### II Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PEC221C</td>
<td>Statistical Signal Processing</td>
<td>4.0</td>
</tr>
<tr>
<td>2</td>
<td>PEC222C</td>
<td>Wireless Communication</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>PEC223C</td>
<td>RF and Microwave Circuit Design</td>
<td>4.0</td>
</tr>
<tr>
<td>4</td>
<td>PEC224C</td>
<td>Error Control Codes</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>Elective – I</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>PEC225E</td>
<td>Wireless Ad hoc Networks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEC226E</td>
<td>Speech Processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEC227E</td>
<td>Network Security</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Elective – I</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>PEC228E</td>
<td>Advances in VLSI Design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEC229E</td>
<td>MEMS in Communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEC230E</td>
<td>Simulation and Modeling Analysis</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PEC231L</td>
<td>Communication Engineering Laboratory - II</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>26.0</td>
</tr>
</tbody>
</table>
**Course Title:** Statistical Signal Processing  
**Course Code:** PEC221C

<table>
<thead>
<tr>
<th>Credits: 4</th>
<th>Teaching Hours: 52 Hrs (13 Hrs/Unit)</th>
<th>Course Code: PEC221C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE Marks: 50</td>
<td>SEE Marks: 50</td>
<td>Total Marks: 100</td>
</tr>
</tbody>
</table>

**Department:** Electronics and Communication Engg.  
**Designation:** Core  
**Prerequisites:** Digital Signal Processing, Probability and Random Variables

### Course Objectives:

1. To provide a broad and coherent treatment of statistical signal processing concepts, techniques and algorithms.
2. To introduce different techniques of discrete-time signal modeling.
3. To provide a comprehensive treatment of optimum estimation, filtering and power spectrum estimation.
4. To provide knowledge of signal processing techniques for applications dealing with information extraction in real time situations governed by random processes and probabilistic models.

### Course Outcomes:

A student who successfully completes this course should be able to

1. Differentiate between digital signal processing and statistical signal processing.
2. Characterize random variables, random process, time varying signals and systems.
3. Model deterministic and non-deterministic signals.
4. Use recursion algorithms and design adaptive filters.
5. Use accurate spectrum estimation techniques in the development of transform domain based DSP algorithms.

*The topics that enable to meet the above objectives and course outcomes are given below:*

#### Unit I (13 hours)


#### Unit II (13 hours)

## Unit III (13 hours)

## Unit IV (13 hours)

### Reference Books
Course Title: Wireless Communication
Course Code: PEC222C

Credits: 4  
Teaching Hours: 52 Hrs (13 Hrs/Unit)  
Contact Hours: 4 Hrs/Week

CIE Marks: 50  
SEE Marks: 50  
Total Marks: 100

Department: Electronics and Communication Engg.
Designation: Core
Prerequisites: Digital Communication

Course Objectives:
1) To understand the examples of wireless communication systems, different generations of mobile networks, WAN and PAN.
2) To understand the concepts of basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference and concepts of outdoor propagation model.
3) To analyze and understand the various modulation techniques used in wireless communication.
4) To understand the Equalization, Diversity and Channel Coding fundamentals and channel accessing techniques.

Course Outcomes:
A student who successfully completes this course should be able to
1) Explain the evolution of wireless communication and examples for analog and digital communication systems like WLL, WLAN etc.
2) Design and analyze the frequency reuse for enhancing capacity of the cellular system.
3) Identify the modulation technique that is used for specific wireless communication standards.
4) Explain the significance of equalization, Diversity, Channel Coding and different channel access techniques.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)
Introduction to wireless communication systems: Evolution of mobile radio communications, Mobile radio standards, examples: Cordless telephone systems, cellular telephone systems, comparison of common wireless communication systems, Modern Wireless Communication Systems: Second generation (2G) cellular networks, Third generation (3G) wireless networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs)

Unit II (13 hours)
The Cellular System Design Introduction, frequency reuse, channel assignment, Hand off mechanism, interface and system capacity, trunking and grade of service, cell splitting, sectoring, repeaters, A microcell zone concept. Mobile Radio Propagation: Large - scale path loss: Outdoor propagation model: Okumura model, Hata Model
### Unit III (13 hours)

### Unit IV (13 hours)
Equalization, Diversity and Channel Coding: Fundamentals of equalization, training, linear and non linear equalizers, IMS and Zero forcing algorithms, diversity techniques, RAKE receivers, fundamental of channel coding, Reed-Solomon codes, Turbo and Trellis codes. Multiple Access Techniques: FDMA, TDMA, FHMA, CDMA and SDMA, capacity of CDMA and SDMA.

### Reference Books
Course Title: RF and Microwave Circuit Design  
Course Code: PEC223C

<table>
<thead>
<tr>
<th>Credits: 4</th>
<th>Teaching Hours: 52 Hrs (13 Hrs/Unit)</th>
<th>Contact Hours: 4 Hrs/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE Marks: 50</td>
<td>SEE Marks: 50</td>
<td>Total Marks: 100</td>
</tr>
</tbody>
</table>

Department: Electronics and Communication Engg.  
Designation: Core  
Prerequisites: Transmission Lines and Microwave Engineering

Course Objectives:
1) To make the students to know why basic circuit theory fails as the frequency increases to a level where the wavelength becomes comparable with discrete circuit components.
2) To introduce the students to topics such as fundamental transmission line theory.
3) To educate the student to know the physical reason for transitioning from lumped to distributed circuit representation.
4) To educate the students about Smith chart for solving transmission-line problems.
5) To educate the students about design of RF filters.
6) To introduce the students of semiconductor fundamentals.

Course Outcomes:
A student who successfully completes this course should be able to understand
1) Why basic circuit theory fails as the frequency increases.
2) The concepts of transmission line theory.
3) Transmission line distributed circuit components.
4) Use of Smith chart.
5) Basic knowledge of RF circuit design.
6) Semiconductor fundamentals.

The topics that enable to meet the above objectives and course outcomes are given below:

**Unit I (13 hours)**

**Unit II (13 hours)**


**Unit III (13 hours)**


**Unit IV (13 hours)**


**Reference Books**

**Course Title:** Error Control Codes  
**Course Code:** PEC224C  
**Credits:** 4  
**Teaching Hours:** 52 Hrs (13 Hrs/Unit)  
**Contact Hours:** 4 Hrs/Week  
**CIE Marks:** 50  
**SEE Marks:** 50  
**Total Marks:** 100  

**Department:** Electronics and Communication Engg.  
**Designation:** Core  
**Prerequisites:** Information Theory and Coding

### Course Objectives:
1. To provide the knowledge of algebra that is necessary to understand the materials in latter chapters.
2. To study in detail the fundamentals of linear block codes and several important class of linear block codes.
3. To study the Encoding, Decoding and error correction of various error control codes.
4. To provide the important concept of concatenated codes, turbo codes and the area of code modulation.
5. To study the methods for correcting the burst errors and combination of burst and random errors.

### Course Outcomes:
A student who successfully completes this course should be able to
1. Understand groups, field and coding concepts built upon them.
2. Understand and identify the role of error control coding techniques and implement some of the error-control codes discussed in class.
3. Apply error control coding to achieve error detection and correction in digital transmission systems.
4. Compare the error correction capability of different error control codes.

*The topics that enable to meet the above objectives and course outcomes are given below:*

### Unit I (13 hours)
Introduction to Algebra: Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF(2^m) and its Basic Properties, Computation using Galois Field GF(2^m), Vector spaces and Matrices. Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block Code, Error Detecting and Correcting Capabilities of Block Code, Standard Array and Syndrome Decoding, Single Parity Check Codes, Repetition codes and Self Dual Codes. Important Linear Block Codes: Hamming Codes, Reed-Muller Codes, The (24,12) Golay Code, Products Codes and Interleaved Codes (Qualitative treatment).

### Unit II (13 hours)
Cyclic Codes: Description of Cyclic Codes, Generator and Parity Check Matrices, Encoding and Decoding of Cyclic Codes, Syndrome Computation and Error Detection, Meggitt Decoder Shortened Cyclic Codes. BCH Codes: Binary Primitive BCH Codes, Decoding of BCH Codes using Gorenstein-Zierler algorithm, Implementation of Galois Field Arithmetic, Implementation of Error Correction. Non-Binary BCH codes: q- ary Linear Block Codes, Primitive BCH Codes over GF (q), Encoding of Reed-Solomon code.
### Unit III (13 hours)
Convolutional Codes: Connection Pictorial Representation, Convolutional Encoding-Time Domain Approach, Transform Domain Approach, Structural and Distance Properties, Optimum Decoding of Convolutional Codes: The Viterbi Algorithm, Suboptimum Decoding of Convolutional Codes: The ZJ (Stack) Sequential Decoding Algorithm, The Fano Sequential Decoding Algorithm, Majority Logic Decoding.

### Unit IV (13 hours)
Concatenated Codes: Single-Level Concatenated Codes, Multi Level Concatenated Codes, Soft- Decision Multi Stage Decoding, Turbo Codes: Introduction to Turbo Coding, Trellis Coded Modulation: Introduction to TCM, TCM code construction, Burst Error Correcting Codes: Introduction, Decoding of Single Burst Error correcting Cyclic Codes and Single Burst Error Correcting Codes, Burst and Random Error Correcting Codes.

### Reference Books

<table>
<thead>
<tr>
<th>Course Title: Wireless Ad hoc Networks</th>
<th>Course Code: PEC225E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits: 4</td>
<td>Teaching Hours: 52 Hrs (13 Hrs/Unit)</td>
</tr>
<tr>
<td>Contact Hours: 4 Hrs/Week</td>
<td>CIE Marks: 50 SEE Marks: 50</td>
</tr>
<tr>
<td>Total Marks: 100</td>
<td></td>
</tr>
</tbody>
</table>

**Department**: Electronics and Communication Engg.

**Designation**: Elective

**Prerequisites**: Computer Networks

**Course Objectives:**
1) To understand need for wireless networks.
2) To know the constraints of physical layer that affects the design and performance of ad hoc network.
3) To know the operations and performance of various MAC layer protocols, unicast routing protocols and transport layer protocols proposed for ad hoc networks.
4) To understand security issues and QoS requirements.

**Course Outcomes:**
A student who successfully completes this course should be able to
1) Understand the challenges in design of wireless networks.
2) To know the media constraints of wireless networks
3) Analyze the protocols at MAC and routing layers of ad hoc networks.
4) Understand and analyze attacks pertaining to network layer.

*The topics that enable to meet the above objectives and course outcomes are given below:*

### Unit I (13 hours)

### Unit II (13 hours)
<table>
<thead>
<tr>
<th><strong>Unit III (13 hours)</strong></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Unit IV (13 hours)</strong></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Reference Books</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1) C. Siva Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks, Architectures and Protocols, Pearson Education</td>
<td></td>
</tr>
<tr>
<td>Course Title: Speech Processing</td>
<td>Course Code: PEC226E</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Credits: 4</td>
<td>Teaching Hours: 52 Hrs (13 Hrs/Unit)</td>
</tr>
<tr>
<td>Contact Hours: 4 Hrs/Week</td>
<td>See Marks: 50</td>
</tr>
<tr>
<td>Total Marks: 100</td>
<td></td>
</tr>
<tr>
<td>CIE Marks: 50</td>
<td></td>
</tr>
</tbody>
</table>

**Department**: Electronics and Communication Engg.  
**Designation**: Elective

**Course Objectives:**

1. To give basics of speech production and perception along with its representation and modeling.  
2. Knowledge of time-domain representation, analysis, and synthesis of speech signal.  
3. Knowledge of frequency-domain representation, analysis, and synthesis of speech signal.  
4. Concept of cepstral transform and linear prediction coding.

**Course Outcomes:**

A student who successfully completes this course should be able to:

1. Understand the production and perception of speech and can represent and model the speech signal.  
2. Represent, analyze, and synthesize speech signal using time domain processing.  
3. Represent, analyze, and synthesize speech signal using frequency domain processing.  
4. Use cepstral transformation and LPC for speech analysis and synthesis.

*The topics that enable to meet the above objectives and course outcomes are given below:*

**Unit I (13 hours)**


**Unit II (13 hours)**

Time-domain models for speech processing: Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, voiced/unvoiced/silence detection. Pitch period estimation (Rabiner and Gold method), short time autocorrelation function, and short time average magnitude difference function, u/v/speech/silence and pitch detection using autocorrelation function. Brief applications of time domain processing of speech signals.
### Unit III (13 hours)
Short time Fourier analysis: Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, linear filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (Vocoders), phase vocoder, channel vocoder, and formant vocoders, spectrographic displays. Brief applications of time domain processing of speech signals.

### Unit IV (13 hours)
Cepstral analysis: Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse cepstum transformation, the complex cepstrum of speech, cepstral vocoder, processing applications of cepstral analysis. Linear predictive coding of speech: Introduction, basic principle of linear predictive coding, autocorrelation method, covariance method.

### Reference Books
<table>
<thead>
<tr>
<th>Course Title: Network Security</th>
<th>Course Code: PEC227E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credits:</strong> 4</td>
<td><strong>Teaching Hours:</strong> 52 Hrs (13 Hrs/Unit)</td>
</tr>
<tr>
<td><strong>CIE Marks:</strong> 50</td>
<td><strong>SEE Marks:</strong> 50</td>
</tr>
</tbody>
</table>

**Department:** Electronics and Communication Engg.

**Designation:** Elective

**Prerequisites:** Computer Networks

**Course Objectives:**

1) To give a clear insight into cryptography, authentication and emerging security standards.
2) To impart knowledge on network security protocols.

**Course Outcomes:**

A student who successfully completes this course should be able to

1) Acquire knowledge about cryptography, techniques for access control and Email security.
2) Develop security algorithms in computer communication network.

*The topics that enable to meet the above objectives and course outcomes are given below:*

**Unit I (13 hours)**

Introduction to Cryptography: Cryptography, Breaking Encryption schemes, Type of cryptographic Functions, Secret Key cryptography, Public Key cryptography Secret Key Cryptography: Generic Block Encryption, Data encryption Standards, Advanced encryption Standards. Modes of Operation: Encrypting a Large message. Hashes and Message Digest: Introduction, Encryption with Message Digest, MD2, MD4, SHA-1 and HMAC.

**Unit II (13 hours)**

Unit III (13 hours)
Kerberos V4: Tickets and ticket granting Tickets, Configuration, Logging into network, Replicated KDCs, Realms, Interrealm authentications, Key version Numbers, Encryption for privacy and Integrity, Encryption for Integrity only, Network Layer Address in Tickets, Message formats.
Unit V Electronic Mail Security: Distribution List, Store and Forward, Security Services, Establishing Keys, Privacy, Authentication of Source, Message Integrity, Non Repudiation, Proof of submission, Proof of Delivery, Message flow confidentiality, Verifying when Message was really sent.

Unit IV (13 hours)

Reference Books
Course Title: Advances in VLSI Design  
Course Code: PEC228E

| Credits: 4 | Teaching Hours: 52 Hrs (13 Hrs/Unit) | Course: Elective  
| CIE Marks: 50 | SEE Marks: 50 | Total Marks: 100  

Department: Electronics and Communication Engg.  
Designation: Elective  
Prerequisites: Digital Electronics, CMOS Digital VLSI Design

Course Objectives:
The objective of the course is to introduce the students
1) Concept of MOSFETs, MESFETs, MODFET devices operation.  
2) Short channel effects and challenges to CMOS.  
3) Concept of super buffers and steering logic.  
4) Concept of layouts and technology mapping.

Course Outcomes:
A student who successfully completes this course should be able to
1) Analyze MOSFETs, MESFETs, and MODFET devices and circuit operation.  
2) Understand MOSFET short channel effects and design challenges.  
3) Analyze different types of super buffers and steering logic.  
4) Draw layouts in CMOS technology.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)
Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI-CMOS. MESFETS: MESFET and MODFET operations, quantitative description of MESFETS. MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Unit II (13 hours)
Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization Beyond CMOS. Evolutionary advances beyond CMOS, carbon Nano tubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular, Diode and diode-diode logic. Defect tolerant computing.
<table>
<thead>
<tr>
<th>Unit III (13 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers-An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks - NMOS and CMOS functional blocks.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Unit IV (13 hours)</td>
</tr>
<tr>
<td>Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR-NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module lay out. System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity &amp; locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom Design.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Reference Books</td>
</tr>
</tbody>
</table>
**Course Title:** MEMS in Communication  
**Course Code:** PEC229E

<table>
<thead>
<tr>
<th>Credits: 4</th>
<th>Teaching Hours: 52 Hrs (13 Hrs/Unit)</th>
<th>Contact Hours: 4 Hrs/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE Marks: 50</td>
<td>SEE Marks: 50</td>
<td>Total Marks: 100</td>
</tr>
</tbody>
</table>

**Department:** Electronics and Communication Engg.  
**Designation:** Elective  
**Prerequisites:** VLSI Technology

**Course Objectives:**
The course is intended to provide the knowledge about
1) Fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.
2) The design and working principle of various microsensing and actuating devices
3) The modeling of various types of micro-systems
4) Simulation and micro fabrication of MEMS
5) Various RF MEMS components, their design and fabrication
6) Various optical devices like lenses and mirrors

**Course Outcomes:**
A student who successfully completes this course should be able to
1) Understand the fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.
2) Design and understand the working principle of various micro sensing and actuating devices
3) Mathematically model the various types of micro-systems
4) Simulate the MEMS devices and understand the process steps in micro fabrication and micromachining of MEMS devices
5) Understand various RF MEMS components, their design and micromachining technique.
6) Understand various optical devices like lenses and mirrors

_The topics that enable to meet the above objectives and course outcomes are given below:_

**Unit I (13 hours)**
Introduction to MEMS technology: Definition, Features of MEMS, Microsensor, microactuator, Microsystems.  
Commercial MEMS Products: Medical pressure sensor, inkjet printer head, accelerometer.
Scaling in Microdomain: Scaling laws in geometry, rigid body dynamics, electrostatic, electromagnetic, electricity, fluid mechanics & heat transfer.
MEMS Design & working principle: Transduction principles in microdomain- Biomedical sensor & biosensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces.
MEMS modeling: modeling elements in electrical, mechanical, thermal and fluid systems. Modeling electrostatic systems.
### Unit II (13 hours)
Simulation of MEMS: Need for simulation, FEM, MEMS design and realization tools such as ANSYS/Multiphysics, CoventorWare, COMSOL.
Microfabrication/Micromachining: Overview of micro fabrication, review of microelectronics fabrication processes like photolithography, deposition, doping, etching, structural and sacrificial materials, and other lithography methods, MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.

### Unit III (13 hours)
Radio Frequency (RF) MEMS: Introduction, Review of RF-based communication systems, RF –MEMS like switches and relays, MEMS inductors and Capacitors, RF filters, resonators, phase shifters, transmission lines, micromachined antenna (Qualitative treatment only).

### Unit IV (13 hours)
Optical MEMS: Preview, passive optical components like lenses and mirrors, actuators for active optical MEMS. Basic optical communication networks using MOEMS devices.
Case Studies: Case studies of Microsystems including micro-cantilever based sensors and actuators with appropriate selection of material properties: thermal, mechanical properties. Static and dynamic mechanical response with different force mechanisms: electrostatic, electromagnetic, thermal.

### Reference Books
<table>
<thead>
<tr>
<th>Course Title: Simulation Modeling and Analysis</th>
<th>Course Code: PEC230E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits: 4</td>
<td>Teaching Hours: 52 Hrs (13 Hrs/Unit)</td>
</tr>
<tr>
<td>CIE Marks: 50</td>
<td>SEE Marks: 50</td>
</tr>
<tr>
<td>Total Marks: 100</td>
<td>Contact Hours: 4 Hrs/Week</td>
</tr>
</tbody>
</table>

Department: Electronics and Communication Engg.
Designation: Elective
Prerequisites: Computer Organization, Probability and Information Theory

Course Objectives:
1. Define the basics of simulation modeling and replicating the practical situations in organizations
2. Generate random numbers and random variates using different techniques.
3. Develop simulation model using heuristic methods.
4. Analysis of Simulation models using input analyzer, and output analyzer
5. Explain Verification and Validation of simulation model.

Course Outcomes:
A student who successfully completes this course should be able to
1. Describe the role of important elements of discrete event simulation and modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Interpret the model and apply the results to resolve critical issues in a real world environment.

The topics that enable to meet the above objectives and course outcomes are given below:

**Unit I (13 hours)**

**Unit II (13 hours)**
### Unit III (13 hours)
Random Number Generators: Linear Congruential, Other Kinds of Generators, Testing Random Number Generators.

### Unit IV (13 hours)
Comparing Alternative System Configurations: Confidence Intervals for the Difference Between the Expected Responses of Two Systems.
Variance Reduction Techniques: Antithetic Variates and Control Variates.

### Reference Books
Course Title: Communication Engineering Laboratory - II  
Course Code: PEC231L

<table>
<thead>
<tr>
<th>Credits: 2.0</th>
<th>Teaching Hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE Marks: 50</td>
<td>SEE Marks: 50</td>
</tr>
<tr>
<td>Contact Hours: 3Hrs/Week</td>
<td></td>
</tr>
<tr>
<td>Total Marks: 100</td>
<td></td>
</tr>
</tbody>
</table>

Department : Electronics and Communication Engg.  
Designation : Laboratory

Course Objectives:
1) Know the different modeling techniques of discrete time signals.
2) Know different error control coding techniques.
3) Characterize different transmission lines and their performance evaluation.
4) Learn different image processing techniques.

Course Outcomes:
After completion of Laboratory the students are able to
1) Visualize the importance of signal modeling in different fields like communication, signal processing, signal compression, etc.
2) Understand the design principles of digital communication systems with minimum error.
3) Understand the limitations of modulation techniques and the communication channels.
4) Process image and multimedia signals.

The Experiments that enable to meet the above objectives and course outcomes are given below:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>LIST OF THE EXPERIMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Modeling of a given discrete time signal using least squares method and computation of modeling error.</td>
</tr>
<tr>
<td>3</td>
<td>Estimation of spectrum of a given finite duration discrete time signal and computation of bias and variance of estimation.</td>
</tr>
<tr>
<td>4</td>
<td>Write a MATLAB code to encode and decode the all possible data words for a systematic linear block code.</td>
</tr>
<tr>
<td>5</td>
<td>Write a MATLAB code to encode and decode the all possible data words for a cyclic code.</td>
</tr>
</tbody>
</table>
| 6      | An experiment to find the distributed components (R, L, G and C) of a transmission line for the following lengths:  
(a) 25mts Transmission Line.  
(b) 50mts Transmission Line.  
(c) 75mts transmission Line.  
(d) 100mts Transmission Line. |
| 7      | An experiment to find the characteristics of a micro-strip low pass filter. |
| 8      | An experiment to find the characteristics of a micro-strip band-pass filter. |
| 9      | An experiment to estimate the spectrum of a given signal using Bartlett’s method. |
| 10     | Develop a code to write image matrix in to a file using imwrite( ) function of MATLAB. |
| 11     | Develop a code to enhance image using histogram equalization technique. |
| 12     | Write HTML program for inserting (a) image (b) table. |