M.TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING)

CURRICULUM AND SYLLABUS

(Effect from the Academic Year 2007 – 08)

PONDICHERRY UNIVERSITY
PUDUCHERRY – 605014.
M.TECH IN (ELECTRONICS AND COMMUNICATION ENGINEERING)  
CURRICULUM AND SCHEME OF EXAMINATION  

(Total number of Credit required for the completion of the Programme: 72)

ELIGIBILITY:

M.Tech. in Electronics and Communication Engineering: Candidates for admission to the first semester of the four semester M.Tech. Course in Electronics and Communication Engineering should have passed B.E/ B.Tech in Electronics & Communication Engineering / Electronics Engineering / Computer Science & Engineering (or) an examination of any University or Authority accepted by the Pondicherry University as equivalent thereto, with at least 55% marks in the degree examination or equivalent CGPA.

SEMESTER – I

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
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20 | 250 | 350 | 600
### SEMESTER – II

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<tr>
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<td>EC921</td>
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<td>Antennas</td>
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<td>Data Communication, Computer Networks and Open Systems</td>
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<td>Digital Logic Design with – VHDL</td>
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<td>EC930</td>
<td>Microwave Circuit Analysis and Design</td>
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MA901 – RANDOM PROCESSES AND QUEUEING THEORY

**Unit – I: Discrete Random Variables**
8 Hours

**Unit – II: Continuous Random Variables**
8 Hours
The Exponential distribution – The Reliability, Failure density and Hazard function – Some important distributions (Hypoexponential, Erlang, Gamma, Hyperexponential, Weibull, Gaussian, Uniform and Pareto distributions)

**Unit – III: Stochastic Processes**
8 Hours

**Unit – IV: Discrete Parameter Markov Chains**
8 Hours

**Unit – V: Continuous Parameter Markov Chains**
8 Hours
The Birth and Death process (M/M/1, M/M/C, M/M/1/N, M/M/C/N (N>C), M/M/C/C, M/M/∞ models only, derivation of Mean number of customer in the system, in the queue and Waiting time – Simple applications) – Special case of Birth and Death model (Pure Birth and Pure Death Processes)

**Text Book:**

**Reference Books:**
EC901 – DIGITAL COMMUNICATION

Unit – I:Introduction
8 Hours
Elements of a digital communication system – An overview of source coding technique for analog sources – Temporal waveform coding – Spectral waveform coding – Model-based source coding – Channel capacity and coding: Channel models and channel capacity, achieving channel capacity with orthogonal signals.

Unit – II:
Linear Block Codes
8 Hours
The generator matrix and the parity check matrix – Examples of linear block codes – Cyclic codes – Hard decision and soft decision decoding of block codes – Performance comparison of the above two schemes.


Unit – III:
Baseband data transmission
8 Hours
Characterisation of bandlimited channels - Signal design for band limited channels. Nyquist Criterion for zero ISI - Partial response signaling, design of bandlimited signals with controlled ISI, data detection for controlled ISI - Signal design for channels with distortion - Optimum receiver for channels with ISI and AWGN.

Equalisation:
Linear decision feedback equalization, adaptive line equalizer – Adaptive decision feedback.

Unit – IV: Digital Modems
8 Hours

Unit – V:
Spread Spectrum Communications
8 Hours

Design Considerations of a digital communication system:
Defining, designing, and evaluating digital communication system – Bandwidth efficiently – Error probability plane – Modulation and coding trade off - Bandwidth efficient modulation – Modulation and coding for bandlimited channels.

Reference Books:
5. John Schiller, “Mobile communication”, Addison - Wesley publication.
EC902 TELECOMMUNICATION NETWORKS

UNIT-1: Introduction 8 Hours

UNIT-II: Data Communications 8 Hours

UNIT-III: Wide Area Networks 8 Hours

UNIT-IV: High-Speed LAN and Backbone Networks 8 Hours

UNIT-V: Network Security 8 Hours
Cryptographic Algorithms - The data encryption standard (DES) - RSA, Message digest 5 (MD5) - Security mechanisms - Public key distribution(X 509) - Example systems - Fire walls, Filter based firewalls, Proxy based firewalls and limitations.

