



GATES INSTITUTE OF TECHNOLOGY

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Department of Electronics & Communication Engineering

I-ISemester, R19		
Course Code	Course Name	Course Outcomes (COs)
19A54101	Algebra & Calculus	CO1: develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6) CO2: Utilize mean value theorems to real life problems (L3) CO3: familiarize with functions of several variables which is useful in optimization (L3) CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5) CO5: Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions
19A56101T	Applied Physics	CO1: Identify the wave properties of light and the interaction of energy with the matter. CO2: Apply electromagnetic wave propagation in different guided media . CO3: Assess the electromagnetic wave propagation and its power in different media. CO4: Calculate conductivity of semiconductors. CO5: Apply the basic properties of superconductivity and nanomaterials in various branches
19A05101T	Problem Solving & Programming	CO1: Construct his own computer using parts (L6). CO2: Recognize the importance of programming language independent constructs (L2) CO3: Select the features of C language appropriate for solving a problem (L4) CO4: Design computer programs for real world problems (L6) CO5: Organize the data which is more appropriated for solving a problem (L6)
19A52101T	Communicative English I	CO1: Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English CO2: Apply grammatical structures to formulate sentences and correct word forms CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions CO4: Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. CO5: Create a coherent paragraph interpreting a figure/graph/chart/table
19A04101	Electronics and	CO1: Introducing electronic components, tools used in electronic

	Communication Engineering Workshop	workshop CO2: Equip with the knowledge of understanding data sheets of electronic components CO3: Give practical experience on soldering the electronic components on a PCB CO4: Introducing EDA tools CO5: Understanding working of various communication systems
19A56101P	Applied Physics Lab	CO1: operate optical instruments like microscope and spectrometer (L2) CO2: determine thickness of a hair/paper with the concept of interference (L2) CO3: estimate the wavelength of different colors using diffraction grating and resolving power (L2) CO4: plot the intensity of the magnetic field of circular coil carrying current with distance (L3) CO5: evaluate the acceptance angle of an optical fiber and numerical aperture (L3) CO6: determine magnetic susceptibility of the material and its losses by B-H curve (L3) CO7: determine the resistivity of the given semiconductor using four probe method (L3) CO8: calculate the band gap of a given semiconductor (L3)
19A05101P	Problem Solving & Programming Lab	CO1. Construct a Computer given its parts (L6) CO2. Select the right control structure for solving the problem (L6) CO3. Analyze different sorting algorithms (L4) CO4. Design solutions for computational problems (L6) CO5. Develop C programs which utilize the memory efficiently using programming constructs like pointers.
19A52101P	Communicative English I Lab	CO1: Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills CO2: Apply communication skills through various language learning activities CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. – CO4: Evaluate and exhibit acceptable etiquette essential in social and professional settings CO5: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.
I-II SEMESTER R19		
19A04201T	Network Theory	CO1: Solve network problems using mesh and nodal analysis techniques (L3) CO2: Analyze networks using Thevenin, Norton, Maximum power transfer, Superposition, Miller and Millman theorems (L4) CO3: Compute responses of first order and second order networks using time & frequency domain analysis (L5) CO4: Design resonant circuits for given bandwidth (L6) CO5: Utilize z, y, ABCD and h parameters for analyzing two port

		circuit behavior (L3)
19A54201	Differential Equations and vector calculus	CO1:Enlighten the concept of differential equations CO2:Enlighten the concept of Multivariable Calculus CO3: Basic concepts at plus two level to lead them in to advanced level CO4:Techniques at plus two level by handling various real world applications.
19A51102T	Chemistry	CO1 : Understand the schodinger wave equation ,molecular orbital energy level diagram and band theory of solids.(L2) CO2 :Explain Nernst equation ,primary cells ,secondary cells and fuel cells. CO3 : Explain the preparation properties and applications of plastomers and elastomers .(L2) CO4 : Explain the principles of spectrometry,GC and HPLC in separation of gaseous and liquid mixtures(L2) CO5 :Apply the principle of supra molecular chemistry in application of molecular machines and switches (L3)
19A05201T	Data Structures	CO 1: Select Appropriate Data Structure for solving a real world problem (L4) CO2: Select appropriate file organization technique depending on the processing to be done (L4) CO3: Construct Indexes for Databases (L6) CO4:Analyse the Algorithms (L4) CO5: Develop Algorithm for Sorting large files of data (L3)
19A03101	Engineering Workshop	CO1: apply wood working skills in real world applications. (L3) CO2: build different parts with metal sheets in real world applications.(L3) CO3: apply fitting operations in various applications. (L3) CO4:apply different types of basic electric circuit connections. (L3) CO5:demonstrate soldering and brazing. (L2)
19A03102	Engineering Graphics Lab	CO1: Draw various curves applied in engineering(L2) CO2:Show projections of solids and sections graphically.(L2) CO3: Draw the development of surface of solids (L3) CO4:Use computers as a drafting tool. (L2) CO5:Draw isometric and orthographic drwaings using CAD packages. (L3)
19A04201P	Network Theory Lab	CO1: Verify Kirchoffs laws and network theorems. (L4) CO2: Measure time constants of RL & RC circuits.(L3) CO3: Analyze behavior of RLC circuit for different cases. (L4) CO4:Design resonant circuit for given specifications. (L6) CO5:Characterize and model the network in terms of all network parameters. (L3)
19A51102P	Chemistry Lab	CO1: Determine the cell constant and conductance of solutions(L3) CO 2:Prepae advanced polymer materials (L2) CO3: Measure the strength of an acid present in secondary batteries (L3)

