II SEMESTER M. Tech (Digital Communication)

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<th>Subject Code</th>
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<th>Exam Marks</th>
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<td>PEC211C</td>
<td>Statistical Signal processing</td>
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<td>Error Control Codes</td>
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<td>PEC221P</td>
<td>Mini Project *</td>
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<td>TOTAL</td>
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<td>26</td>
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* Mini Project should be done individually.

**ELECTIVE III**

- PEC215E  Wireless and Mobile Network Architecture
- PEC216E  Speech Processing
- PEC217E  Cryptography

**ELECTIVE IV**

- PEC218E  Advances in VLSI Design
- PEC219E  MEMS in Communication
- PEC220E  Wireless Sensor Networks
Subject: Statistical Signal processing

Subject Code: PEC211C

Credits: 4 (52 Hours)

Unit I (13 hrs)
Discrete time Random Process: Introduction: Random variables, definitions, jointly distributed random variables, joint moments, independent, Uncorrelated, Orthogonal random variables, Gaussian random variables, random processes, Filtering, Spectral factorization.

Unit II (13 hrs)

Unit III (13 hrs)

Unit IV (13 hrs)
Spectrum Estimation and Adaptive filtering: introduction, nonparametric methods, adaptive of the periodogram, parametric methods, adaptive filtering, introduction, FIR, Steepest Descent adaptive filter, LMS algorithm, Application channel equalization, recursive Least Squares, Exponentially weighted RLS, Sliding window RLS.

References
Subject: Wireless Communications
Subject Code: PEC212C
Credits: 4 (52 Hours)

Unit I (13 hrs)
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 hrs)
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 Indoor propagation model: Attenuation factor model, Small scale fading and multi path: Small scale multi path propagation, parameters of mobile multi path channels, Fading effects due to multipath time delay spread and due to Doppler spread, Clark and Gans fading model.

Unit III (13 hrs)

Unit IV (13 hrs)
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.
References

Subject: RF Circuits and Systems

Subject Code: PEC213C

Credits: 4 (52 Hours)

Unit I (13 Hrs)


Unit II (13 Hrs)


Unit III (13 Hrs)

Unit IV  (13 Hrs)


References
Subject: Error Control Codes

Subject Code: PEC214C

Credits: 4 (52 Hours)

Unit I (13 Hrs)

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 Hrs)

Cyclic Codes: Description of Cyclic Codes, Generator and Parity Check Matrices, Encoding and Decoding of Cyclic Codes, Syndrome Computation and Error Detection, Shortened Cyclic Codes. BCH Codes: Binary Primitive BCH Codes, Decoding of BCH Codes, Iterative Algorithm for Finding the Error –Location Polynomial. Non Binary BCH codes: q-array Linear Block Codes, Primitive BCH Codes over GF (q), Reed Solomon Codes, Decoding of Non Binary BCH and RS Codes: Berlekamp Algorithm.

Unit III (13 Hrs)

Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, Optimum Decoding of Convolutional Codes: The Viterbi Algorithm, Soft Output Viterbi Algorithm. Suboptimum Decoding of Convolutional Codes: The ZJ (Stack) Sequential Decoding Algorithm, The Fano Sequential Decoding Algorithm, Majority Logic Decoding.

Unit IV (13 Hrs)

References
Subject: Wireless and Mobile Network Architecture

Subject Code: PEC215E

Credits: 4 (52 Hours)

Unit I (13 Hrs)
Introduction to PCS architecture, cellular telephony & Low tier PCS, third generation wireless system; Mobility management; Handoff management detection and assignment; Handoff management radio link transfer; IS-41 network signaling.

Unit II (13 Hrs)
Intersystem handoff & authentication in IS-41; GSM system overview; GSM network signaling; GSM mobility management; GSM short message service; International Roaming for GSM.

Unit III (13 Hrs)
GSM operations, administration, and maintenance; Mobile number portability; VoIP service for mobile networks; Mobile prepaid phone services; General Packet Radio Service (GPRS).

Unit IV (13 Hrs)
Wireless Networking: Satellite communication; Cellular wireless network; Cordless systems and wireless local loop; Mobile IP and wireless access protocol.

References

Subject: Speech Processing

Subject Code: PEC216E

Credits: 4 (52 Hours)

UNIT-I (13 Hrs)


Digital models for the speech processing: Introduction, the process of speech production and classification and basics of phonetics, phonetic description of phonemes, the acoustic theory of speech production, digital models for speech- vocal tract, radiation, excitation, the complete model.

Brief introduction to speech perception: Anatomy of ear-outer, middle and inner ear, conversion of acoustical signal into neural firings.

UNIT-II (13 Hrs)

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, 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 Hrs)

Short time Fourier analysis: Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, liner filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (vocoders), Phase vocoder, channel vocoder, formant vocoders, spectrographic displays.

Brief applications of frequency domain processing of speech signals.

UNIT-IV (13 Hrs)

Cepstral analysis: Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse Cepstrum transformation, the complex Cepstrum of speech, Cepstral vocoder, processing applications of Cepstral analysis.

Linear predictive coding of speech: Introduction, basic principles of linear predictive coding, autocorrelation method, covariance method.
References

Subject: Cryptography

Subject Code: PEC217E

Credits: 4 (52 Hours)

UNIT-I (13 Hrs)
Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security.
Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

UNIT-II (13 Hrs)
Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Problems.
Other Public Key Crypto Systems and Key Management: Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems.

UNIT-III (13 Hrs)
Authentication Applications: Kerberos, X.509 authentication service, Kerberos encryption technique, Problems.

UNIT-IV (13 Hrs)
Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.
IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Security associations, Key management, Problems.)
Firewalls: Firewall design principles; trusted systems, Problems.
References

Subject: Advances in VLSI Design

Subject Code: PEC218E

Credits: 4 (52 Hours)

UNIT-I (13 Hrs)

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 Hrs)

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-dioide logic. Defect tolerant computing.

UNIT-III (13 Hrs)

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.

UNIT-IV (13 Hrs)

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom Design.
References

Subject: MEMS in Communication

Subject Code: PEC219E

Credits: 4 (52 Hours)

UNIT-I (13 Hrs)

Introduction to MEMS technology: Basic concepts of MEMS, Scaling in Microdomain: scaling laws in electrostatic, electromagnetic, structures etc.
MEMS working Principles and Design: Transduction principles in microdomain.
MEMS modeling and Simulation: modeling elements in electrical, mechanical, thermal and fluid systems. Modeling elastic, electrostatic, electromagnetic systems.

UNIT-II (13 Hrs)

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 Hrs)

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 Hrs)

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.
References

Subject: Mini Project

Subject Code: PEC221P

Credits: 2

- The objective of the mini project in II semester is to experience the technical and documentation experience for the final project i.e., in III and IV Semester.
- Mini project should be carried out in the II Semester of M. Tech.
- Basically, in this mini project, the student can take up any Industry oriented application or research oriented problems in his/her field of interest. The student has to submit an Abstract of the mini project to the PG coordinator. Once the PG coordinator and Head of the Department (H. O. D.) approves the abstract, they will assign a guide to the project.
- In the mini project, students have a choice to take up a survey/study based mini project or kit based or simulation based mini project which will be helpful for their final project. This should be done individually and compulsory in the Institute.
- After the completion of mini project (i.e., at the end of II semester), the student has to submit the mini project report. It is also mandatory to give the seminar on the mini project. At the end of the semester, seminar dates will be announced by the P.G. coordinator in consultation with the guides.
- The mini project and its report will be evaluated at the end of semester.
- At the end of the II semester, the Evaluation Committee evaluates the mini project. Evaluation Committee consists of H. O.D., P. G. Coordinator, Internal Guide and External Examiner.
- Continuous Internal Assessment of mini project is allotted for 70 marks. Semester End Evaluation of the mini project is done by the Evaluation Committee for 30 marks.