Reference Books:

EC903 - BROAD BAND NETWORKS

UNIT - I: Introduction to B-ISDN

UNIT - II: Asynchronous Transfer Mode

UNIT - III: Routing

UNIT - IV: ATM Switching
Shared medium architectures. Shared memory architectures, Space division architecture Performance analysis of ATM architectures.

UNIT - V: Network Architectures for High Speed LANs And MANs
FDDI, FDDI-II IEEE 802.6; topology, protocol, architecture, DQDB layer, distributed queue access protocol. SMDS and frame relay services.

Reference Books:
1. W.Stallings, “Local and Metropolitan Area Networks”, (5/E), P.H.
2. W. Stallings, “ISDN and Broadband ISDN With Frame Relay and ATM”, (3/E), P.H.
6. De Pryker, “ATM Networks”.
UNIT - I: Introduction to Cellular concepts  8 Hours
Evolution of mobile radio communications. Examples of mobile radio systems. System design fundamentals, frequency reuse, hand-off strategies, interference. Paging systems: on-site paging, wide area paging, signaling methods, POCSAG, transmitters and receivers, propagation system architectures, paging terminal, Digital european cordless telephone (DECT).

UNIT - II: Cellular Radio Design Principles  8 Hours

UNIT - III: Mobile Radio Propagation  8 Hours
Introduction, free space propagation model. The three basic propagation mechanisms; reflection, diffraction and scattering. Practical propagation models; long - distance path loss models, outdoor propagation models, small scale fading: flat fading and frequency selective fading.

UNIT - IV: Co-channel Interference Reduction  8 Hours
Exploring Co-channel interference areas in a system, real time Co-channel interference measurements, omni directional and directional antenna designs for interference reduction. Power control, diversity techniques. Types of non-Cochannel interference and their reduction.

UNIT - V: Digital Cellular Systems  8 Hours

Reference Books:
UNIT I: Discrete Time Signals and Systems

UNIT II: Discrete Time Random Signal Processing

UNIT III: Spectrum Estimation

UNIT IV: Linear Estimation and Prediction

UNIT V: Adaptive Filters

Reference Books:
EC929 – INFORMATION THEORY AND CODING

Unit – I: Information and Channel Capacity
Measure of Information – Information content of message – Average information content (Entropy) of symbols in long independent sequences - Average information content (Entropy) of symbols in long depends sequences – Markov statistical model for information sources – Entropy and information rate of Markov sources.

Unit – II: Source Encoding
Shannon’s first fundamental theorem – Noiseless coding – Source with finite memory – Shannon’s second fundamental theorem on coding for memory less noisy channels – Channel capacity theorem - Shannon’s Encoding algorithm – Huffman Coding Algorithm.

Unit – III: Communication Channels
Discrete Communication channels – Rate of information transmission over a discrete channel – Capacity of discrete channel with continuous noise – Discrete channel with discrete noise- Continuous channels – Shannon Hartley theorem implication – Continuous channel with continuous noise – Efficiencies of different communication system

Unit – IV: Error Correcting Codes
Types of errors – Linear block codes – Error detection and error correction – Single error correcting Hamming codes – Binary cyclic codes – Encoder, Syndrome calculation, error detection and correction - BCH Codes – Burst Error Correcting codes – Burst and random error correcting codes.

Unit – V: Error Correcting Codes
Galois fields, vector spaces and matrices – Concatenated block codes - Punctured convolutional codes – Non-binary dual-K codes and concatenated codes – Trellis coded modulation - Binary cyclic codes – Multiple error correcting codes – Majority logic decoding – Convolution codes - Burst error correcting codes – Two dimensional codes – ARQ – Performance of codes.

Text Book:

Reference Books:
EC925 DATA COMMUNICATION, COMPUTER NETWORKS AND OPEN SYSTEMS

Unit – I: Introduction
Data communication networks and open system standards – The electrical interface - Data transmission protocol basics - Data link control protocols.

