ECL201 ELECTRONIC CIRCUITS (3-0-2-4)
Pre-requisite: NIL.

Contents:
Semiconductor diodes V-I characteristics, modeling for various circuit applications, rectifier, Clamping and clamping circuits RF filters.
Introduction: Scope and applications of analog electronic circuits. Amplifier models. Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations(such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of volt-age gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.
High frequency transistor models, frequency response of single stage and multistage amplifiers, cascade amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.
Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpits, Clapp etc.), non-sinusoidal oscillators.
Digital circuit families DTL, TTL, MOS, CMOS circuits. Basic CMOS circuits.
Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL202 DIGITAL CIRCUITS (3-0-2-4)
Pre-requisite: NIL.

Contents:
Lab based on 6th unit: VHDL and Verilog based examples of M. Mano
Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL203 SIGNALS AND SYSTEMS (3-2-0-4)
Pre-requisite: NIL

Contents:
Introduction to Transforms, Fourier series and Fourier Transform, Convergence of Fourier Transform, Properties of Fourier Transform.
Part of tutorials will be based on MATLAB.

Text Books:

Additional Books:

ECL204 ANALOG COMMUNICATION (3-0-2-4)
Pre-requisite: NIL.

Contents:
Radio receivers: TRF and super-heterodyne receiver, AGC, FM receiver, sensitivity, selectivity, communication receiver and its special features. Realization of communication systems. Noise in analog communication systems. SNR calculations for AM, FM systems. Analog pulse modulation: Sampling theorem, PAM, PWM, PPM, QAM generation & Detection of these pulse modulated signals, TDM.

Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL205 ELECTROMAGNETIC WAVES (3-2-0-4)
Pre-requisite: NIL.

Contents:

Text Books:

Additional Books:

ECL206 ELECTRONIC MATERIALS AND DEVICES (3-0-0-3)
Pre-requisite: NIL
Contents:

Text Books:

Additional Books:

ECL301 LINEAR INTEGRATED CIRCUITS (3-0-2-4)
Pre-requisite: ECL201 ELECTRONIC CIRCUITS
Contents:
1. Operational amplifier and Opamp design, configurations (FET, BJT). DC & AC analysis, constant current bias, current mirror, cascaded differential amplifier stages, level translator. Op-amp, inverting, non-inverting, differential amplifier configurations, negative feedback, voltage gain, input & output impedance, Bandwidth. Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR, Frequency response, Linear applications, DC, ac amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator. First/second order low/ high/ band pass, band reject active filters, All pass filter Phase shift oscillator, Wein bridge oscillator, Square wave and triangular waveform generators. Nonlinear applications, Comparators, Schmidt Trigger, Clipping and Clamping circuits, Abutment coupling, Phase constant, Peak detectors, Sample and hold circuits, Log and antilog amplifiers. Sample Hold, R-2-R ladder DAC, Flash, successive approximation, dual slope ADC circuits. Introduction to sigma delta ADC. Special ICs for communications systems: 555 Timer, Voltage Regulator.

Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL302 DIGITAL COMMUNICATION (3-0-2-4)
Pre-requisite: NIL
Contents:

Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL303 MICROWAVE AND ANTENNAS (3-0-2-4)
Pre-requisite: ECL205 ELECTROMAGNETIC WAVES
Contents:

Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL304 DIGITAL SIGNAL PROCESSING (3-0-2-4)
Pre-requisite: ECL203 SIGNALS AND SYSTEMS
Contents:
Discrete time signals and systems, Sampling process, Classification of LTI systems, Discrete time systems, Linear convolution, Inverse systems, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), theorems, DFT symmetry relations. Circular convolution, Linear convolution using DFT, overlap addmethod, overlap save method. Fast Fourier Transform (FFT) algorithms, decimation in time and frequency domain and algorithms, Goertzel algorithms.

**Practical:** Practicals as per course contents.

**Text Books:**

**Additional Books:**

**ECL305 MICROCONTROLLER AND INTERFACING (3-0-2-4)**

**Pre-requisite:** ECL202 DIGITAL CIRCUITS

**Contents:**
- Tuning machine, von Neumann and Harvard architecture. Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 80186 architecture). Interfaceing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic/Logic processors; System level interfacing design; Bus architectures - Concepts of virtual memory, Cache memory. Microprocessor v/s Microcontroller, overview of various microcontrollers. Architecture and hardware description of signals of 8051/PIC. Instruction set and timing diagrams. Assembly language programming of 8051. Developing an application using 8051. Introduction to ARM microcontroller architecture and organization. Lab experiments will be based on 8085 and CS1 architecture.

**Practical:** Practicals as per course contents.

**Text Books:**

**Additional Books:**

**ECL402 FINITE AUTOMATA (3-2-0-4)**

**Pre-requisite:** ECL202 DIGITAL CIRCUITS

**Contents:**

**Text Book:**

**Additional Books:**

**ECL403 HARDWARE DESCRIPTION LANGUAGE (3-0-2-4)**

**Pre-requisite:** ECL202 DIGITAL CIRCUITS

**Contents:**

**Practical:** Practicals as per course contents.

**Text Book:**

**Additional Books:**

**ECL404 INDUSTRIAL ELECTRONICS (3-0-0-3)**

**Pre-requisite:** NIL

**Contents:**

**Practical:** Practicals as per course contents.

**Text Book:**

**Additional Book:**

**ECL405 ADAPTIVE SIGNAL PROCESSING (3-2-0-4)**

**Pre-requisite:** ECL304 DIGITAL SIGNAL PROCESSING

**Contents:**

**Text Book:**

**Additional Books:**

**ECL406 WIRELESS DIGITAL COMMUNICATION (3-0-2-4)**

**Pre-requisite:** ECL302 DIGITAL COMMUNICATION

**Contents:**
- Cellular engineering concepts; frequency reuse, frequency management and channel assignment, handoff and handoff strategies, trunking theory, coverage and capacity improvements, medium access techniques, FDMA, TDMA, CDMA, SDMA.
- Wireless Mobile Communication channel characterization: large scale path loss, free space propagation model, propagation effects such as reflection, diffraction, scattering etc. Outdoor and indoor propagation models, ray tracing and coverage prediction. Small scale fading effects: time-variant impulse response model, channel correlation functions and spectral densities, coherence time, coherence bandwidth, channel models for Rayleigh, Ricean and Nakagami fading.
Spread Spectrum methods: basics; generation and properties of PN se quences, DS-SS system analysis; slow and fast FH-SS system; performance analysis. Interference measurement and reduction, co-channel and other interference, Diversity methods for Mobile Wireless Radio Systems, concepts of diversity branch and signal paths, combining and switching methods, C/N and C/I ratio improvements, average error probability improvements. Review, and discussion on fundamental design issues of 2/3G systems: GSM, GPRS, CDMA2000, UMTS, LTE. IEEE 802.11 Wireless LAN’s system and protocol architecture, physical layer and MAC, options like 802.11b, a g etc. and their purpose. Bluetooth: User scenarios, layered architecture, link management, L2CAP, SDP, IEEE 802.15

Practical: Practicals as per course contents.

Text Book:

Additional Books:

ECL408 RADIO FREQUENCY AND MICROWAVE ENGINEERING (3-2-0-4) Pre-requisite: ECL205 ELECTROMAGNETIC WAVES

Contents:
Two port RF networks-circuit representation, Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of S parameters, properties of S parameters. Reciprocal and lossless net-works, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor. RF transistor amplifier design and matching networks, Amplifier power relation, stability considerations, gain considerations noise figure, impedance-matching networks, frequency response, T and II matching networks, micro strip line matching networks, significance of microwave frequency range-applications of microwaves. Scattering matrix-Concept of N port scattering matrix representation. Microwave junctions, Tee junctions, Magic Tee, Rat race, Corners, bends and twists, Directional couplers, two hole directional coupler, Ferrites micro-wave properties and applications, Termination, Gyration, Isolator, Circulator, Attenuator, Phase changer, S Matrix for microwave components, Cylindrical cavity resonators. Microwave semiconductor devices, operation, characteristics and application of BJTs and FETs -Principles of tunnel diodes-Varactor, Step recovery diodes, Gunn diode-Avalanche Transit time devices-IMPATT and TRAPATT devices. Parametric devices-Principles of operation- applications of parametric amplifier. Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques. Microwave tubes and monolithic Microwave tubes- High frequency limitations - Principle of operation of Multi cavity Klystron, Reflex Klystron, Traveling Wave Tube, and Magnetron. Measurement of power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

