M.E. MICROELECTRONICS

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<mark>**LIST OF COURSES**</mark>

<mark>**CORE COURSES**</mark>   <mark>**L P U**</mark>

MEL G611	IC Fabrication Technology	5
MEL G621	VLSI Design	5
MEL G631	Physics & Modeling of Microelectronic Devices	5
MEL G632	Analog IC Design	5
MEL G641	CAD for IC Design	5

<mark>**ELECTIVE COURSES (ANY SIX)**</mark>

BITS F415	Introduction to MEMS	3 1 4
CS G553	Reconfigurable Computing	5
CS G562	Advanced Architecture and Performance Evaluation	3 2 5
CS G612	Fault Tolerant System Design	2 3 5
EEE F434	Digital Signal Processing	3 1 4
EEE G510	RF Microelectronics	5
EEE G512	Embedded System Design	3 1 4
EEE G522	Advanced Satellite Communication	5
EEE G572	Digital Signal Processing	3 2 5
EEE G594	Advanced VLSI Devices	5
EEE G595	Nanoelectronics and Nanophotonics	5
EEE G613	Advanced Digital Signal Processing	5
EEE G626	Hardware Software Co-Design	4
MEL G512	Optoelectronic Devices Circuits and Systems	3 2 5
MEL G531	Testable Design and Fault Tolerant Computing	3 2 5
MEL G612	Integrated Electronics Design	2 2 4
MEL G622	Introduction to Artificial Neural Networks	2 2 4
MEL G623	Advanced VLSI Design	5
MEL G624	Advanced VLSI Architectures	5
MEL G625	Advanced Analog and Mixed Signal Design	5
MEL G626	VLSI Test and Testability	5
MEL G642	VLSI Architectures	2 2 4

<mark>**COURSE DESCRIPTION:**</mark>

<mark>**CORE COURSES**</mark>   <mark>**LPU**</mark>

MEL G611   **IC Fabrication Technology**   **3 2 5**

Material properties; crystal growth and doping; diffusion; oxidation; epitaxy; ion implantation; deposition of films using CVD, LPCVD and sputtering techniques; wet and dry etching and cleaning; lithographic process; device and circuit fabrication; process modeling and simulation.

MEL G621   VLSI Design   5

Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; structured design and testing; symbolic layout systems; CMOS subsystem design; system case studies.

MEL G631   Physics & Modeling of Microelectronic Devices   5

Physics and properties of semiconductor - a review; pn junction diode; bipolar transistor; metal-semiconductor contacts; JFET and MESFET; MOSFET and scaling; CCD and photonic devices.

MEL G632   Analog IC Design   5

Basic concepts; BICMOS process and technology; current and voltage sources; differential and operational amplifiers; multipliers and modulators; phase-lock techniques; D-to-A and A- to-D converters; micropower circuits; high voltage circuits; radiation resistant circuits; filter design considerations.

MEL G   641 CAD for IC Design   5

Introduction to VLSI design methodologies and supporting CAD tool environment; overview of `C', data structure, graphics and CIF; concepts, structures and algorithms of some of the following CAD tools; schematic editors; layout editors; module generators; silicon compilers; placement and routing tools; behavioural, functional, logic and circuit simulators; aids for test generation and testing.

ELECTIVE COURSES (ANY SIX)

BITS F415   Introduction to MEMS   3 1 4

Overview, history and industry perspective; working principles; mechanics and dynamics, thermofluid engineering; scaling law; microactuators, microsensors and microelectromechanical systems; microsystem design, modeling and simulation; materials; packaging; microfabrication: bulk, surface, LIGA etc; micromanufacturing; microfludidics; microrobotics; case studies.

CS G553   Reconfigurable Computing   5

Overview of Programmable Logics. FPGA fabric architectures. Logic Elements and Switch Networks. Design and Synthesis of Combinational and Sequential Elements. Placement and Routing. Pipelining and other Design Methodologies. Fine-grained and Coarse- Grained FPGAs. Static and Dynamic Reconfiguration. Partitioning. Hardware/Software Portioning and Partial Evaluation. Systolic Architectures.

CS G562   Advanced Architecture and Performance Evaluation   3 2 5

Introduction to advanced architectures; parallel processing; pipelining and vector processing; array processing;SIMD computers and processor enhancement; performance evaluation methods, statistics and discrete math applications; modelling for evaluation of virtual memory; time sharing environments.

CS G612   Fault Tolerant System Design   2 3 5

Principles of fault tolerant systems, redundancy, parallel and shared resources, spatial systems, configurations,design aspects etc.

EEE F434   Digital Signal Processing   3 1 4

Introduction; design of analog filters; design of digital filters (IIR and FIR); structures for the realization of digital filters; random signals and random processes; linear estimation and prediction; Wiener filters; DSP processor architecture; DSP algorithms for different applications.

EEE G510   RF Microelectronics   5

Introduction; application of RF electronics in modern systems; basic concepts in RF circuit design, active RF components: various RF diodes and transistors and their circuit models, matching and biasing networks, RF amplifier design: low power, low noise and broadband amplifiers, RF oscillator design; negative resistance oscillator; dielectric resonator oscillators, phase noise. RF Mixers: Balanced mixers; low noise mixers; noise in RF circuits, microwave transmitters and receivers.

EEE G512　　　Embedded System Design　　　　　　　　　　　　　　3 1 4

Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

EEE G522　　　Advanced Satellite Communication　　　　　　　　　　　　5

Radio wave propagation effects, low, medium and geo-synchronous earth orbits and their main characteristics. Various sub-systems of the satellite , the outer space and its impact on the design of spacecraft subsystems, LEO satellite network and its routing calls; Battery technology , propagation loss models, modulation and error correction techniques, Digital Video Applications, Satellite Mobile including NGEO, satellite access techniques, third generation satellite communication, remote sensing, bandwidth utilization and throughput capability, the Indian National Satellite System (INSAT), INTELSAT and other international satellite programs, VSAT, Mobile and Personal Satellite communication, principles of Global Positioning System (GPS), GPS receivers and its applications, regulatory and interference issues. Study and design of uplink transmitter, down link receiver, spacecraft transponder, satellite communication links.

EEE G572　　　Digital Signal Processing　　　　　　　　　　　　　　3 2 5

EEE G594　　　Advanced VLSI Devices　　　　　　　　　　　　　　　5

Device physics of and engineering of advanced transistors, review of metal oxide semiconductor (MOS) with quasi-ballistic and ballistic transport, Shortchannel effects (SCEs) in nanometer regime, scaled MOSFETs, Device physics and engineering of sub- 100nm MOSFETs , Limits of the state-of-the-art silicon device technology, issues in the miniaturization, Alternative device structures, non-conventional MOSFETs, and transport in novel nanodevices. Analytical expression (supported by TCAD simulation) for the onedimensional transport and interpretation of novel device characteristics.

EEE G595　　　Nanoelectronics and Nanophotonics　　　　　　　　　　　5

Semiconductor Fundamentals, Band Theory, Quantum Structures and Quantum Mechanics, Transport in Quantum Structures, Optical Properties of Semiconductor Quantum Structures, Strain Engineering, Electro-Optic Effects, Photonic / electronic Devices based on Nano structures.

EEE G613　　　Advanced Digital Signal Processing　　　　　　　　　　　5

Review of stochastic processes, models and model classification, the identification problem, some field of applications, classical methods of identification of impulse response and transfer function models, model learning techniques, linear least square estimator, minimum variance algorithm, stochastic approximation method and maximum likelihood method, simultaneous state and parameter estimation of extended kalman-filter, non-linear identification, quasi linearization, numerical identification methods.

EEE G626　　　　Hardware Software Co-Design　　　　　　　　　　　4

FPGA and ASIC based design, Low-Power Techniques in RT Embedded Systems On-chip networking. Hardware Software partitioning and scheduling, Co-simulation, synthesis and verifications, Architecture mapping, HW-SW Interfaces and Re-configurable computing.

MEL G512　　　Optoelectronic Devices Circuits and Systems　　　　　　　3 2 5

Physics of optical radiation and principles of calculation in radiation physics & optics, fundamental laws of photometry. Interaction between optical radiation and matter. Radiation sources. Parameters of IR detectors and junction photodetectors, parameters common to emitters and receiver, radiation measurements, optoelectronic components, optoelectronic integrated devices, photodetector circuits, methods of modulation and optoelectronic system design and applications.

MEL G531　　　Testable Design and Fault Tolerant Computing　　　　　　3 2 5

Fault: types, modelling and simulation; testing methodologies, coverage, economics and quality; test vector generation: design for testability, built-in self tests; fault tolerant computing; fault tolerant software.

MEL G612　　　Integrated Electronics Design　　　　　　　　　　　　2 2 4

General architectural features of 8/16/32 bit microprocessors, programmers model of 8086, assembly language programming, hardware design around 8086, bus based systems design, system design around IBM PC, design of real-time systems, ASIC's development tools.

MEL G622   Introduction to Artificial Neural networks   2 2 4

Fundamentals and definitions; Perceptrons, backpropagation and counterpropagation Networks;Statistical methods for network training; Hopfield nets; Associative memories; Optical neural networks; Applications of neural networks in speech processing,computer networks and visual processing.

MEL G623   Advanced VLSI Design   5

Deep submicron device behavior and models, Interconnect modeling for parasitic estimation, Clock signals and system timing--Digital phase locked loop design, memory and array structures, Input/output circuits design, ASIC technology, FPGA technology, High speed arithmetic circuits design,-Parallel prefix computation, Logical effort in circuit design, Low power VLSI circuits-Adiabatic logic circuits, Multi threshold circuits, Digital BICMOS circuits, Design of VLSI systems.

MEL G624   Advanced VLSI Architectures   5

Instruction set design and architecture of programmable DSP architectures; dedicated DSP architectures for filters and FFTs; DSP transformation and their use in DSP architecture design; Application Specific Instruction set Processor; superscalar and VLIW architectures.

MEL G625   Advanced Analog and Mixed Signal Design   5

Mixed signal blocks and design issues, Design of high speed comparators, opamps, Design of sample and hold circuits, Different architectures of analog to digital and digital to analog converters, Design of CMOS analog multipliers and dividers, Design of switched capacitor filters, Design of phase locked loop, Layout techniques for analog and mixed signal design, noise issues.

MEL G626   VLSI Test and Testability   5

Mixed signal blocks and design issues, Design of high speed comparators, opamps, Design of sample and hold circuits, Different architectures of analog to digital and digital to analog converters, Design of CMOS analog multipliers and dividers, Design of switched capacitor filters, Design of phase locked loop, Layout techniques for analog and mixed signal design, noise issues.

MEL G642   VLSI Architectures   2 2 4

Overview of CISC processor architectures; Instruction set architecture of CISC processor; hardware flowcharting methods; implementing microprocessor logic from hard-ware flowcharts; RISC instruction set architecture; Pipelined execution of RISC instructions; pipeline execution unit design; control hazards; design of memory hierarchy.