Unit – II: Networks

Unit – III: Protocols

Unit – IV: Presentation and Session Layer
Application support protocols – Session layer – Presentation layer – ASN.1 – Data encryption - Presentation protocol – Association control service element – Commitment, concurrency and recovery - Reliable transfer service element.

Unit – V: Applications

Reference Books:
EC927 EMBEDDED SYSTEMS

UNIT I 8 Hours
Embedded Hardware Architecture – 32 Bit Microcontrollers: ARM 2 TDMI core based 32 Bit microcontrollers and family of processors, Register, Memory and Data transfer, Arithmetic and Logic instructions, Assembly Language, I/O operations interrupt structure, ARM cache. ARM Bus, Embedded systems with ARM. Networks for Embedded systems: Serial bus protocols: The CAN bus, and the USB bus, Parallel bus protocols: The PCI Bus and GPIB bus, The Embedded Computing Platform: Design, PC as a platform, Development. Environment, Debugging techniques and Debugging Challenges.

UNIT II 8 Hours

UNIT III 8 Hours
Real Time Scheduling: Systems of State Machines: State-machines, State charts, Declarative specifications: Regular expressions and extn, traditional logics and real-time logic. Deterministic scheduling: assumptions and candidate Algorithms, RM (rate monotonic) and EDF (earliest deadline first), realizing the assumptions, priority inversion and inheritance, Execution time prediction: Approaches and issues, measurement of S/W by S/W, program analysis by timing scheme, prediction by optimization and system interferences and architectural complexities. Keeping time on computers: Timer applications, properties of real and ideal clocks, clock servers and clock synchronization, real time language features.

UNIT IV 8 Hours
Real time operating systems: Real time function and services, real time UNIX and POSIC processes and threats. Comparative study of sample of RTOS such as eCOS, real time Linux, Windows CE.

UNIT V 8 Hours
Validation and testing of Embedded Systems: Program validation and testing, clearbox testing, blackbox, evaluating function tests and performance testing. System design techniques: Design methodologies, requirements analysis, specifications, quality assurance.

Text Books:
1. (Unit I, II &V) Wayne Wolf, Computers as Components – Principles of Embedded Computing system Design – Harcourt India Pvt. Ltd – Morgan Kaufmann Publishers – First Indian Reprint 2001, Chapter 1, 5, 6, 7, 8, 9 & Appendix A on UML.

References:
4. Rajkamal,”Embedded systems–architecture, programming and design”, TMH India 2003.
UNIT – I: Introduction to ASICS 8 Hours
Types of ASICS – Design flow – Case study – Economics of ASICS.

UNIT – II: CMOS Logic 8 Hours

UNIT – III: ASIC Design 8 Hours
ASIC library design - Programmable ASICS - Programmable ASIC logic cells - Programmable ASIC I/O cells - Programmable ASIC interconnect - Programmable ASIC design software – Low level design entry.

UNIT - IV: VHDL 8 Hours
A counter - A 4 bit multiplier - Syntax and semantics - Identifiers and hiterds - entities architecture - Packages and library interface declaration - Sequential statements – Operators- Arithmetic - Concurrent statements - Execution – Configurations and specifications.

UNIT - V: Applications 8 Hours
Verilog HDL - Logic synthesis - Simulation - Test - ASIC construction - Floor planning and placement - Routing. Design examples in Verilog.

Reference Books:
UNIT I: Radiation and Antennas
Definition – Radiation principle – Hertzian dipole – different current distribution in linear antennas – radiation from half-wave dipole.

UNIT II: Analysis of linear arrays
Radiation pattern of alternating current element – centre fed vertical dipoles-uniform linear arrays – Broadside and end-fine arrays – Multiplication of patterns – Binomial array.

UNIT III: Array Synthesis

UNIT IV: Antenna measurements

UNIT V: Antennas for Special Applications

Reference Books:

EC931 MODERN SATELLITE COMMUNICATION

Unit - I: Satellite Communication Technology 8 Hours
Satellite orbits, Satellite constellation and ISL, orbital parameters, look angle determination, launching procedures. Spacecraft subsystems - Attitude and orbit control, power, TT & C, communication and antennas. Earth station design - Digital transmitter and receiver, antenna and beam steering techniques.

