

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
INSTITUTE OF ENGINEERING AND MANAGEMENT
M.TECH. IN ELECTRONICS AND COMMUNICATION ENGINEERING
WITH
SPECIALISATION IN VLSI TECHNOLOGY

CURRICULUM

1st Semester

<u>Theory</u>	<u>Credit</u>	<u>Marks</u>	<u>Code</u>
ADVANCED ENGINEERING MATHEMATICS	4	100	MH901
ADVANCED DIGITAL SIGNAL PROCESSING	4	100	EC901
IC FABRICATION PROCESS	6	100	EC 902
DIGITAL INTEGRATED CIRCUIT DESIGN	6	100	EC903

Sessional

DIGITAL SIGNAL PROCESSING LABORATORY	4	100	EC910
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Total	24	500	
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2ND Semester

<u>Theory</u>	<u>Marks</u>	<u>Credit</u>	<u>Code</u>
MODERN DIGITAL COMMUNICATION TECHNIQUE	100	4	EC1001
ADVANCED ANALOG INTEGRATED CIRCUIT DESIGN	100	6	EC1002
EMBEDDED AND REALTIME SYSTEM	100	6	EC1003

Sessional

VLSI DEVICE AND CIRCUIT SIMULATION LAB	100	4	EC1010
VLSI DESIGN AND TESTING LAB	100	4	EC1011

Total	500	24	
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<u>3rd Semester</u>				Code
Elective Subject (any one)	100	4	1104	
Thesis (Part I)		300		16 1112
COMPREHENSIVE VIVA VOCE		100		4 1113
Total		500		24

<u>4th Semester</u>	Marks	Credit	Code
Thesis (Part II)	300	16	1214
Viva	200	8	1215
Total	500		24

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1st Semester

ADVANCED ENGINEERING MATHEMATICS

Complex Variables:

Elements of set theory, set notations, Applications of set theory, open and closed sets, complex variables, conformal mapping and transformations, Functions of Complex Variables, Integration with respect to complex argument, Residues and basic theorems on residues.

Numerical Methods & Programming: Introduction, Interpolation formula, Difference equations, Roots of equations, Solutions of simultaneous linear and non linear equations, solution techniques for ODE and PDE, Introduction to stability, Matrix eigen value and eigen vector problems, related algorithms & programming.

Probability and statistics : Defination and postulates of Probability Field of probability, Mutually exclusive events, Bayes theorem, Independence Bernoulli trial, discrete Distributions, continuous distributions, probable errors, Linear regression, Introduction to nonlinear regression, correlation, Analysis of variance.

ADVANCED DIGITAL SIGNAL PROCESSING

Brief recapitulation of linear and circular convolutions, Linear filtering, DFT, Goertzel and chirp-z transform algorithms, FFT algorithms, Quantization error in FFT algorithms.

Difference equation for digital filter: Defination and properties, FIR filters, IIR Filters, Digital Filter design techniques: Impulse in variance, Bilinear transformation, Finite difference, window design methods; Frequency sampling optimization algorithms.

Parametric signal modeling: Auto regressive signal modeling based on linear prediction, pole zero modeling, Time varying auto regressive models. Parametric signal modeling in presence of noise, applications, spectral analysis.

Power spectral analysis using DFT, Maximum / entropy spectral estimation (MEM).

Adaptive signal processing: Time adaptive systems – LMS ALGORITHM, 2 D SIGNAL PROCESSING: filter design and implementation, 2D spectral factorization and analysis.

Applications of DSP: Radar, Sonar, Biomed, Communications, speech and Image processing

IC FABRICATION PROCESS

Clean room concept, Growth of single crystal silicon-czochralski and float zone method, wafer processing, cleaning and etching.

Physical Vapour deposition: Vacuum evaporation sputtering.

Chemical vapour deposition: APCVD, Plasman CVD, MOCVD.

Epitaxial growth: Liquid Phase epitaxy, vapour phase epitaxy, molecular beam epitaxy, Heteroepitaxy.

Oxidation: Growth mechanism and kinetics of oxidation, oxidation techniques and systems, oxide properties, oxide induce defects.

Diffusion: Fick's equations, Atomic diffusion mechanism, measurement techniques, Diffusion in Polysilicon and SiO₂, Diffusion System,

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Ion implantation: Range theory, Equipment, Annealing, shallow junctions, High energy implantation.

Lithography: Optical Lithography, Optical mask printing and masking techniques, Electron Lithography, X-ray Lithography.

Plasma deposition and Etching: Plasma properties, Plasma assisted deposition of Polysilicon, silicon dioxides and silicon nitrides, reactive plasma etching techniques and equipments, specific etch processes.

Metallization: Metallization application, Patterning interconnects, Multilayer Metallization, Measurement.

VLSI process Integration: Fundamental consideration of IC technology, NMOS and CMOS IC processing, MOS Memory IC processing, BICMOS processing.

DIGITAL INTEGRATED CIRCUIT DESIGN

CMOS transmission gates, Pseudo NMOS, Domino logic gates, multilevel gate circuits and design.

Sequential MOS logic circuits: Pass transistor logic, synchronous dynamic circuit techniques, High performance dynamic CMOS circuits.

Semiconductor Memories: ROM circuits, SRAM circuits, DRAM circuits, drivers and buffers, Design issues in memory and array structures.

Low power CMOS Logic circuit, overview of power consumption, low powered design through voltage scaling, estimation and optimization of switching activity, quasisiabatic logic circuits, multithreshold CMOS, SOI MOSFET design issues, scaling and small geometry effect.

BICMOS Logic Circuits: Basic BICMOS Circuits, Static behaviour, switching characteristic in BICMOS logic circuits, BICMOS applications.

Input-output Circuits: ESD protection, input and output buffer design, on-chip clock generation and distribution, latch up and its prevention.

2nd Semester

MODERN DIGITAL COMMUNICATION TECHNIQUE

Baseband, narrowband and wideband signals and noise representation and characteristics of communication channels, Linear and optimal filtering, Baseband binary signal transmission, Intersymbol Interference, Bit time recovery and errors, Partial response signaling, Line codes, M-ary signals: Orthogonal representation, Gram-Schmidt procedure, signal space concept, bandwidth efficient digital modulation techniques, carrier synchronization, spread spectrum technique-codes, transmitters, receivers, performance.

Signal design for band limited channel (a) for no ISI (b) with ISI and AWGN

Linear Quantization and Adaptive Quantization

Multi Channel & Multi Carrier System, Multi Cluster Communication

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Communication through Multi path fading channel

ADVANCED ANALOG INTEGRATED CIRCUIT DESIGN

Basic MOS device and model. CMOS inverter, characteristics, transient response and delay analysis, Power considerations.

Mos resistor, MOS current source, current mirror circuits: Design and performance enhancement issues, MOS voltage source, design and improvement considerations, Linear Voltage and Current converter.

CMOS operational amplifier design, Differential amplifier, Level shifter, source follower, output stage voltage and power amplifier, compensation techniques.

BICMOS circuit techniques. BICMOS device and technology, basic analog sub circuits, low voltage BICMOS operational amplifier design.

Analog filters: Switched capacitor (SC) fundamentals, first order and high second order SC circuit and cascade design, analytical techniques for SC circuits. SC ladder filter, switched current filter.

Analog VLSI interconnects: Physics of interconnects in VLSI, scaling of interconnects, distributed RC model, transmission line model. Improvement in interconnect performance, future interconnect technologies.

EMBEDDED AND REAL TIME SYSTEMS

Methodologies and technologies for behavioral synthesis and real time issues in embedded systems. Topics include behavioral synthesis, hardware/Software code sign, interface synthesis, scheduling, real time constraints, real-time specification and modeling, transformation and estimations during synthesis and design optimization, concurrency, real time OS and embedded processes. Design for low power, verification and debugging.

Sessional

VLSI DEVICE AND CIRCUIT SIMULATION LAB
VLSI DESIGN AND TESTING LAB

INFORMATION THEORY AND CODING TECHNIQUES

Sources – memory less and markov; Information; Entropy; Extended source; Shannon’s noiseless coding theorem; source coding, Mutual Information; channel capacity, BSC and other channels, Shannon’s channel capacity theorem, continuing channels, companion of communication system based on Information theory, channel coding – block and convolution block codes-majority logic decoding, Majority decoding algorithm, coding gains and performance.

COMPOUND SEMICONDUCTOR AND APPLICATIONS

Compound semi conductor classifications, “ An introduction to bulk compound semiconductor capital growth; Electronic properties of compound semiconductor materials, photonic applications of compound semiconductor materials; opt electronic sources and detector; semiconductor lasen, avalance photodiode; High speed device applications – HEMT, MESFET, dc and ac analysis, equivalent circuits, frequency response etc, MISFET, high speed logic circuits using GaAS MESFET and HEMTS; Microwave and millimeter wave sources; Gunn diodes, Applications of compound semiconductor and sensors and actuator.

VLSI CIRCUITS AND SYSTEMS

Introduction to VLSI systems, Timing circuit, clock generator, Direct and PLL frequency synthesizer; Data conversion, SAR, Over sampled A/D and high speed converter; advanced A/D converter; Filter design, Memory (Volatile and non-volatile); DSP chip; CPU architecture, advanced low power circuits.