Text Books:

Additional Books:

ECL409 RADIO FREQUENCY CIRCUIT (3-2-0-4) Pre-requisite: ECL205 ELECTROMAGNETIC WAVES

Contents:

Text Books:

Additional Books:

ECL410 IMAGE PROCESSING (3-2-0-4) Pre-requisite: NIL

Contents:

Text Books:

Additional Books:

ECL412 VLSI TECHNOLOGY (3-0-2-4) Pre-requisite: NIL

Contents:

Practical: Practicals as per course contents.

Text Book:

Additional Book:

ECL413 MICRO-ELECTROMECHANICAL SYSTEMS (3-0-2-8) Pre-requisite: NIL

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Contents:
Introduction to MEMS, MEMs devices overview, Fabrication, Mechanical Properties, Electromechanical properties and modeling, Interfacing circuits. MEMS Application Areas: All-mechanical miniature devices, 3-D electromagnetic actuators and sensors, RF/Electronics devices, Optical/Photonic devices, Medical devices e.g. DNA-chip, micro-arrays.

Practical: Practicals as per course contents.

Text Book:

Additional Books:

ECL414 ELECTRONIC SYSTEM DESIGN
(3-0-2-4)
Pre-requisite: NIL.

Contents:

Practical: Practicals as per course contents.

Text Books:

Additional Books:

ECL415 BIOMEDICAL INSTRUMENTATION
(3-0-3)
Pre-requisite: NIL.

Contents:

Text Book:

Additional Book:

ECL418 RF RECEIVER DESIGN FOR WIRELESS APPLICATIONS
(3-0-3)
Prerequisite: NIL.

Contents:
Introduction to Wireless Systems: Classification of wireless systems; Design and performance issues: Choice of operating frequency, multiple access and duplexing, circuit switching versus packet switching, propagation, radiated power and safety; Cellular telephone systems and standards. Noise and Distortion in Microwave Systems: Basic threshold detection, noise temperature and noise figure, noise figure of a lossy transmission line; Noise figure of cascade systems: Noise figure of passive networks; Noise figure of passive networks, two-port networks, mismatched transmission lines and Wilkinson power dividers; Dynamic range and inter-modulation distortion. Microwave Amplifier Design: Two-port power gains; Stability of transistor amplifier circuits; Amplifier design using S-parameters: Design for maximum gain, maximum stable gain, design for specified gain, low-noise amplifier design, and design of class-A power amplifiers. Mixers: Mixer characteristics: Image frequency, conversion loss, noise figure; Devices for mixers: p-n junctions, Schottky barrier diode, FETs, Diode mixers: Small-signal characteristics of diode, single-ended mixer, large-signal model, switching model; FET Mixers: Single-ended mixer, other FET mixers; Balanced mixers; Image reject mixers. Switches; Devices for microwave switches; Device models; Types of switches; Switch configurations; Basic theory of switches; Multi-port, broad-band and isolation switches. Oscillators and Frequency Synthesizers: General analysis of RF oscillators, transistor oscillators, voltage-controlled oscillators, dielectric resonator oscillators, frequency synthesis methods, analysis of first and second order phase-locked loop, oscillator noise and its effect on receiver performance.

Pre-requisite: ECL206 ELECTRONIC MATERIAL AND DEVICES, EEL202 BASIC ELECTRICAL CIRCUITS

Contents:

Practical: Practicals as per course contents.

Text Book:

Additional Books:

ECL417 RF AND MICROWAVE MEASUREMENT SYSTEM TECHNIQUES
(3-0-3)
Pre-requisite: NIL.

Contents:
Review of measurement and instrumentation basics, Principles and applications of various sensors used in characterization of RF materials, devices, circuits and system: acoustic, ultrasonic, magnetic, electrical, thermal, optical, radiation and smart sensors, Mechanical and thermal engineering issues for RF modules/ instruments. Instrumentation concepts and measurement techniques in: Oscilloscopes, Spectrum analyzers, Network analyzer, Lock-in-amplifiers, Waveform generators, Bit-error rate measurement, S/N measurement telemetry, Data recording and display, Recent advances in RF and Microwave measurement Techniques.

Text Book:

Additional Book:

ECL416 ANALOG INTEGRATED CIRCUITS
(3-0-2-4)

Text Book:
Additional Books:

ECL419 CAD OF RF AND MICROWAVE CIRCUITS (3-0-2-4)
Pre-requisite: NIL
Contents:
Practical: Practicals as per course contents.
Text Book:

Additional Books:

ECL420 HUMAN AND MACHINE SPEECH COMMUNICATION (3-0-2-4)
Pre-requisite: ECL203 SIGNALS AND SYSTEMS
Contents:
Introduction: Human-machine speech communications aspects; digital representations of speech; intensity level of sound. Speech production: Anatomy and physiology of speech organs; articulatory phonetics; acoustic phonetics; phonetics transcription, Physiological and Mathematical Model. Speech signal analysis: Time domain methods; Frequency domain methods; Pitch estimation spectrogram analysis; Spectrum analysis, MFCC. Linear prediction coding: Least squares autocorrelation and covariance methods; Line spectral frequencies. Psychoacoustics and auditory perception: Hearing; critical bands; phenomena of masking; Mel scale. Speech signal coding: Speech coder attributes; Coding rates; PCM; ADPCM; CELP; Coding standards. Assessment of speech quality: Objective and subjective quality evaluation measures. Automatic Speech recognition: Pattern recognition approach; Dynamic time warping; Feature extraction; HMM; Language models.
Practical: Practicals as per course contents.
Text Book:

Additional Books:

ECL421 OPTICAL COMMUNICATION SYSTEM (3-0-0-3)
Pre-requisite: NIL
Contents:
Text Book:

Additional Books:

ECL422 RF MEMS (3-0-0-3)
Pre-requisite: NIL
Contents:
Introduction to RF MEMS technologies: need for RF MEMS components in wireless communications. Review of micromachining techniques and MEMS fabrication approaches, Actuation methods in MEMS, RF MEMS design and modeling. Examples of RF MEMS components from industry and academia. Case studies: micro switches, tunable capacitors, inductors, resonators, filters, and oscillators.
Text Book:

Additional Books:

ECL423 RADAR SYSTEMS (3-0-0-3)
Pre-requisite: ECL204 ANALOG COMMUNICATION
Contents:
Text Book:

Additional Books:

ECL424 SATELLITE COMMUNICATION SYSTEMS (3-0-0-3)
Pre-requisite: ECL204 ANALOG COMMUNICATION
Contents:

Basic Principles: General features, frequency allocation for satellite services, properties of satellite communication systems.

Satellite Orbits: Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

Satellite Construction (Space Segment): Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

Satellite Links: Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

Earth Station: Introduction, earth station subsystem, different types of earth stations.

Satellite system: GPS, remote sensing etc.

Text Book:

Additional Books:

ECL425 SOLID STATE DEVICES (3-0-0-3)
Pre-requisite: ECL201 ELECTRONIC CIRCUITS

Contents:

Carrier transport: Random motion Drift and diffusion. Excess carriers: Injection level, Lifetime, Direct and indirect semiconductors

Procedure for analysing semiconductor devices, Basic equations and approximations.

P-N Junction: Device structure and fabrication, Equilibrium picture, DC forward and reverse characteristics, Small-signal equivalent circuit, Switching characteristics, Solar cell.

Bipolar Junction Transistor: Device structures and fabrication, Transistor action and amplification, Common emitter DC characteristics

MOS Junction: C-V characteristics, threshold voltage, body effect.

Metal Oxide Field Effect Transistor: Device structures and fabrication, Common source DC Characteristics, Small-signal equivalent circuit, Differences between a MOSFET and a BJT.