Unit - II: Link Design 8 Hours
Digital satellite link analysis and design for FSS and BSS - link budget and E_b/N_0 calculations. Performance impairments - Noise, interference, propagation effects and frequency considerations.

Unit - III: Access Techniques 8 Hours
FDMA concept- Intermodulation and back off - SPADE system. TDMA concept - Frame and burst structure - Frame acquisition and synchronization - Satellite Switched TDMA system. CDMA concepts - DS and FH System acquisition and Tracking.

UNIT - IV: Satellite Services 8 Hours

Unit - V: Mobile Satellite Networks 8 Hours

Reference Books:

UNIT – I: Components
9 Hours

UNIT – II: First Generation Optical Networks
9 Hours

UNIT – III: WDM Technology
9 Hours

UNIT – IV: OTDM Technology
9 Hours

UNIT – V: FTH and PON Technology
9 Hours
Proposed architecture and issues of Fiber to the home (FTH) – Passive optical networks (PON) – Near space communication – Open air optical communication – Inter satellite link hops (ISL). Introduction to all optical networks (AON). Military, civil, consumer and industrial applications.

Reference Books:

UNIT – I: Overview of Computer Networks and Architecture  

UNIT – II: Data Link and MAC layer  
Design issues in data link layer. Example data link layer protocols: HDLC, data link layer in internet and ATM. Overview of MAC layer protocols in MANs and LANs, ethernet, token bus, token ring and DQDB. Bridges: transparent bridges, source routing bridges, remote bridges. Comparison of remote bridges. High speed LANs: FDDI, fast ethernet, HIPPI fiber channel. An overview of network layer design issues.

Unit – III: Network Layer  
Internetworking: Concatenated VCs, connectionless internetworking, tunneling, internet work routing, fragmentation, firewalls, network layer in the internet and ATM networks.

Unit – IV: Elements of Transport Layer Protocols  
Internet transport protocols. TCP service model, TCP protocol, TCP segment header, TCP connection management, transmission policy, congestion control, and timer management, UDP, wireless TCP and UDP. The AAL layer protocols. Structure of the AAL: AAL1, AAL2, AAL3/4, AAL5. Comparison of AAL protocols. Service specific connection oriented protocol.

UNIT - V: Application Layer  
E-mail: Architecture and services. User agents, message formats, message transfer, email privacy. USENET: Implementation, user view of USENET. World Wide Web: Client side, server side, writing a web page in HTML, Java, locating information on the web. Multimedia: Audio, video, data compression, video and demand; multicast backbone.

Reference Books:
EC926 DIGITAL LOGIC DESIGN WITH VHDL

UNIT I
8 Hours

UNIT II
8 Hours

UNIT III
8 Hours

UNIT IV
8 Hours

UNIT V
8 Hours
Digital system design: Building block circuits: Flip-flops and registers with enable inputs, shift registers with enable inputs, SRAM, SRAM blocks in PLDs – design examples: Bit-counting circuit, ASM chart implied timing information, shift and add multiplier, divider, arithmetic mean, sort operation - clock synchronization: clock skew, flip-flop timing parameter, asynchronous input – switch debouncing testing of logic circuits: fault model – design for testability – build-in self test – random test – testing PCBs.

Text books:

Reference Books:
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Text Book:


Reference Books:

EC935 SENSOR NETWORKS

UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

Reference Books:

2. www.UWB.org
EC932 OFDM FOR WIRELESS COMMUNICATION

UNIT – I  
**OFDM Basics:** Introduction to Wireless OFDM – OFDM principles, system model – Generation of sub carrier using IFFT, Guard time and cyclic extension, windowing, choice of OFDM parameters, OFDM signal processing.

UNIT – II  
**Coding and Modulation:** Introduction – Forward error correcting coding – Interleaving – Quadrature Amplitude modulation – Coded modulation – Synchronization – sensitivity to phase noise and frequency offset and timing errors – Synchronization using cyclic extension and special training symbols.

UNIT – III  
**Channel estimation for OFDM system:** Coherent and Differential Detection – Coherent detection – one and two dimensional channel estimators, special training symbols, Decision directed channel estimation – Differential detection – Differential detection in the time and frequency domain – Differential amplitude and phase shift keying.

UNIT – IV  
**Orthogonal Frequency Division Multiple Access:** Frequency hopping in OFDMA, Difference between OFDMA and MC-CDMA. OFDMA system description – channel coding, modulation, Time and Frequency synchronization, Initial modulation timing and frequency offset synchronization accuracy, power control. Random frequency hopping operation – Dynamic channel allocation (simple and fast) – capacity of OFDMA.

UNIT – V  
**Application of OFDMA:** Digital Audio Broadcasting – Front end Impairments in the OFDM modem – system simulation tools – Analysis and simulation of the main front end effects – Terrestrial digital video broadcasting – Magic wand (Wireless ATM project). IEEE 802.11, Hyper LAN/ 2 and MMAC, Wireless LAN standards – OFDM parameters, channelization, OFDM signal processing, Training, Difference between IEEE 802.11, Hyper LAN/ 2 and MMAC.

**Reference Books:**

EC924 CDMA TECHNOLOGY

UNIT I 8 Hours

UNIT II 8 Hours

UNIT III 8 Hours

UNIT IV 8 Hours

UNIT V 8 Hours
Next Generation CDMA: Physical channel – Multirate design – Spreading technique – Advanced error control techniques – Coherent detection – Inter operability in next generation CDMA – Multicarrier CDMA option – Forward link – Reverse link.

Reference Books:
UNIT-I: Review of 2-D Systems 8 Hours
Linearity and space-variance, point-spread function and 2-D convolution, 2-D Fourier transforms. DISCRETE IMAGES AND IMAGE TRANSFORMS: 2-D sampling, reconstruction from samples. Nyquist rate, aliasing, sampling of random fields, practical limitations in sampling and reconstruction. Image quantization: Optimum mean-square (Lloyd-Max) quantizer. 2-D orthogonal and unitary transforms - Separability. 2-D discrete fourier, cosine, sine, hadamard, haar, slant and K-L transforms, their properties and applications. Outer product expansion and singular value decomposition (SVD). properties of SVD.

UNIT-II: Image Enhancement 8 Hours

UNIT-III: Image Restoration 8 Hours

UNIT-IV: Image Data Compression 8 Hours

UNIT-V: Image Analysis 8 Hours

Reference Books:
EC937 WIRELESS LAN AND PAN

UNIT I  8 Hours
Basic of Networks: Telephone, Computer, cable television and wireless networks, networking principles, digitization: service integration, network services and layered architecture, traffic characterization and QoS, network services: network elements and network mechanisms.

UNIT II  8 Hours
Packet switched networks: OSI and IP models: Ethernet (IEEE 802.3); token ring (IEEE 802.5), FDDI, DQDB frame relay: SMDS, internet working with SMDS.

UNIT III  8 Hours

UNIT IV  8 Hours
ATM and Wireless Networks: Main features – addressing signaling and routing; ATM header structure – adaptation layer, management and control; BISDN; interworking with ATM, wireless channel, link level design, channel access; Network design and wireless networks.

UNIT V  8 Hours
Optical Networks and switching: optical links – WDM systems, cross-connects, optical LANs, optical paths and networks; TDS and SDS: modular switch designs – packet switching, distributed, shared, input and output buffers.

Text Book:


Reference Books:

UNIT I
8 Hours
Wireless systems – Introduction, spheres of wireless activities, the home and office, the ground fixed/mobile platform, the space platform, wireless standards, systems and architectures, conceptual wireless systems, wireless transceiver wireless appliances enable ubiquitous connectivity.

UNIT II
8 Hours
Elements of RF circuit design – Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, DC biasing, impedance mismatch effects in RF MEMS.

UNIT III
8 Hours
RF MEMS – enabled circuit elements and models – RF/Microwave substrate properties, Micro machined – enhanced elements – capacitors, inductors, varactors, MEM switch – shunt MEM switch, low voltage hinged MEM switch approaches, push-pull series switch, folded – beam – springs suspension series switch, Resonators – transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acoustics wave resonators, MEMS modeling – mechanical modeling, electromagnetic modeling.

UNIT IV
8 Hours

UNIT V
8 Hours
RF MEMS based circuit design – Phase shifters – fundamentals, X-Band RF MEMS phase shifter for phased array applications, Ka-Band RF MEMS phase shifter for radar systems applications, Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMS filters – A Ka-Band millimeter-wave Micro machined tunable filter, A High-Q 8 MHz MEM Resonators filter, RF MEMS Oscillators – fundamentals, A 14GHz MEM Oscillator, A Ka-Band Micro machined cavity oscillator, A 2.4 GHz MEMS based voltage controlled oscillator.

Text Book:

Reference Books:
UNIT-I: S- Parameters and Microwave Transistor 8 Hours

UNIT-II: Amplifier Design 8 Hours
Unilateral and non-unilateral design - One stage and multistage design - Low-noise amplifiers - High-power amplifiers - Balanced amplifiers - Feedback - Design examples - Small-signal distributed amplifiers.

UNIT- III: Oscillator Design 8 Hours

UNIT-IV: Mixer Design 8 Hours

UNIT-V: MIC Design 8 Hours
Integrated microwave workstation approach - Non-linear tools - Field drivers design -Designing non-linear circuits using the harmonic balanced method - Programmable microwave tuning system - Introduction to MMIC considering layout effects - Microwave integrated circuit components.

Reference Books:
EC933 OPTICAL COMPUTERS

UNIT – I: Introduction 8 Hours
Basic elements of optical systems - Mirrors-Gratings-lenses -transducers-Spatial light modulators - Holographic elements-fundamental limitations on dynamic range-hybrid optical/electronic systems-dependence between optics and electronics.

UNIT - II: Optical Image and Signal Processing 8 Hours
Spectral analysis and filtering - Pattern recognitions - picture deblurring - synthetic aperture radar imaging - radio signal analysis - Simple arithmetic-matrix operations-Differentiation and integration- analog solution of practical differential equations.

UNIT – III: Non-linear Optics 8 Hours
Non-linear effects – Optical bistability – Hybrid polarization devices-Optical phase conjugation-uses of optical phase conjugation

UNIT – IV: Digital Optical Computers 8 Hours
Internal representations – Implementations of binary logic elements – Implementation of arithmetic units – Memory – Interconnection and communication – architectures.

UNIT – V: Feasibility and Technology 8 Hours
Thin film wave guides - Passive integrated optic devices-active integrated optic devices-properties and limitations.

Reference Books:
UNIT - I: Introduction
Introduction to wireless networks and mobile computing-Challenges of mobile computing-Mobile channel characteristics-Folding and shadowing communication issues-Review of cellular schemes, model and methodology.

UNIT-II: Medium Access Control
Hidden /Exposed terminals-Near / Far terminals-SDMA, FDMA, TDMA and CDMA.
Wireless LANS:
Infrared radio transmission, infrastructure Vs Ad hoc Networks, IEEE 802.11: Architecture. MAC layer- Synchronization, power management, roaming-IEEE 802.11b, 802.11a, new developments. Blue tooth overview.

UNIT -III: Mobile IP
Overview, network elements, packet delivery agent discovery, registration - Tunneling and encapsulation optimization, IPv6, IP micro mobility support, DHCP and mobile IP, mobile transport layer- Traditional TCP and implications on mobility, indirect and snooping TCP - TCP over 2.5G/3G networks- Performance enhancing process.

UNIT IV: Mobile Computing
File systems and WWW architectures for mobile computing - WAP-Architecture, protocols wireless applications, environment WML, push architecture, push/pull services, WAP 1.72 stacks, I-mode, WAP 2.0 - J2ME- BREW.

UNIT V: Wireless Security

Text Book:

Reference Books: