processing, TMH Education Private Limited, New Delhi, 2009.
2. William K. Pratt , Digital Image Processing, , John Wiley & Sons, 3rd Edition, 2004.
3. Anil K. Jain, Fundamentals of Digital Image Processing, , PHI,2003.
4. Ardeshir Goshtasby, 2D and 3D Image Registration for Medical , Remote Sensing and Industrial Applications, John Wiley and Sons, 2005

Website:

1. www.nptel.ac.in

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE58	Advanced Microprocessor and Microcontroller	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To understand the high performance RISC and CISC architectures • To understand the programming concepts using ARM Processor • To introduce Motorola 68HC11 processor and its instruction set • To understand programming using Free scale HC9S9 Microcontroller							
Outcome	• Knowledgeable in the general microprocessor architecture • Ability to examine the difference between RISC and CISC architecture • Ability to write simple Program using the instruction set of ARM, Motorola and Free scale Microcontrollers							

UNIT – I	**Microprocessor Architecture**	**Hours: 9**
Instruction set – Data formats – Instruction formats – Addressing modes – Memory Hierarchy – Register file – Cache– Virtual memory and paging – Segmentation – Pipelining – Instruction pipeline – Pipeline hazards – Instruction level parallelism – Reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation – On-chip register files versus cache evaluation.		
UNIT – II	**High Performance CISC Architecture – Pentium**	**Hours: 9**
Software model – Functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipe lining – Branch prediction – Instruction and caches – Floating point unit – Protected mode operation – Segmentation – Paging – Protection – multitasking – Exception and interrupts – Input/Output – Virtual8086 model – Interrupt processing – Instruction types – Addressing modes – Processor flags – Instruction set – Basic programming of the Pentium Processor.		
UNIT – III	**High Performance RISC Architecture**	**Hours: 9**
ARM: The ARM architecture – ARM organization and implementation – The ARM instruction set – The thumbinstruction set – Basic ARM Assembly language program – ARM CPU cores.		
UNIT – IV	**Motorola 68HC11 Micro-Controller**	**Hours: 9**
68HC11 Processor architecture - Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – Parallel I/O ports – Flats– Real time clock – Programmable timer – Pulse accumulator – Serial communication interface – A/D converter – Hardware expansion – Basic Assembly Language programming.		
UNIT – V	**Freescale HC9S9 Micro-Controller**	**Hours: 9**
HC9S9 Processor architecture – Operating modes – I/O ports – Embedded C Programming - Interrupt - Key wake-up interrupt – Real time interrupt - Timers – Memory – Serial communication interface – ADC interface – Pulse width measurement.		

Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**	**Total Hours: 60**

Text Books:

1. Daniel Tabak, Advanced Microprocessors, McGraw Hill.Inc., 1995.
2. James L. Antonakos, The Pentium Microprocessor, Pearson Education, 1997.
3. SteaveFurber, ARM system – on – chip architecture, Addison Wesley, 2000.
4. Jonathan W. Valvano,Embedded Microcomputer Systems Real Time Interfacing, Cengage Learning, Third Edition, 209.

Reference Books:

1. Gene. H.Miller, Micro Computer Engineering, Pearson Education, 2003.
2. James L Antonakos, An Introduction to the Intel family of Microprocessors, Pearson
3. Education,1999.
4. Barry B.Breg,, The Intel Microprocessors Architecture, Programming and Interfacing, PHI, 2002.

Websites:

1. www.arm.com/Products/Processors/ARM Architecture.pdf
2. https://web.eecs.umich.edu/~prabal/.../ARM_Architecture_Overview.pdf
3. www.en.wikipedia.org/wiki/Freescale_68HC11

4. https://www.cs.uaf.edu/2007/fall/cs441/proj1notes/sawyer/
5. www.dee.ufrj.br/microproc/HC11/68hc11ur.pdf
6. www.ache.freescale.com/files/microcontrollers/doc/ref.../S9CPUV2.pdf

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE59	Mobile Satellite Communication	4	-	-	4	40	60	100
Prerequisite	-							
Objectives	• To learn the fundamentals of mobile satellite communication • To introduce the ideas and need for satellite communication • To study the Satellite system architecture • To understand the role of mobility management • To introduce inter-networking with mobile core networks • To be aware of the applications of MSS • To know the recent trends in mobile satellite communication							
Outcome	• Knowledgeable in identifying the constituents of Mobility management • Ability to demonstrate the challenges in Handover controlling schemes • Ability to demonstrate the possible Integration scenarios for various applications							
UNIT – I	**Introduction**							**Hours: 12**
Evolution – Satellite system Architecture – Types – Categorisation of MSS – Regulatory considerations – Design objectives – Network availability – Reliability – Service coverage – Network capacity – Characteristics of mobile services through terrestrial and satellite media – Applications of MSS – Practical limitations - Related satellite systems.								
UNIT – II	**Mobile Satellite Network**							**Hours: 12**
Satellite personal communication networks - Network architecture – Operational frequency – Mobile network propagation environment - Logical channels – Traffic channel – Control channel – Equations of satellite orbit – Aeronautical link – Maritime link – Fixed link.								
UNIT – III	**S-PCN Signaling and Mobility Management**							**Hours: 12**
Overview of GSM signaling – S-PCN interfaces & Signaling protocol architecture – Functional interfaces of a GMR system – Mobility management – Satellite cells and Satellite location areas –Location Management – Location updates - GCA approach – Terminal based approach – Handover management – Handover strategies – Handover controlling schemes – Resource management – Effects of satellite system characteristics – Effects of mobility.								
UNIT – IV	**Integrated Terrestrial - Satellite Mobile Network**							**Hours: 12**
Integration with PSTN – Gateway functions and operations – Protocol architecture of SS7 – Access functions – Integration with GSM – Integration Requirements – User requirements – Network operator requirements – Integration scenarios – Integration at BSC, MSC, BTS, GTS, GSC and GMSC – Dual mode terminal in terrestrial/SPCN integration – Session set up – Registration – call handling – Re-registration.								
UNIT – V	**Trends in Mobile Satellite Communication**							**Hours: 12**
Inter-networking with mobile core networks: Satellite integration with GSM/EDGE – a GERAN approach Satellite integration with UMTS – a UTRAN approach. **Prospective satellite markets**: Service category – super GEO's – Non-GEO stationary satellites – Hybrid constellations – Mobile broad band satellite services – Mobile IP – Fixed mobile convergence – High altitude platforms – Location based service delivery.								
Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**				**Total Hours: 60**		

Text Books:

1. Ray E. Sheriff and Y. Fun Hu, Mobile Satellite communication Networks, John Wiley & Sons, 2008.
2. Michael, J.Miller,BrankaVucetic and Les berry, Satellite Communication: mobile and fixed services, Kluwer Academic Publishers, 2007.
3. M.RichhariaMobile Satellite Communications, Principles and Trends, Pearson Education, 2007.

Reference Books:

1. StojceDimovIllcev , Global mobile satellite communication for maritime land and aeronautical Applications.http://w15.easy-share.com/11522731.html.
2. Peter Alfred Swan and Carrie L.Devieux, Global mobile satellite Systems: A systems overview, 2003.

Websites:

1. www.britannica.com/EBchecked/topic/524891/satellite-communication

2. www.radio-electronics.com/.../satellite/communications satellite/satellite.
3. www.dot.gov.in/data-services/vsat-satellite-communication.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE60	Speech and Audio Signal Processing	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To establish artificial models for speech production • To estimate speech parameters • To develop predictive model for speech compression • To analyze and apply model for automatic speech recognition							
Outcome	• Knowledgeable in speech production mechanism and nature of speech signal • Ability to characterize the frequency and time domain methods for speech analysis • Ability to formulate the speech predictive models by estimating the speech parameters • Ability to build an automatic speech recognition system							
UNIT – I	**Digital Models for Speech Signal**					**Hours: 9**		
Speech signal - Applications of digital speech processing - mechanism of speech production- acoustic theory of speech production- lossless tube models – digital models for speech signals.								
UNIT – II	**Time Domain Models for Speech Processing**					**Hours: 9**		
Time dependent processing of speech - Short- time energy and zero-crossing rate – Short time autocorrelation function (STACF)– pitch period estimation- digital representation of speech waveform - sampling and quantization – adaptive quantization – delta modulation and differential PCM								
UNIT – III	**Short Time Fourier Analysis**					**Hours: 9**		
Fourier transform interpretation – linear filtering interpretation – filter bank summation method – design of digital filter banks – pitch detection.								
UNIT – IV	**Linear Predictive Analysis**					**Hours: 9**		
Basic principles – computation of gain for the model – solution of LPC equations – prediction error signal – frequency domain interpretation of LP analysis – comparison to other spectrum analysis methods								
UNIT – V	**Homomorphic Speech Processing and ASR**					**Hours: 9**		
Short time cepstrum – computation of cepstrum – short time homomorphic filtering of speech – Application to pitch detection – Formant Estimation – Homomorphic Vocoder – Automatic Speech Recognition – Building a speech recognition system – decision process in ASR – challenges .								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Text Books:								
1. Rabiner and Schafer : Digital Processing of speech signal - fourth edition Pearson, 2009								
Reference Books:								
1. L.R. Rabiner and R.WSchafer :Introduction to Digital speech processing , Prentice Hall, 2007 2. Jacob Benesty, M. M. Sondhi, Yiteng Huang: Springer handbook of Speech Processing, Springer 2008								
Websites:								
1. Speech and audio signal processing – lectures notes : http://www.spg.tu-darmstadt.de/lectures/saap/lecturenotes_1/lecturenotes.en.jsp 2. Multimedia signal processing lecture notes: http://dea.brunel.ac.uk/cmsp/courses/ multimedia_signal_processing.html								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE61	Advanced Radiating Systems	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To understand the concept of various theorems involved in Radiating systems • To understand the effect of radiation from various types of apertures • To design different microstrip patch antennas • To study several array antennas • To study different measurement techniques involved in Radiating system							
Outcome	• Ability to design and fabricate rectangular and circular patch • Knowledgeable in determining the effect of adaptive antenna system • Ability to describe the effect of radiation from linear, uniform and phase arrays • Ability to characterize the radiations from various Slot, Horn and Reflector antennas							
UNIT – I	**Fundamental Parameters of Antennas**					**Hours: 9**		
Antenna fundamental parameters-Radiation integrals-Radiation from surface and line current distributions–dipole, monopole, loop antenna-Mobile phone antenna-base station antenna-Image, Induction and reciprocity theorem-matching techniques-Balance to unbalance transformer.								
UNIT – II	**Radiation from Apertures**					**Hours: 9**		
Field equivalence principle-Radiation from Rectangular and Circular apertures-Uniform aperture distribution on an infinite ground plane-Slot antenna-Horn antenna-Reflector antenna-aperture blockage and design consideration								
UNIT – III	**Antenna Arrays**					**Hours: 9**		
Linear array-uniform array-end fire and broad side array-gain, beam width, side lobe level-Two dimensional uniform array-Phased array-beam scanning-grating lobe-feed network-Linear array synthesis techniques-Binomial and Chebyshev distributions.								
UNIT – IV	**Microstrip Antennas**					**Hours: 9**		
Radiation Mechanism and Excitation techniques-Microstrip dipole-Rectangular patch- Circular patch- Ring antenna–radiation analysis from cavity model-input impedance of rectangular and circular patch antenna-Microstrip array-Microstrip broadband antennas-Log periodic-Biconical-Multi turn loop								
UNIT – V	**Smart Antennas and Antenna Measurements**					**Hours: 9**		
Adaptive antenna systems-Wide band smart antennas-Digital radio receiver & software radio for smart antennas-Antenna measurement and Instrumentation– Gain, Impedance and antenna factor measurement-Antenna test range Design								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			

Text Books:

1. Balanis.A, Antenna Theory Analysis and Design, John Wiley and Sons, New York, 1982.
2. Krauss.J.D, Antennas, II edition, John Wiley and sons, New York, 1997.
3. I.J. Bahl and P. Bhartia, Microstrip Antennas ,Artech House,Inc.,1980
4. W.L.Stutzman and G.A.Thiele, Antenna Theory and Design, 2nd edition, John Wiley & Sons Inc., 1998.

Reference Books:

1. 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,1999.
2. Hubregt.J.Visser, Antenna Theory and Applications 1st Edition, John Wiley & Sons Ltd, Newyork, 209.
3. W.L.Stutzman and G.A.Thiele, Antenna Theory and Design, 2nd Edition, John Wiley& Sons Inc., 1998.
4. S.Drabowitch, et.al,Modern Antennas , 2nd Edition Springer science business Media, Inc.2005.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE62	High Speed Networks	4	-	-	4	40	60	100
Prerequisite	-							
Objectives	• To develop a comprehensive understanding of multimedia networking • To study the types of VPN and tunneling protocols for security • To learn about network security in many layers and network management							
Outcome	• Ability to demonstrate ATM with its services • Knowledgeable in the functions of ISA and DSA architectures • Ability to examine the performance of MPLS based VPN • Ability to demonstrate security administration for ASN.1							
UNIT – I								**Hours: 12**
Review of OSI, TCP/IP and VDP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN Network elements; Network Monitoring; Network Control; network mechanisms ;Network Element Management								
UNIT – II	**Multimedia Networking Applications**							**Hours: 12**
Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services. Technology Trends in IP Networks, internet protocol, IP Packet Communications in Mobile Communication Networks ; Intelligent Network (IN) Scheme; Comparison with Conventional Systems ; Merits of the IN Scheme ; CATV.								
UNIT – III	**Advanced Networks Concepts**							**Hours: 12**
VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS- operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks- P2P connections.								
UNIT – IV	**ATM Networks**							**Hours: 12**
Introduction to ATM; The ATM Reference Model ; The ATM Layer; The ATM Adaptation Layer (AAL) ;AAL1 ;AAL2 ; AAL3/4 ; AAL5; Traffic Classes; Traffic Management and Quality of Service ; Traffic Descriptor ; Traffic Shaping; ABR and Traffic Congestion ;Network Management ; Layer Management; ATM Signalling ; ATM Addressing Format ;; Connection Establishment; IP/ATM Internetworking ;IP Multicast over ATM								
UNIT – V	**High Performance Networking with Wimax and Ultra Wideband (WPAN)**							**Hours: 12**
Introduction ; WiMAX Overview ; Competing Technologies ; Overview of the Physical Layer ; PMPMode ; Mesh Mode ; Multihop Relay Mode. Introduction; Time-Hopping Ultrawideband ;Direct Sequence Ultrawideband ; Multiband; Other Types of UWB.								
Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**			**Total Hours: 60**			

Text Books:

1. J.F. Kurose & K.W. Ross, Computer Networking- A top down approach featuring the internet, Pearson, 2ndedition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2 nd Edition, 2000.
3. Leom-Garcia, Widjaja, Communication networks, TMH seventh reprint 2002.

Reference Books:

1. Aunuragkumar, D. M Anjunath, Joy kuri, Communication Networking, Morgan Kaufmann Publishers, 1ed 2004.
2. HersentGurle& petit, IP Telephony, packet Pored Multimedia communication Systems, Pearson education 2003.
3. Fred Halsall and Lingana Gouda Kulkarni, Computer Networking and the Internet fifth edition, Pearson education 2006
4. Nader F.Mir ,Computer and Communication Networks, first edition 2010 8. Larry l.Peterson& Bruce S.David, Computer Networks: A System Approach- 1996.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE64	Multimedia Networking	4	-	-	4	40	60	100
Prerequisite								
Objectives	• To understand the concepts of emerging multimedia communication. • To learn the different applications of multimedia networking. • To understand the Performance parameters and standards of multimedia communication. • To learn the ideas of middleware technology and resource management. • To study distributed multimedia applications and their protocols.							
Outcome	• Knowledgeable in the multimedia communication model and network requirements. • Ability to understandarchitectures for network applications and multicasting. • Ability to demonstrateresource management,IP networking and multicasting. • Ability to understand different multimedia standards.							

UNIT – I	**Multimedia Communications**	**Hours: 12**
Introduction – Multimedia communication model – Elements of multimedia systems – User requirements – Network requirements – Packet transfer concept – Multimedia requirements – Multimedia terminals.		
UNIT – II	**Multimedia Networking**	**Hours: 12**
Human communication model – Symbol encoding - cognitive systems - convergence of telecommunication and computing – Architectures for network applications – Networked computers – integration – Transportable computation - Intelligent agents – Convergence – Technology Framework – Multimedia networking and Conferencing – Multicasting.		
UNIT – III	**Multimedia Standardization**	**Hours: 12**
Introduction – Standardization activities – Technology Cycle - Standards to build a New Global Information Infrastructure (GII) – Performance parameters – Functional Model – Implementation Model – Digital Audio / Video Standards - ITU-T standardization for Audio Visual communication – Video Coding standards – Speech Coding Standards – Multimedia Multiplex – Synchronization Standards – MPEG Standards for Multimedia Communication – Still Image Coding Standards.		
UNIT – IV	**Distributed Multimedia Systems**	**Hours: 12**
Distributed multimedia system – DMS resource management - IP networking – IP Multicasting – Real Time Protocol – Integrated Management Architecture for IP based Networks - Distributed Multimedia Application - IMS Evolution – Standards – Benefits - Architecture of IMS Network – Protocols – Session Control Protocol – AAA Protocol – Real Time Data Transfer Protocol – Policy Control Protocol – Call Flow in IMS Networks – Charging Functions – Online/Offline Charging Mechanisms.		
UNIT – V	**Middleware Technologies and Resource Management**	**Hours: 12**
Middleware Technologies for Multimedia Networks – Middleware Support Sensor Network Applications – Peer to Peer Middleware – Multimedia Traffic Management – Resource allocation - Bandwidth allocation - QOS in Network Multimedia system – QOS provision – QOS control – QOS Management - QOS architecture – Parameters – Classes of service – QOS based routing – Hybrid QOS management		

Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**	**Total Hours: 60**

Text Books:

1. Nalin K. Sharda, Multimedia Information Networking, PHI, 2002
2. K.R.Rao, Zoran S. Bojkovic, DragoradA.Milovanovic, Multimedia Communication Systems, PHI, 2010
3. K.R.Rao, Zoran S. Bojkovic, DragoradA.Milovanovic, Introduction to Multimedia Communication, John Wiley & Sons, 2011
4. Asoke K Talukder, Hasan Ahmed and Roopa R Yavagal, Mobile Computing, Tata McGraw Hill, 2010

Reference Books:

1. Raj Kamal, Mobile Computing, Oxford University Press, 2010.
2. Stefan Poslad, Ubiquitous Computing, Wiley India Edition, 2010
3. Frank Adelstein, Sandeep K.S Gupta, Golden G. Richard III and Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw Hill, 2010

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE65	Wavelet Transforms and Applications	3	1	-	4	40	60	100
Prerequisite								
Objectives	• To study the basics of signal representation and Fourier theory • To understand Multi Resolution Analysis and Wavelet concepts • To study the wavelet transform in both continuous and discrete domain • To understand the design of wavelets using Lifting scheme • To understand the applications of Wavelet transform							
Outcome	• Ability to demonstrate the use of Fourier tools to analyse signals • Knowledgeablein MRA and representation using wavelet bases • Knowledgeable in various wavelet transforms and design wavelet transform • Ability to demonstrate the applications of wavelet transform in various signal and image processing techniques							

UNIT – I	**Fundamentals**	**Hours:9**
Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and OrthonormalityRelationship Between Vectors and Signals – Signal Spaces – Concept ofConvergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion,Fourier transform, Short time Fourier transform, Time-frequency analysis.		
UNIT – II	**Multi Resolution Analysis**	**Hours: 9**
Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of GeneralOrthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT– Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.		
UNIT – III	**Continuous Wavelet Transforms**	**Hours: 9**
Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency– Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (DaubechiesCoiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.		
UNIT – IV	**Discrete Wavelet Transform**	**Hours: 9**
Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWTComputation by Filter Banks – Basic Properties of Filter Coefficients – Choice of WaveletFunction Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – MultiBand Wavelet Transforms Lifting Scheme- Wavelet Transform Using PolyphaseMatrixFactorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z – Domain.		
UNIT – V	**Applications**	**Hours: 9**
Wavelet methods for signal processing- Image Compression Techniques: EZW–SPHIT Coding –Image Denoising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions –Edge Detection and Object Isolation, Image Fusion, and Object Detection.		

Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**	**Total Hours: 60**

Text Books:

1. Rao R M and A S Bopardikar, —Wavelet Transforms Introduction to theory and Applications, Pearson Education, Asia, 2000.
2. L. Prasad & S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

Reference Books:

1. J. C. Goswami and A. K. Chan, Fundamentals of wavelets: Theory, Algorithms and Applications WileyIntersciencePublication,John Wiley & Sons Inc., 1999.
2. M. Vetterli, J. Kovacevic, Wavelets and subband coding Prentice Hall Inc, 1995.
3. Stephen G. Mallat, A wavelet tour of signal processing 2 nd Edition Academic Press, 2000.
4. Soman K P and Ramachandran K I, Insight into Wavelets From Theory to practice, Prentice Hall, 2004.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE66	RADAR Signal Processing	4	-	-	4	40	60	100
Prerequisite								
Objectives	• To understand the Radar Signal acquisition and sampling in multiple domains • To provide clear instruction in radar DSP basics • To equip the skills needed in both design and analysis of common radar algorithms • To understand the basics of synthetic aperture imaging and adaptive array processing • To illustrate how theoretical results are derived and applied in practice							
Outcome	• Knowledgeable in basic RADAR signal processing and signal models • Ability to demonstrate the sampling and quantization of pulsed RADAR signals • Ability to demonstrate moving target detection							
UNIT – I	**Introduction to Radar Systems**					**Hours: 12**		
History and application of radar, basic radar function, elements of pulsed radar, review of signalprocessing concepts and operations, A preview of basic radar signal processing, radar systemcomponents, advanced radar signal processing								
UNIT – II	**Signal Models**					**Hours: 12**		
Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model.								
UNIT – III	**Sampling and Quantization of Pulsed Radar Signals**					**Hours: 12**		
Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling inslow time: selecting the pulse repetition interval,sampling the doppler spectrum, Sampling in thespatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q.								
UNIT – IV	**Radar Waveforms**					**Hours: 12**		
Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.								
UNIT – V	**Doppler Processing**					**Hours: 12**		
Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing,dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, cluttermapping and the moving target detector, MTI for moving platforms: adaptive displaced phasecenter antenna processing.								
Total contact Hours: 60	**Total Tutorials: -**	**Total Practical Classes: -**				**Total Hours: 60**		

Reference Books:

1. Mark A. Richards McGraw-Hill, Fundamentals of Radar Signal Processing, New York, 2005
2. Francois Le Chevalier, Principles of Radar and Sonar Signal Processing, Artech House.
3. Michael O Kolawole ,Radar systems, Peak Detection and Tracking, 2010, Elseveir.
4. McGraw Hill, Introduction To Radar Systems 3/E, Skolnik.
5. Peyton Z. Peebles, Radar Principles, 2009 Wiley India
6. Fred E. Nathanson, Radar Design Principles-Signal Processing and the environment, PHI

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE68	DSP Integrated Circuits	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To study the procedural flow of system design in DSP and Integrated circuit • To analyse the frequency response and transfer function of DSP systems • To compare and study the performance of various transforms for signal processing • To design FIR and IIR filters for the given specifications • To study the architectures for DSP system • To study the design layout for VLSI circuits							
Outcome	• Knowledgeable in the various process technologies in VLSI • Ability to demonstrate the difference between the standard DSP architecture and application specific processor architecture • Knowledgeable in the various DSP algorithms • Ability to design FIR and IIR filter structure and analyze the sampling rate change with respect to integer factor • Ability to demonstrate the effects of noise due to scaling of the signal • Ability to design the necessary arithmetic units in a DSP and to generate VLSI layout							
UNIT – I	**DSP Integrated Circuits and VLSI Circuit Technologies**							**Hours: 9**
Standard digital signal processors, Application specific ICs 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**							**Hours: 9**
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**							**Hours: 9**
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**							**Hours: 9**
DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors andMulticomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSPalgorithms onto hardware, Implementation based on complex PEs, Shared memory architecture withBit – serial PEs.								
UNIT – V	**Arithmetic Units and Integrated Circuit Design**							**Hours: 9**
Conventional number system, Redundant Number system, Residue Number System, Bit-parallel andBit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers,Improved shift-accumulator. Layout of VLSI circuits, FFT processor, DCT processor and Interpolatoras case studies. Cordic algorithm.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Reference 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.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, Digital signal processing – A practical approach, Second Edition, Pearson Education, Asia.
4. KeshabK.Parhi, VLSI Digital Signal Processing Systems design and Implementation, John Wiley & Sons, 1999.

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE69	Automotive Electronics	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To understand the concepts of automotive electronics • To become aware of the different types of sensors and actuators used in automotive. • To understand the principles electronic fuel injection, ignition and digital control systems • To understand the basic electronic dashboard instruments • To understand the microcontroller architecture and its usage in IVN • To understand the IVN, its benefits and protocols							
Outcome	• Ability to demonstrate the concepts of automotive electronics • Ability to identify the type of sensor and actuator required for a specific function in automotive • Knowledgeable in the basic electronic dashboard instruments • Ability to demonstrate microcontroller's usage in IVN • Ability to implement IVN protocols							
UNIT – I								**Hours: 9**
Current trends in modern automobiles, Open and close loop systems-Components for electronic engine management, Electronic management of chassis system, Vehicle motion control								
UNIT – II								**Hours: 9**
Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor- Altitude sensor, flow sensor. Throttle position sensors. Solenoids, stepper motors, and relays								
UNIT – III								**Hours: 9**
Introduction, feedback carburetor systems. Throttle body injection and multi-port or point fuel injection, fuel injection systems, Injection system controls. Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control								
UNIT – IV								**Hours: 9**
Open loop and closed loop control systems-Engine cranking and warm up control-Acceleration enrichment-Deceleration leaning and idle speed control. Distributor less ignition-Integrated engine control systems, Exhaust mission control engineering. Electronic dashboard instruments-Onboard diagnosis system, security and warning system.								
UNIT – V								**Hours: 9**
Microcontroller Architecture – Memory, Low-Speed Input/Output Ports, High-Speed I/O Ports Need and benefits of IVN, Classes of IVN protocols, Multiplexed electrical systems, Vehicle multiplexing, Bitwise contention, Network elasticity, Error processing and management.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**			**Total Hours: 60**			
Text Book:								
1. Ronald K.Jurgen , Automotive Electronics Handbook, Mc-Graw Hill Inc,1999.								
Reference Book:								
1. William B. Ribbens, Understanding Automotive Electronics, Butterworth, Heinemann Woburn, 5th Edition, 1998.								

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE70	Free Space Optical Communication	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To learn the fundamentals, recent developments and applications of free space optics • To study about the factors affecting FSO communication • To learn the modulation, detection and coding techniques for FSO • To learn the mitigation techniques for improving the performance of FSO • To compare FSO with other approaches							
Outcome	• Knowledgeable in FSO systems, their installation and applications • Ability to model and analyze the effects of various factors like atmospheric turbulence on FSO signal communication • Knowledgeable in the tradeoff involved in choice of modulation and coding • Knowledgeable in the latest development and applications of FSO communication							
UNIT – I	**Fundamentals of Free Space Optics (FSO)**					**Hours: 9**		
Introduction to FSO communication- FSO architectures/topologies- FSO network implementation – integrated FSO for satellite, terrestrial and home networks – FSO MANET –underwater FSO communication-indoor FSO communication **FSO communication signal propagation through atmospheric channel:** FSO communication in the presence of atmosphere- optical propagation through atmospheric turbulence relevant to FSO communications- PDF models for FSO communication systems								
UNIT – II	**Modulation, Detection and Coding for FSO**					**Hours: 9**		
FSO communication channel models- AWGN channel, band limited channel, fading and randomly varying optical channel- modulation schemes in FSO communication- on/off keying, PPM and BPSK-channel capacity and coding for FSO communication. **Mitigation techniques for improved system performance:** Mitigation techniques for improved FSO communications -aperture averaging- diversity techniques-spatial diversity- time diversity- coding techniques-adaptive optics techniques								
UNIT – III	**Non-Line-of-Sight Ultraviolet and Indoor FSO Communication**					**Hours: 9**		
NLOS UV communication- UV communications- source-detector-channel model- performance analysis- indoor FSO system- indoor link configurations- indoor optical wireless system- propagation modeling **Free space optical platforms:** unmanned aerial vehicle FSO communication- UAV scenarios for FSO communication link- alignment and tracking- practical issues and recent development- mobile FSO communication								
UNIT – IV	**Chaostic and THz Free Space Communications**					**Hours: 9**		
Basics of chaotic optical communication- Chaotic FSO communication over turbulent channel- chaos based secure FSO communication link- indoor THz communication- THz wireless communication. Fundamental of free space quantum communication-quantum cryptography								
UNIT – V	**Installation of FSO Systems, Laser Safety and Alternative Access Technologies**					**Hours: 9**		
Installation of FSO systems –infrastructure installation-verifying the link-maintaining and supporting. Lasers and eyes- laser safety regulations-laser classification-methods to ensure eye safety. DSL-cable modems-power line communications-LMDS-MMDS-unlicensed microwave systems-fiber access-FSO versus the other alternatives								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**				**Total Hours: 60**		
Text Books								
1. Arun K. Majumdar, Advanced Free space optics – A systems approach, Springer, 2015 2. Heinz Willebrand and Bhaksheesh S. Ghuman, Free space optics: Enabling optical Connectivity in Todays network, SAMS publishing, 2002								
Reference Book:								
1. Arun K. Majumdar and JenifferRicklin, Free space laser communications, Springer, 2008								

Websites:
1. www. freespaceoptics.org 2. www.lightpointe.com

Department: Electronics and Communication Engineering		**Programme:** M.Tech.(Electronics and Communication Engineering)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE63	MEMS and NEMS	3	1	-	4	40	60	100
Prerequisite	-							
Objectives	• To introduce the concepts of micro electromechanical devices • To know the fabrication process of Microsystems • To understand the design concepts of micro sensors and micro actuators • To pioneer the concepts of quantum mechanics and nano systems							
Outcome	• Knowledgeable in the design of MEMS and NEMS Systems • Knowledgeable in the fabrication process of MEMS • Knowledgeable in the design of micro sensors and construction of micro actuators • Knowledgeable in the atomic structures and quantum mechanics of the nano systems • Ability to demonstrate the molecular and nanostructure dynamics; molecular wires and molecular circuits involved in the nano systems							
UNIT – I	**Overview and Introduction**						**Hours: 9**	
New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals.								
UNIT – II	**MEMS Fabrication Technologies**						**Hours: 9**	
Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.								
UNIT – III	**Micro Sensors**						**Hours: 9**	
MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor.								
UNIT – IV	**Micro Actuators**						**Hours: 9**	
Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, and Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.								
UNIT – V	**Nanosystems and Quantum Mechanics**						**Hours: 9**	
Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**			**Total Hours: 60**			

Reference Books:

1. Marc Madou, Fundamentals of Microfabrication, CRC press 1997.
2. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers,2001
3. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture,TataMcraw Hill, 2002.
4. Chang Liu, Foundations of MEMS, Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, MEMS and NEMS: Systems, Devices, and Structures CRC Press,2002

Websites:

1. http://ihome.ust.hk/~microsys/index.html
2. http://www.analog.com/en/index.html --MEMS and sensors.
3. http://home.earthlink.net/~trimmerw/mems/Stroud_Dbase.html

Department: Electronics and Communication Engineering		**Programme** : M.Tech (Electronics and Communication Engineering)						
		Category : TY						
Course Code	**Course Name**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ECE67	Detection and Estimation Theory	3	1	-	4	40	60	100
Prerequisite:	-							
Objectives:	• To enable the student to understand the basic principles of random signal processing, spectral estimation methods and their applications • To enable the student to understand the different signal detection and estimation methods • Communication system design and the implications of proper synchronization methods for proper functioning of the system							
Outcome:	• Ability to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and their applications • Ability to demonstrate an understanding of the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system • Ability to design a baseband system addressing the channel impairments							
UNIT – I	**Discrete Random Signal Processing**							**Hours: 9**
Discrete Random Processes- Ensemble Averages, Stationary processes, Bias and Estimation,Autocovariance, Autocorrelation, Parsevals theorem, Wiener-Khintchine relation, White noise,Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types ofRandom Processes – ARMA, AR, MA – Yule-Walker equations.								
UNIT – II	**Spectral Estimation**							**Hours: 9**
Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modifiedperiodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR andMA model based spectral estimation, Solution using Levinson-Durbin algorithm.								
UNIT – III	**Detection and Estimation Criteria**							**Hours: 9**
Detection criteria : Bayes detection techniques, MAP, ML,– detection of M-ary signals, NeymanPeason, minimax decision criteria. Estimation: linear estimators, non-linear estimators, Bayes,MAP,ML, properties of estimators, phase and amplitude estimation.								
UNIT – IV	**Synchronization**							**Hours: 9**
Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.								
UNIT – V	**Receivers for AWGN and Fading Channels**							**Hours: 9**
Optimum receivers for AWGN channel -Correlation demodulator, matched filter, maximumlikelihood sequence detector, envelope detectors for M-ary signals; Characterization of fadingmultipath channels, RAKE demodulator, Multiuser detection techniques.								
Total contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: -**						**Total Hours:60**

Reference Books:

1. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc, Singapore, 2002
2. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing, Pearson Education, 2002.
3. John G. Proakis., Digital Communication, 4 thedition, McGraw Hill Publication, 2001.
4. Bernard Sklar and Pabitra Kumar Roy, Digital Communications: Fundamentals & Applications, 2/E, Pearson Education India, 2009

5. John G. Proakis, MasoudSalehi, Communication Systems Engineering, Prentice Hall, 1994.
6. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, Digital communication receivers, Vol I &Vol II, John Wiley, New York, 1997.
7. Sergio Verdu, Multiuser Detection, Cambridge University Press, 1998.