JunctionFET and MESFET, Recent Developments, Heterojunction FET, Heterojunction bipolar transistor.

Text Books:

Additional Books:

ECL426 DIGITAL INTEGRATED CIRCUITS (3-0-2-4)
Pre-requisite: ECL202 DIGITAL CIRCUITS

Contents:

CMOS Inverter Static and Dynamic Behaviour, Noise Margin, Power Consumption and Power Delay Product, Latch up, Technology Scaling.


Sequential Circuits: Bistability, CMOS static flip-flop, Pseudo static latch, Dynamic two-phase flip-flop, CMOS latch, NOA (no race)-CMOS logic design style, Schmidt Trigger, Astable and monostable circuits.


Memory and array structures: ROM and RAM cells design, SRAM and arrays, memory peripheral circuits.

BiCMOS Logic Circuits: Introduction, Basic BiCMOS Circuit behavior, Switching delay in BC MOS logic circuits.

Practical: Practicals as per course contents.

Text Book:

Additional Books:

ECL427 INTRODUCTION TO PROBABILISTIC GRAPHICAL MODELS: PRINCIPLES AND TECHNIQUES (3-0-0-3)
Pre-requisite: SCL203 SIGNALS AND SYSTEMS

Contents:


Inference: Variable Elimination: Complexity and Graph Structure. MAP Inference: Variable Elimination for (Marginal) MAP, Max-Product in Clique Trees. Inference in Temporal Models: Exact Inference, Approximate Inference, Hybrid DBNs.


Text Book:

Additional Books:

ECL428 LOW NOISE OSCILLATOR FOR WIRELESS APPLICATIONS (3-0-0-3)
Pre-requisite: ECL205 ELECTROMAGNETIC WAVES

Contents:
Course will be project-oriented and involve a combination of analytical derivations and simulation in EM simulator.


Project 1 will be focused on the design and simulation of a low noise oscillator for phase-locked loop applications. Project 2 will be focused on the analytical derivations of project 1.

Text Book:

Additional Books:

ECL429 ADVANCED WIRELESS MOBILE COMMUNICATIONS (3-0-0-3)
Pre-requisite: ECL302 DIGITAL COMMUNICATION

Contents:


UWB (Ultra-Wide Band): UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB


Text Book:

Additional Books:

ECL430 THEORY OF ESTIMATION AND DETECTION (3-0-0-3)

Pre-requisites: SCL203 PROBABILITY & NUMERICAL METHODS, ECL304 DIGITAL SIGNAL PROCESSING

Contents:


Maximum Likelihood Estimation (MLE): Basic Procedure of MLE, MLE for Transformed Parameters, MLE for General Linear Model, Asymptotic Property of MLE.


Estimation of Signals: Linear Minimum Mean Square Error (LMMSE) Estimator, Bayesian Gauss-Markov Theorem, Wiener Filtering and Prediction.

Detection Theory: Simple hypothesis testing, Neyman-Pearson criterion, Bayes criterion, Minimax criterion, Composite hypothesis testing, Bayesian criterion.

Generalized likelihood ratio tests.

Text Book:

Additional Books:

ECL431 MOS DEVICE MODELING (3-0-0-3)

Pre-requisite: ECL301 DIGITAL COMMUNICATION

Contents:
Spatio-Temporal Propagation Modeling (Introduction, Directional Channel Modeling, Gaussian Wide Sense Stationary Uncorrelated Scattering, Gaussian Scatter Density Model.


Information Theory and Electromagnetism: The Laws of Electromagnetism, Spatial Capacity and Correlation, Spatial Sampling and MIMO Capacity, MIMO Capacity of Waveguide Channels, Spatial Capacity of Waveguide Channels.

Introduction to Space-Time Coding: MIMO System and Space-Time Coding, Alamouti’s Transmit Technique, Space-Time Block Codes, Orthogonal Space-Time Block Codes, Space-Time Trellis Codes.

Feedback Techniques for MIMO Channels: Limited Feedback MIMO, Quantized Signal Adaptation Algorithms.


Performance of Multi-User Spatial Multiplexing: Multiple-User MIMO Channel, Multi-User MIMO Transmission Schemes.

Text Book:

Additional Books:

ECL432 PROBABILISTIC, STOCHASTIC PROCESS AND NUMERICAL METHODS (3-0-0-3)

Pre-requisite: NIL

Contents:


Text Books:

Additional Books:

ECL433 MOS DEVICE MODELING (3-0-0-3)

Pre-requisite: NIL

Contents:
Review of MOS basics, Modeling Techniques, Numerical, analytical and empirical approaches.

MOSFET DC models: Pao-Sah model, charge sheet model, piece-wise linear model, models for depletion devices, carrier mobility models in deep-submicron and nanoscale dimensions, short geometry models, source/drain resistance evaluation, Dynamic models: Intrinsic charges and capacitance, Meyer’s model, quasi-static and non quasi-static model, low frequency modeling of MOS transistors, high frequency modeling of MOS transistors. SPICE MOSFET models: Level 1, 2, 3 and 4 models and their comparison. Statistical modeling: Model sensitivity, principal factor method, principal component analysis, regression models.

Text Book:

Additional Book:

ECL434 LOW POWER VLSI DESIGN (3-0-0-3)

Pre-requisite: ECL425 SOLID STATE DEVICES, ECL426 DIGITAL INTEGRATED CIRCUITS

Contents:

NITUK Course Book-2016

Text Book:

Additional Books:

ECL435 VLSI TESTING (3-0-0-3)
Prerequisite: NIL

Contents:

Text Book:

ECL436 NANOSCALE DEVICES (3-0-0-3)
Prerequisite: ECL425 SOLID STATE DEVICES

Contents:
CMOS scaling challenges in nanoscale regimes: Moore and Koomrey’s law, Leakage current mechanisms in nanoscale CMOS, leakage control and reduction techniques, process variations in devices and interconnects. Device and technologies for sub 100nm CMOS: Silicidation and Cu-low k interconnects, strain silicon – biaxial strain and process induced strain, Metal-high k gate; Emerging CMOS technologies at 52nm scale and beyond – FINFETs, surround gate nanowire MOSFETs, heterostructure (Bi-V) and Si-Ge MOSFETs. Device scaling and ballistic MOSFET: Two dimensional scaling theory of single and multigate MOSFETs, generalized scale length, quantum confinement and tunnelling in MOSFETs, velocity saturation, carrier back scattering and injection velocity effects, scattering theory of MOSFETs.


Text Book:

Additional Books:

ECL437 CAD FOR VLSI (3-0-2-4)
Prerequisite: NIL

Contents:

Practical: Practicals as per course contents.

Text Book:

Additional Book:

ECL438 VLSI INTERCONNECTS (3-0-0-3)
Prerequisite: NIL

Contents:

Text Book:

Additional Books:

**ECL439 VLSI PHYSICAL DESIGN (3-0-0-3)**
**Pre-requisite: NIL**
**Contents:**
Introduction: Layout and design rules, materials for VLSI fabrication, basic algorithmic concepts for physical design, physical design processes and complexities.
Partition: Kernighan-Lin’s algorithm, Fiduccia Mattheyses algorithm, Krishnamurty extension, hMETIS algorithm, multilevel partition techniques.
Floor-Planning: Hierarchical design, wirelength estimation, slicing and nonslicing floorplan, polar graph representation, operator concept, Stockmeyer algorithm for floorplanning, mixed integer linear program.
Placement: Design types: ASICs, SoC, microprocessor RLM; Placement techniques: Simulated annealing, partition-based, analytical, and Hall’s quadratics; Timing and congestion considerations.
Routing: Detailed, global and specialized routing, channel ordering, channel routing problems and constraint graphs, routing algorithms, Yoshimura and Kuh’s method, zone scanning and net merging, boundary terminal problem, minimum density spanning forest problem, topological routing, cluster graph representation.
Sequential Logic Optimization and Cell Binding: State based optimization, state minimization, algorithms; Library binding and its algorithms, concurrent binding.

**Text Book:**

**Additional Books:**

**ECL440 OPTOELECTRONIC DEVICES (3-0-0-3)**
**Pre-requisite: NIL**
**Contents:**
Optical processes in semiconductors, EHP and recombination, absorption and radiation in semiconductor, deep level transitions, Auger recombination, luminescence and time resolved photoluminescence, optical properties of photonic band-gap materials Junction photodiode: PIN, heterojunction and avalanche photodiode; Comparisons of various photodetectors, measurement techniques for output pulse.
Photovoltaic effect, V-I characteristics and spectral response of solar cells, heterojunction and cascaded solar cells, Schottky barrier and thin film solar cells, design of solar cell, Modulated barrier, NS and MSM photodiodes; Wavelength selective detection, coherent detection; Microcavity photodiode.
Dynamic effects of MOS capacitor, basic structure and frequency response of charge coupled devices, buried channel charge coupled devices. Electroluminescent process, choice of light emitting diode (LED) material, device configuration and efficiency; LED: Principle of operation, LED structure, frequency response, deflects, and reliability.
Semiconductor laser diode, Einstein relations and population inversion, lasing condition and gain, junction lasers, heterojunction laser, multi quantum well lasers, beam quantization and modulation.

**Text Book:**

**Additional Books:**

**ECL441 FIBER OPTIC COMMUNICATION SYSTEMS & TECHNOLOGY (3-0-0-3)**
**Pre-requisite: NIL**
**Contents:**
Optical Transmitters: Basic concepts - LED's structures - Spectral Distribution - Semiconductor lasers - Structures - Threshold conditions - SLM and STM operation - Transmitter design.
Optical Detectors and Amplifiers: Basic Concepts - PIN and APD diodes structures, Photo detector Noise, Receiver design. Amplifiers: Basic concepts - Semiconductor optical amplifiers; Raman - and Brillouin amplifiers - Erbium-doped fiber amplifiers, pumping requirements, cascaded in-line amplifiers.
Optical Components for Communication & Networking: Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters.

**Text Book:**

**Additional Books:**

**ECL442 MICROWAVE AND MILLIMETRE WAVE ENGINEERING (3-0-0-3)**
**Pre-requisite: NIL**
**Contents:**
Noise and Distortion in Microwave: Review of Random Process, Noise distributions, Noise in linear system, Basic Threshold detection, Noise Temperature and Noise Figure, Noise Figure of Passive Networks, Dynamic Range, Link Analysis.
Modern Trends in Microwave & Millimetre wave Engineering: Effect of Microwave on Human body, Medical and civil application of microwave, Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC), Monolithic Microwave IC Fabrication, RF MEMS for Microwave components, Microwave Imaging.

**Text Book:**

**Additional Books:**

**ECL443 2D SIGNALS AND IMAGE PROCESSING (3-0-2-4)**
**Pre-requisite: NIL**
**Contents:**
2D Signals and system: 2D filtering, FIR, IIR. Digital Image fundamentals: image representation, image sampling and quantization.

Morphological processing: Mathematical morphology, binary morphology, dilation, erosion, opening and closing, duality relations. Gray scale morphology, applications such as hit-and-miss transform, thinning and shape decomposition. Image compression: JPEG, H.26x standards.


Practical: Practicals as per course contents.

Text Book:

ECL446 FINITE AUTOMATA (3-0-0-3)
Pre-requisite: ECL202 DIGITAL CIRCUITS
Contents:

Text Book:

Additional Books:

ECL447 ADAPTIVE SIGNAL PROCESSING (3-0-0-3)
Pre-requisite: ECL304 DIGITAL SIGNAL PROCESSING
Contents:

Frequency domain block LMS Algorithm, Kalman Filter as the basic of RLS filter. Forward and backward linear prediction.

Text Book:
ECL453 ADVANCED DIGITAL COMMUNICATION (3-0-0-3)
Pre-requisite: ECL302 DIGITAL COMMUNICATION

Contents:

Text Book:

Reference Books:

ECL501 MIXED SIGNAL VLSI DESIGN (3-0-0-3)
Pre-requisites: ECL416 ANALOG INTEGRATED CIRCUITS, ECL426 DIGITAL INTEGRATED CIRCUITS

Contents:

Text Book:

Additional Books: