# 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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subjects</th>
<th>Category</th>
<th>Periods</th>
<th>Marks</th>
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<tbody>
<tr>
<td>MA155</td>
<td>Probability and Stochastic Process</td>
<td>TY</td>
<td>3 1 0</td>
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<td>Advanced Digital Communication</td>
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<td>EC153</td>
<td>Low Power CMOS VLSI Circuit Design</td>
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**Total Credits** 26

### II Semester

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<td>RF System Design</td>
<td>TY</td>
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<td>40 60 100</td>
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**Total Credits** 27
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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
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<td>ECE53</td>
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<td>ECE55</td>
<td>Communication Networks Modelling and Simulation</td>
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<td>6.</td>
<td>ECE56</td>
<td>Computer Aided Design of VLSI Circuits</td>
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<td>ECE57</td>
<td>Advanced Image Processing</td>
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<td>8.</td>
<td>ECE58</td>
<td>Advanced Microprocessor and Microcontroller</td>
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<td>9.</td>
<td>ECE59</td>
<td>Mobile Satellite Communication</td>
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<td>ECE61</td>
<td>Advanced Radiating Systems</td>
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<td>Detection and Estimation Theory</td>
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<td>ECE68</td>
<td>DSP Integrated Circuits</td>
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<td>20.</td>
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<td>Free Space Optical Communication</td>
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Department: Mathematics  
Programme: M.Tech.(Electronics & Communication Engineering)  
Semester: One  
Category: TY  

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<td>MA155</td>
<td>Probability and Stochastic Process</td>
<td>3 1 - 4 40 60 100</td>
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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


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


UNIT – IV  
Stochastic Processes  
Hours: 9


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:

Reference Books:

Website:
1. www.nptel.ac.in
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech. (Electronics and Communication Engineering)

<table>
<thead>
<tr>
<th>Semester</th>
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<td>EC151</td>
<td>Advanced Digital Communication</td>
<td>3 1 -</td>
<td>4 40</td>
<td>60 100</td>
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</table>

**Prerequisite**
- 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

**Objectives**
- 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

**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**
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**
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**
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**
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**
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:**

**Reference Books:**

**Website:**
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<td>4</td>
<td>40</td>
<td>60</td>
<td>100</td>
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</table>

**Prerequisite**
- 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

**Objectives**
- 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

**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**  

**UNIT – II Spectrum Estimation**  

**UNIT – III Linear Estimation and Prediction**  
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**  

**UNIT – V Multirate Digital Signal Processing**  
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:**

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<td>EC153</td>
<td>Low Power CMOS VLSI Circuit Design</td>
<td>L 3, T 1, P -</td>
<td>C 4</td>
<td>CA 40, SE 60, TM 100</td>
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**Prerequisite**

- 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

**Objectives**

- 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

**Outcome**

- Ability to identify the sources of power consumption in a given VLSI Circuit
- To understand the basic principle of low power

**UNIT – I**

**Introduction to Low Power VLSI Design and Analysis**

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**

Circuit - transistor and gate sizing - pin ordering - network restructuring and reorganization - adjustable threshold voltages – logic signal gating - logic encoding. Pre-computation logic.

**UNIT – III**

**Special Low Power VLSI Design Techniques**

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**

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**

Low power circuit design style - Software power estimation – Co-design for low power.

**Reference Books:**


**Website:**

1. www.nptel.ac.in
### Department: Electronics and Communication Engineering | Programme: M.Tech. (Electronics and Communication Engineering)

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<td>- - 3 2</td>
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</table>

**Prerequisite**

- 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

**Objectives**

- 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

**Outcome**

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.
11. Modeling the 802.11 environment and study of the performance at network level and link level

**List of Experiments**

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**Total contact Hours:** -  
**Total Tutorials:** -  
**Total Practical Classes:** 45  
**Total Hours:** 45
### Department: Electronics and Communication Engineering

**Programme:** M.Tech. (Electronics and Communication Engineering)

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<td>TY</td>
<td>EC155</td>
<td>RF System Design</td>
<td>3 1 - 4</td>
<td>40 60 100</td>
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### Prerequisite

- 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

### Objectives

- 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

### Outcome

- 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 – I

**Transceiver Specifications and Architectures**

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**

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**

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**


### UNIT – V

**Mixers and Oscillators**

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: 0  Total Hours: 60

### Text Books:


### Reference Books:

**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech. (Electronics and Communication Engineering)

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<td>EC156</td>
<td>Embedded Systems and RTOS</td>
<td>3</td>
<td>2</td>
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</table>

**Prerequisite**

- 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

**Objectives**

- 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

**Outcome**

- \[\text{Introduction to Embedded Systems} \quad \text{Hours: 9}\]

- \[\text{Survey of Software Architectures} \quad \text{Hours: 9}\]
  - 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.

- \[\text{Basic Design Using an RTOS} \quad \text{Hours: 9}\]
  - Principle, Encapsulating Semaphores and Queues, Hard Real Time scheduling considerations, Saving memory space, Saving power.

- \[\text{Embedded Software Development Tools} \quad \text{Hours: 9}\]
  - 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.

- \[\text{Writing Software for Embedded Systems} \quad \text{Hours: 9}\]
  - 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, Printing out 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. Debounce 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.

<table>
<thead>
<tr>
<th>Total contact Hours: 45</th>
<th>Total Tutorials: -</th>
<th>Total Practical Classes: 30</th>
<th>Total Hours: 75</th>
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</thead>
</table>

**Text Books:**

**Reference Books:**

**Websites:**
1. www.tik.ee.ethz.ch/education/lectures/ES/slides/6RTOS.pdf
3. www.rtos.com
4. www.cse.iitd.ernet.in/~suban/csl373/rtos.ppt
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<thead>
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<th>Subject Code</th>
<th>Subject</th>
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<tr>
<td>EC157</td>
<td>Mini project</td>
<td></td>
<td>2</td>
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</table>

**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.
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech. (Electronics and Communication Engineering)

<table>
<thead>
<tr>
<th>Semester</th>
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<td>Subject code</td>
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<tr>
<td>EC158</td>
<td>Research Methodology</td>
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</table>

**Prerequisite**
- To educate students to methods of selection of research problems
- To expose students to different research methods

**Objectives**
- 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.

**Outcomes**
- **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
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
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<td>EC159</td>
<td>Project Phase I</td>
<td>-</td>
<td>9</td>
<td>150 150 300</td>
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</table>

**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 the 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.
<table>
<thead>
<tr>
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<td>CA  SE  TM</td>
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<tr>
<td>EC160</td>
<td>Project Phase II</td>
<td>-  -  -</td>
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<td>200 200 400</td>
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**Prerequisite**
- 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

**Objectives**
- 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.
<table>
<thead>
<tr>
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<th>Subject</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<td>ECES1</td>
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</tbody>
</table>

**Prerequisite**

- 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

**Objectives**

- Ability to develop different symmetric key algorithms
- Ability to develop application oriented PKC protocols
- Ability to develop 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

**Outcome**

UNIT – I
**Introduction and Symmetric Key Encryption**


UNIT – II
**Number Theory and Public Key Encryption and Authentication Schemes**


UNIT – III
**Network Security**


UNIT – IV
**System Security and its Blueprint**


UNIT – V
**Wireless Threats and Security**


**Text Books:**


**Reference Books:**

**Website:**
1. www.nptel.ac.in
<table>
<thead>
<tr>
<th><strong>Department:</strong> Electronics and Communication Engineering</th>
<th><strong>Programme:</strong> M.Tech.(Electronics and Communication Engineering)</th>
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<td><strong>Semester:</strong></td>
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<td></td>
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<tr>
<td>ECE52</td>
<td>Wireless Sensor Networks</td>
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</table>

**Prerequisite**
- 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

**Objectives**
- 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

**Outcome**
- 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

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

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

**UNIT – III**
**Mac Protocols for WSN**
- Hours: 12
- Case study: Sensor-MAC

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

**UNIT – V**
**Transport Protocols and Applications of WSN**
- Hours: 12
- Case Study: Sensing Global Phenomena

**Text Books:**
2. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004

**Reference Books:**

<table>
<thead>
<tr>
<th>Websites:</th>
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<tr>
<td>ECE53</td>
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</table>

**Prerequisite**: 
- 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

**Objectives**
- 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

**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

**Text Books:**

**Reference Books:**
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech.(Electronics and Communication Engineering)

<table>
<thead>
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<td>1</td>
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</table>

**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


**UNIT – II**
Fuzzy Logic  
Hours: 9


**UNIT – III**
Artificial Neural Networks  
Hours: 9


**UNIT – IV**
Neuro-Fuzzy Modeling  
Hours: 9


**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:**

**Reference Books:**
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech. (Electronics and Communication Engineering)  
**Semester:**  
**Category:** TY  

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<tr>
<td>ECE55</td>
<td>Communication Networks Modeling and Simulation</td>
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<td>40 60 100</td>
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</table>

**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**  

**UNIT – II**  
**Generation and Parameter Estimation**  

**UNIT – III**  
**Modeling of Communication Systems**  
Information sources, source coding, base band modulation, channel coding, RF and optical modulation, filtering, multiplexing, detection/demodulation- carrier and timing recovery for BPSK and QPSK. Modeling considerations for PLL.

**UNIT – IV**  
**Communication Channel Models**  
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**  

**Text Books:**

**Reference Books:**
<table>
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<th>Subject Code</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<td>ECE56</td>
<td>Computer Aided Design of VLSI Circuits</td>
<td>3 1 -</td>
<td>4 40 60 100</td>
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**Prerequisite**
- 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

**Objectives**
- 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

**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**


**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,


**UNIT – III**  
**Partitioning**  
**Hours: 9**


**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:**

**Reference Books:**
<table>
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<th>Subject Code</th>
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<tr>
<td>ECE57</td>
<td>Advanced Image Processing</td>
<td>3</td>
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<table>
<thead>
<tr>
<th>Prerequisite</th>
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<tbody>
<tr>
<td>To introduce the fundamental concepts in digital image processing</td>
</tr>
<tr>
<td>To understand the need for transforms and to learn about different 2D transforms</td>
</tr>
<tr>
<td>To impart knowledge in image enhancement techniques</td>
</tr>
<tr>
<td>To get familiarized with image compression techniques</td>
</tr>
<tr>
<td>To learn about different segmentation methods</td>
</tr>
<tr>
<td>To get acquainted with the image registration and image fusion topics</td>
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<table>
<thead>
<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>Knowledgeable in the fundamentals of image processing</td>
</tr>
<tr>
<td>Ability to analyze different 2D transforms in-depth</td>
</tr>
<tr>
<td>Knowledgeable in image enhancement techniques</td>
</tr>
<tr>
<td>Ability to examine segmentation and various segmentation techniques and image compression techniques</td>
</tr>
<tr>
<td>Ability to examine image registration and image fusion and the related topics</td>
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<table>
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<th>UNIT – II</th>
<th>Image Enhancement</th>
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<tbody>
<tr>
<td>Hours: 09</td>
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</table>

Need for image enhancement - Point operations - Spatial filtering concepts: smoothing & sharpening filters, Transform domain filtering: smoothing & sharpening filters.

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<thead>
<tr>
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<th>UNIT – IV</th>
<th>Image Segmentation</th>
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<tbody>
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<td>Hours: 09</td>
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</table>

Need for segmentation – Point, line and edge detection techniques – Thresholding- Region based segmentation – Watershed segmentation algorithm.

<table>
<thead>
<tr>
<th>UNIT – V</th>
<th>Image Registration and Image Fusion</th>
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<tbody>
<tr>
<td>Hours: 09</td>
<td></td>
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</table>

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.

<table>
<thead>
<tr>
<th>Total contact Hours: 45</th>
<th>Total Tutorials: 15</th>
<th>Total Practical Classes: -</th>
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Text Books:

Reference Books:

Website:
1. www.nptel.ac.in
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<tbody>
<tr>
<td>ECE58</td>
<td>Advanced Microprocessor and Microcontroller</td>
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**Prerequisite**
- 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

**Objectives**
- 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

**Outcome**
- To understand programming using Free scale HC9S9 Microcontroller
- To introduce Motorola 68HC11 processor and its instruction set
- To understand the programming concepts using ARM Processor
- To understand the high performance RISC and CISC architectures

**UNIT – I**
**Microprocessor Architecture**

**UNIT – II**
**High Performance CISC Architecture – Pentium**

**UNIT – III**
**High Performance RISC Architecture**

**UNIT – IV**
**Motorola 68HC11 Micro-Controller**

**UNIT – V**
**Freescale HC9S9 Micro-Controller**

**Text Books:**

**Reference Books:**
2. James L Antonakos, An Introduction to the Intel family of Microprocessors, Pearson

**Websites:**
1. www.arm.com/Products/Processors/ARM Architecture.pdf
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech.(Electronics and Communication Engineering)

<table>
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<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
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<th>Maximum Marks</th>
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<tr>
<td>ECE59</td>
<td>Mobile Satellite Communication</td>
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| 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**  

**UNIT – II**  
**Mobile Satellite Network**  

**UNIT – III**  
**S-PCN Signaling and Mobility Management**  

**UNIT – IV**  
**Integrated Terrestrial - Satellite Mobile Network**  

**UNIT – V**  
**Trends in Mobile Satellite Communication**  

**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.

**Text Books:**

**Reference Books:**

**Websites:**
1. www.britannica.com/EBchecked/topic/524891/satellite-communication
Department: Electronics and Communication Engineering
Programme: M.Tech.(Electronics and Communication Engineering)

Semester: 
Category: TY
Subject Code: ECE60
Subject: Speech and Audio Signal Processing

<table>
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<td>L T P C CA SE TM</td>
<td>3 1 - 4 40 60 100</td>
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</table>

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

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

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

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

Text Books:

Reference Books:

Websites:
1. Speech and audio signal processing – lectures notes : http://www.spg.tudarmstadt.de/lectures/saap/lecturenotes_1/lecturenotes.en.jsp
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
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<tr>
<td>ECE61</td>
<td>Advanced Radiating Systems</td>
<td>L T P C CA SE TM</td>
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<td>3 1 - 4 40 60 100</td>
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**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 systems

**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

- 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

- 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

- 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

- 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

- Adaptive antenna systems
- Wide band smart antennas
- Digital radio receiver & software radio
- Smart antennas
- Antenna measurement and Instrumentation
- Gain, Impedance and antenna factor measurement
- Antenna test range

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

**Text Books:**

**Reference Books:**
### Subject Code: ECE62

#### Subject: High Speed Networks

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<td>4 - - 40 60 100</td>
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</table>

#### 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


### 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

#### 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:

### Reference Books:
### Reference Books:

### Text Books:

### Programme: M.Tech.(Electronics and Communication Engineering)

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<th>Semester</th>
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<td>ECE64</td>
<td>Multimedia Networking</td>
<td>4</td>
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</table>

#### Prerequisite
- 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.

#### Objectives
- Knowledgeable in the multimedia communication model and network requirements.
- Ability to understand architectures for network applications and multicasting.
- Ability to demonstrate resource management, IP networking and multicasting.
- Ability to understand different multimedia standards.

#### Outcome
- To study distributed multimedia applications and their protocols.
- To understand the Performance parameters and standards of multimedia communication.
- To learn the different applications of multimedia networking.
- To understand the concepts of emerging multimedia communication.
- To learn the ideas of middleware technology and resource management.

#### UNIT – I
**Multimedia Communications**

#### UNIT – II
**Multimedia Networking**

#### UNIT – III
**Multimedia Standardization**

#### UNIT – IV
**Distributed Multimedia Systems**

#### UNIT – V
**Middleware Technologies and Resource Management**

**Total contact Hours: 60**
**Total Tutorials: -**
**Total Practical Classes: -**
**Total Hours: 60**
**Department:** Electronics and Communication Engineering  
**Programme:** M.Tech. (Electronics and Communication Engineering)

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<th>Subject Code</th>
<th>Subject</th>
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<th>Credit</th>
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<tr>
<td>ECE65</td>
<td>Wavelet Transforms and Applications</td>
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<td>4 40</td>
<td>60 100</td>
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</table>

**Prerequisite**
- 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

**Objectives**
- Ability to demonstrate the use of Fourier tools to analyse signals
- Knowledgeable in 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

**Outcome**
- Ability to demonstrate the use of Fourier tools to analyse signals
- Knowledgeable in 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

**UNIT – II**  
**Multi Resolution Analysis**  
Hours: 9
Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal 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 (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal) – Tiling of Time – Scale Plane for CWT.

**UNIT – IV**  
**Discrete Wavelet Transform**  
Hours: 9

**UNIT – V**  
**Applications**  
Hours: 9

**Text Books:**

**Reference Books:**
### ECE66 RADAR Signal Processing

<table>
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<th>Subject Code</th>
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<tr>
<td>ECE66</td>
<td>RADAR Signal Processing</td>
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</table>

#### Prerequisite
- 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

#### Objectives
- 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

#### 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 signal processing concepts and operations. A preview of basic radar signal processing, radar system components, 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 in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial 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, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phasecenter antenna processing.

#### Reference Books:
5. Peyton Z. Peebles, Radar Principles, 2009 Wiley India
### 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**

### UNIT – III
**Digital Filters and Finite Word Length Effects**
**Hours: 9**

### UNIT – IV
**DSP Architectures and Synthesis of DSP Architectures**
**Hours: 9**
DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and Multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PEs.

### UNIT – V
**Arithmetic Units and Integrated Circuit Design**
**Hours: 9**
Conventional number system, Redundant Number system, Residue Number System, Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift-accumulator. Layout of VLSI circuits, FFT processor, DCT processor and Interpolator as case studies. Cordic algorithm.

### Reference Books:
Department: Electronics and Communication Engineering  
Programme: M.Tech.(Electronics and Communication Engineering)

<table>
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<th>Subject Code</th>
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<td>ECE69</td>
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Prerequisite

- 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

Objectives

- 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

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:

Reference Book:
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

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

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

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

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

Arun K. Majumdar and Bhaksheesh S. Ghuman, Free space optics: Enabling optical Connectivity in Todays network, SAMS publishing, 2002
Heinz Willebrand and Bhaksheesh S. Ghuman, Free space optics: Enabling optical Connectivity in Todays network, SAMS publishing, 2002
### Websites:

1. [www.freespaceoptics.org](http://www.freespaceoptics.org)
2. [www.lightpointe.com](http://www.lightpointe.com)
<table>
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<th>Subject Code</th>
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<tr>
<td>ECE63</td>
<td>MEMS and NEMS</td>
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</table>

**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


**UNIT – II**
MEMS Fabrication Technologies


**UNIT – III**
Micro Sensors

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


**UNIT – V**
Nanosystems and Quantum Mechanics

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shroedinger 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**:
4. Chang Liu, Foundations of MEMS, Pearson education India limited, 2006,

**Websites**:
<table>
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<th>Course Code</th>
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<td>ECE67</td>
<td>Detection and Estimation Theory</td>
<td>3 L, 1 T, 1 P, 4 C</td>
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