COURSE CODE AND DEFINITIONS:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Lecture</td>
</tr>
<tr>
<td>T</td>
<td>Tutorial</td>
</tr>
<tr>
<td>P</td>
<td>Practical</td>
</tr>
<tr>
<td>BSC</td>
<td>Basic Science Courses</td>
</tr>
<tr>
<td>ESC</td>
<td>Engineering Science Courses</td>
</tr>
<tr>
<td>HSMC</td>
<td>Humanities and Social Sciences including Management courses</td>
</tr>
<tr>
<td>PCC</td>
<td>Professional Core Courses</td>
</tr>
<tr>
<td>LC</td>
<td>Laboratory Courses</td>
</tr>
<tr>
<td>MC</td>
<td>Mandatory Courses</td>
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<tr>
<td>PT</td>
<td>Practical Training</td>
</tr>
<tr>
<td>S</td>
<td>Seminar</td>
</tr>
<tr>
<td>TH</td>
<td>Theory</td>
</tr>
<tr>
<td>Pr</td>
<td>Practical</td>
</tr>
</tbody>
</table>

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.
### Scheme of Studies and Examination

**B.TECH (Electronics & Communication Engineering) – 5th Semester**  
**w.e.f. 2020-21**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
<th>Total Contact Hrs. per week</th>
<th>Credit</th>
<th>Examination Schedule (Marks)</th>
<th>Duration of Exam (Hours)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Professional Core Course</td>
<td>PCC-ECE301</td>
<td>Electromagnetic Waves</td>
<td>3 1 0</td>
<td>4</td>
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<td>25 75</td>
<td>100 3</td>
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<tr>
<td>2</td>
<td>Professional Core Course</td>
<td>PCC-ECE303</td>
<td>Computer Organization &amp; Architecture</td>
<td>3 0 0</td>
<td>3</td>
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<td>25 75</td>
<td>100 3</td>
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<tr>
<td>3</td>
<td>Professional Core Course</td>
<td>PCC-ECE305</td>
<td>Communication Theory</td>
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<td>4</td>
<td>25 75</td>
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<tr>
<td>4</td>
<td>Professional Core Course</td>
<td>PCC-ECE307</td>
<td>Digital Signal Processing</td>
<td>3 1 0</td>
<td>4</td>
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<td>25 75</td>
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<tr>
<td>5</td>
<td>Program Elective Course</td>
<td>Refer to Annexure I</td>
<td>Program Elective –I</td>
<td>3 1 0</td>
<td>4</td>
<td>4</td>
<td>25 75</td>
<td>100 3</td>
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<td>6</td>
<td>Open Elective Course</td>
<td>Refer to Annexure II</td>
<td>Open Elective-I</td>
<td>3 0 0</td>
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<td>25 75</td>
<td>100 3</td>
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<td>7</td>
<td>Professional Core Course</td>
<td>LC-ECE323</td>
<td>Electromagnetic Waves Lab</td>
<td>0 0 3</td>
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<td>25 25</td>
<td>50 3</td>
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<td>8</td>
<td>Professional Core Course</td>
<td>LC-ECE325</td>
<td>Digital Signal Processing Lab</td>
<td>0 0 3</td>
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<td>1.5</td>
<td>25 25</td>
<td>50 3</td>
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<tr>
<td>9</td>
<td>Training</td>
<td>PT-ECE327</td>
<td>Practical Training – 1</td>
<td>- - -</td>
<td>2</td>
<td>-</td>
<td>- -</td>
<td>* Refer Note 1</td>
</tr>
</tbody>
</table>

**TOTAL CREDIT**: 25 700

**Note**: The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
<th>Contact Hrs. per week</th>
<th>Total Credit</th>
<th>Examination Schedule</th>
<th>Duration of Exam (Hours)</th>
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<tbody>
<tr>
<td>1</td>
<td>Professional Core Course</td>
<td>PCC-ECE302</td>
<td>Control Systems</td>
<td>3 1 0</td>
<td>4 4</td>
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<td>2</td>
<td>Professional Core Course</td>
<td>PCC-ECE304</td>
<td>Computer Network</td>
<td>3 1 0</td>
<td>4 4</td>
<td>25 75</td>
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<tr>
<td>3</td>
<td>Humanities/Basic Science</td>
<td>HUM-ECE-306</td>
<td>Engineering Ethics</td>
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<td>Professional Core Course</td>
<td>PCC-ECE308</td>
<td>CMOS Design</td>
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<tr>
<td>5</td>
<td>Program Elective Course</td>
<td>Refer to Annexe I</td>
<td>Program Elective –II</td>
<td>3 1 0</td>
<td>4 4</td>
<td>25 75</td>
<td>100</td>
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<tr>
<td>6</td>
<td>Open Elective Course</td>
<td>Refer to Annexe II</td>
<td>Open Elective-II</td>
<td>3 0 0</td>
<td>3 3</td>
<td>25 75</td>
<td>100</td>
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<tr>
<td>7</td>
<td>Professional Core Course</td>
<td>LC-ECE322</td>
<td>Computer Network Lab</td>
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<td>8</td>
<td>Professional Core Course</td>
<td>LC-ECE324</td>
<td>Control System Lab</td>
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<tr>
<td>9</td>
<td>Professional Core Course</td>
<td>LC-ECE326</td>
<td>Mini Project/Electronic Design workshop</td>
<td>0 0 4</td>
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**TOTAL CREDIT** 27.5 750

**Note:**

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.
Annexure I
Program Elective Courses

Elective –I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEC-ECE309</td>
<td>Power Electronics</td>
</tr>
<tr>
<td>PEC-ECE311</td>
<td>Nano electronics</td>
</tr>
<tr>
<td>PEC-ECE313</td>
<td>Linear IC Applications</td>
</tr>
<tr>
<td>PEC-ECE315</td>
<td>Scientific computing</td>
</tr>
</tbody>
</table>

Elective –II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEC-ECE310</td>
<td>Bio-Medical Electronics</td>
</tr>
<tr>
<td>PEC-ECE312</td>
<td>VHDL and Digital Design</td>
</tr>
<tr>
<td>PEC-ECE314</td>
<td>Introduction to MEMS</td>
</tr>
<tr>
<td>PEC-ECE316</td>
<td>Speech and Audio Processing</td>
</tr>
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</table>

Annexure II
Open Elective Courses

Open Elective-I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEC-ECE317</td>
<td>Object Oriented Programming with C++</td>
</tr>
<tr>
<td>OEC-ECE319</td>
<td>Additive Manufacturing</td>
</tr>
<tr>
<td>OEC-ECE321</td>
<td>Measurements and Instrumentation</td>
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</table>

Open Elective-II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEC-ECE318</td>
<td>Python Programming</td>
</tr>
<tr>
<td>OEC-ECE320</td>
<td>Probability and Stochastic Processes</td>
</tr>
</tbody>
</table>
PCC-ECE301 ELECTROMAGNETIC WAVES

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I
Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II

Unit III
Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit IV
Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

References:

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Characterize uniform plane wave
4. Calculate reflection and transmission of waves at media interface
5. Analyze wave propagation on metallic waveguides in modal form
6. Understand principle of radiation and radiation characteristics of an antenna
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit: General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit III

Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl’s Law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.

Unit IV

Input-output Organization: I/O device interface, I/O transfers—program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

References:


Course Outcomes:
At the end of this course students will demonstrate the ability to
1 Understand the basics structure of computers, operations and instruction
2 Design arithmetic and logic unit.
3 Understand pipelined execution and design control unit.
4 Understand parallel processing architectures.
5 Understand the various memory systems and I/O communication.
PCC-ECE305 COMMUNICATION THEORY

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I
Spectral Analysis:
Fourier series, Fourier transforms, Convolution Theorem, Correlation, Cross-Correlation and autocorrelation.

Unit -II
Information Theory:
Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon’s Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundancy coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels, effect of noise and its minimization.

Unit -III
Random Signal Theory:
Representation of random signals, concept of probability, probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function, joint probability density functions.

Unit -IV
Random Signal Theory:
Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes

References:

1. Principles of Communication Systems : Taub Schiling; TMH
2. Communication Systems : Singh and Sapre ; TMH
3. Communication Systems : A Bruce Carlson; TMH

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.
2. To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.
3. Design a digital communication system by selecting an appropriate error correcting codes for a particular application.
4 To learn about Probability of Random signal theory and process.
5 Formulate the basic equations of linear block codes and a cyclic code.
6 Compare the performance of digital communication system by evaluating the probability of error for different error correcting codes
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I
Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.


Unit II

Unit III

Unit IV

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References:
1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles,
Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.
LC-ECE323  ELECTROMAGNETIC WAVES LAB
L T P  Practical Exam: 25 Marks
-  -  3  Lab work : 25 Marks
     Total: 50 Marks
     Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE301G

LC-ECE325G  DIGITAL SIGNAL PROCESSING LAB
L T P  Practical Exam: 25 Marks
-  -  3  Lab work : 25 Marks
     Total: 50 Marks
     Duration of Exam: 3 Hour

List of Experiments

Experiments to be performed:

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I
Systems Components and Their Representation
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II
Time Response Analysis And Stability Concept
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Unit III
Frequency Domain Analysis
Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV
Control System Analysis Using State Variable Methods
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Characterize a system and find its steady state behaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigate stability of a system using different tests
4. Illustrate the state space model of a physical system.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction and Physical Layer

UNIT II

Data-Link Layer & Media Access

UNIT III

Network Layer

UNIT IV

Transport Layer and Application Layer
WWW and HTTP – FTP –Telnet –SSH – DNS –Electronic mail, MIME, SNMP.

References:

Course Outcomes:
At the end of this course students will demonstrate the ability to:

1. Visualise the different aspects of networks, protocols and network design models.
2. Examine various Data Link layer design issues and Data Link protocols.
3. Analyse and compare different LAN protocols.
4. Compare and select appropriate routing algorithms for a network.
5. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.
UNIT I


UNIT II


UNIT III

**Truth and Truthfulness:** Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.


UNIT IV

**Environmental Ethics:** Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.


References:

8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition
9 Web sources:
   i. www.onlineethics.org
   ii. www.nspe.org
   iii. www.globalethics.org
   iv. www.ethics.org

Outcomes:
Upon completion of the course, the student should be able to
1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development
PCC-ECE308 CMOS DESIGN

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I
Introduction of MOS Transistor
MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II
Combinational Circuit Design
Interconnect: Interconnect Modelling and Impact

UNIT III
Sequential Circuit Design
Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

UNIT IV
Design of Arithmetic Building Blocks and Subsystem
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

References:

5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition
Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Examine the CMOS circuit’s behaviour and its characteristics.
2. Design and realization of combinational & sequential digital circuits.
3. Interpret different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
4. Design the Arithmetic blocks and Memory structures
List of Experiments

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messages over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of “Connection Establishment” in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.
LC-ECE324 CONTROL SYSTEM LAB

L T P Practical Exam: 25 Marks
- - 3 Lab work : 25 Marks
                  Total: 50 Marks

Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE307G
Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, microcontroller with which functional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within two week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation/report writing.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.
PROGRAM ELECTIVE COURSES

PEC-ECE309  POWER ELECTRONICS
L T P  Theory: 75 Marks
3 1 - Class work : 25 Marks

Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I
Role of Power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction & working principle of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT and their V-I characteristics. Basic idea about the selection of Heat sink for thyristors.

Unit -II
Controlled Rectifiers: Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier (Half Bridge and Full Bridge with R, R-L Load), Single phase full wave centre tapped rectifier, Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)

Inverters: Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications.

Unit -III

Cyclo-converters: Dual Converters and cyclo-converters: Introduction, types & basic working principle of dual converters and cyclo-converters & their applications.

Unit -IV
Thyristorised Control of Electric drives
DC drive control: Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers)

AC drive control: Phase control, Constant V/F operation, Cyclo-converter /Inverter drives, Slip control AC drives

Applications of power devices:
light intensity control, speed control of universal motors, fan regulator, battery charger. Uninterrupted power supplies (UPS online, off line), SMPS Application of Power Electronics in Electrical vehicles controls. UJT as relaxation oscillator.

References:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.
PEC-ECE311 NANO ELECTRONICS

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Unit -II
Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III
Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -IV
Nano electronis devices : Resonant Tunneling Diode, Coulombdots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

References:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

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

Unit-II

**Op-amp with negative feedback and frequency response**: Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback differential amplifiers, frequency response compensating network, frequency response of internally compensative op-amp and non compensating op-amp. High frequency op-amp equivalent circuit, open loop gain V/s frequency, closed loop frequency response, circuit stability, slew rate.

Unit-III

**Op-amp application**: DC, AC amplifiers, peaking amplifier, summing, scaling, averaging and instrumentation amplifier, differential input output amplifier, voltage to current converter, current to voltage converter, very high input impedance circuit, integration and differential circuit, wave shaping circuit, active filters, oscillators.

Unit-IV

**Specialized linear IC applications**: 555 timer IC (monostable & astable operation) & its applications, Universal active filter, PLL, power amplifier, 8038 IC.

References:
1. R.A. Gayakwaed, OP-amps and Linear Integrated circuits.
2. K.R.Botkar, Integrated circuit

Course Outcomes:

- At the end of this course students will demonstrate the ability to
  1. Design linear and non-linear applications of op-amps.
  2. Design the applications using Timer and PLL.
  3. Design the applications using Voltage regulator and Function generator ICs.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy
Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-II
Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting
Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III
Nonlinear equations: Fixed Point Iteration, Newton’s Method, Inverse Interpolation Method
Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares
Interpolation: Purpose for Interpolation, Choice of Interpolating Function, Polynomial Interpolation, Piecewise Polynomial Interpolation
Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation

Unit-IV

References:

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyse the various system using Linear and Non Linear methods.
4. Understand application of these methods in various areas.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Physiology and Transducers
Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

UNIT II

Electro – Physiological Measurements
Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes; Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers; Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

UNIT III

Non-Electrical Parameter Measurements
Measurement of blood temperature, pressure and flow; Cardiac output; Heart rate; Heart sound; Pulmonary function measurements; spirometer; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

UNIT IV

Medical Imaging
Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

UNIT V

Assisting And Therapeutic Equipments
Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

References:
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, latest edition
5. Leslie Cromwell, —Biomedical Instrumentation and Measurementl, Prentice Hall of India, New Delhi, latest edition
Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handling bio- substances.
3. Evaluate and analyze the biological processes like other electronic processes.
4. Familiar the various Bio Medical Measuring Instruments and therapeutic equipments.
5. Aware of electrical safety of medical equipments
PEC-ECE312 VHDL AND DIGITAL DESIGN
L T P Theory: 75 Marks
3 1 - Class work: 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

Unit-II

VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

Unit-III

Combinational & Sequential Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Unit-IV

Design of Microcomputer & Programmable Device: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

References:

1. Ashenden - Digital design, Elsevier
7. VHDL-IV Edition: Perry; TMH latest edition
Course Outcome

At the end of the course, students will demonstrate the ability to:
1. Understand the need & application of hardware description language.
2. Modelling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.
PEC-ECE314 INTRODUCTION TO MEMS
L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Unit -II
Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -III
Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes’s law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods

Unit -IV

References:


Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems
PEC-ECE316 SPEECH AND AUDIO PROCESSING

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I
Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid; Requirements of speech codecs – quality, coding delays, robustness.

Unit-II
Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals – prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III
Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV
Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729 standards

References:
Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.
**OEC-ECE317**  
**OBJECT ORIENTED PROGRAMMING WITH C++**

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**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Unit – I**

**Object-Oriented Programming Concepts:** Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, data abstraction, encapsulation, inheritance, polymorphism.

**Basic Concepts of C++:** Structure of C++ Program, Basic Data Types, Expressions and Control Structures, Functions in C++: Call by Value, Call by Reference, Recursion, Function Overloading.

**Unit - II**

**Classes and Objects:** Specifying a class, creating class objects, accessing class members, access specifiers, static data members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes.

**Constructors and Destructors:** Need for constructors and destructors, copy constructor, dynamic constructors, destructors.

**Unit - III**

**Inheritance:** Introduction, defining derived classes, forms of inheritance, virtual base classes.

**Operator Overloading and Type Conversion:** Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

**Unit - IV**

**Virtual functions & Polymorphism:** Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.
**Exception Handling:** Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

**References:**


**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Students will able to understand and implement real-world entities like inheritance, data hiding, polymorphism, etc in programming.
2. Students will aware about C++ Programming concepts.
3. Students will implement the function overloading and operator overloading concepts.
4. Students will understand the concept of Exception handling.

Unit-II
Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Unit-III
Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Unit-IV
Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2-D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Unit-V
Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE-scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

References:
Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Apply the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
2. Understand the applications in various fields, reverse engineering techniques.
3. Understand about mechanical properties and geometric issues relating to specific rapid prototyping applications.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Unit-I**

Science of Measurement
Measurement System – instrumentati on – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

Transducers

**Unit-II**

Signal Conditioning and Signal Analyzers

**Unit-III**

Digital Instruments

**Unit-IV**

Data Display Recording and Systems
Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

References:

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Discuss about the principles of various measurement techniques.
2. Analyze the transducers and its impact.
3. Explain about the signal conditioning system and signal analyzers.
4. Illustrate the digital measurement equipments.
5. Emphasize the need for data acquisition, recording and display systems.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I
Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

UNIT II
Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

UNIT III
Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

UNIT IV
Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

References:

Course outcomes:
At the end of the course, students will demonstrate the ability to:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.
2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language
OEC-ECE320  PROBABILITY AND STOCHASTIC PROCESSES

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Understand representation of random signals
2. Investigate characteristics of random processes

References:

3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.