		CO4: Analyze the IR and NMR of some organic compounds (L3)
19A05201P	Data Structures Lab	CO1: Select the data structure appropriate for solving the problem (L5) CO 2: Implement searching and sorting algorithms (L3) CO3: Design new data types (L6) CO4: Illustrate the working of stack and queue (L4) CO5: Organize the data in the form of files (L6)
II-I SEMESTER R 19		
19A54302	Complex Variables and Transforms	CO1: Understand the analyticity of complex functions CO 2: Understand the Singularities of complex functions CO3: Understand Laplace transforms of special functions CO4: Apply fourier series to establish identities among Euler coefficients CO5: Evaluate the fourier series expansion of periodic functions
19A04301	Signals & Systems	CO1: Understand the concepts of various transform techniques CO 2: Apply sampling theorem to convert continuous time signals to discrete time signals CO3: Analyze the frequency spectra of various continuous time using different transform methods. CO4: Analyze the frequency spectra of various discrete time using different transform methods. CO5: Classify the system based on their properties and determine the response of them
19A04302T	Electronic Devices and Circuits	CO1: Understand the principle, operation of BJT and FET. CO 2: Describe basic operation and characteristics of various semiconductor devices CO3: Analyze diode circuits for different applications. CO4: Design various biasing circuits for BJT and FET. CO5: Compare the performance of various semiconductor devices
19A04303	Probability Theory and Stochastic Process	CO1: Understand the concept of probability, random variables. CO 2: Learn how to deal with multiple random variables CO3: Formulate and solve the engineering problems involving random variable and random processes. CO4: Analyze various probability density functions of random variables. CO5: Derive the response of linear system Gaussian noise and random signals as inputs
19A04304	Digital electronics and Logic Design	CO1: Understand various number systems, error detecting, correcting codes. CO 2: Understand the logic families, combinational and sequential circuits CO3: Apply Boolean laws, KMap, QM methods to minimize switching functions CO4: Design combinational and sequential logic circuits. CO5: Compare different types of PLDs.
19A02304T	Electrical Technology	CO1: Able to calculate the emf generated on DC generator CO 2: Able to conduct open circuit and short circuit tests on single phase transformer CO3: Able to analyze three phase circuits, three induction motor

		CO4: Able to have knowledge on synchronous machine.
19A04302P	Electronic Devices and Circuits Lab	CO1: Understand the basic characteristics and applications of basic electronic devices CO 2: Observe the characteristics of electronic devices by plotting graph CO3: Analyze the characteristics of UJT, BJT, FET and SCR CO4: Design FET based amplifier circuits CO5: Simulate all circuits in PSPICE/ Multisim.
19A04305	Basic simulation Lab	CO1: Understand the basic concepts of programming in MATLAB. CO 2: Generate signals and sequences to perform various operations. CO3: Analyze signals using Fourier, Laplace and Z transforms.. CO4: Compare fourier transform of a given signal and plot its magnitude and phase spectrum CO5: Determine convolution and correlation between signals and sequences.
19A02304P	Electrical Technology Lab	CO1: Understand the various characteristics of DC generators and DC motors CO 2: Predetermine the efficiency and regulation of transformer CO3: Know power measurement in 3 phase circuits. CO4: Understand various characteristics of Induction motors CO5: Understand various characteristics of Synchronous machines
19A99302	Biology for Engineers	CO1: Basics for classification of living organisms CO 2: About biomolecules useful in Industry CO3: Briefly about human physiology CO4: About genetic material, DNA, genes and RNA CO5: Understand the applications of biological principles.
II-II Semester, R19		
19A04401	Electromagnetic Waves and Transmission lines	CO1: Explain basic laws of electromagnetic fields. CO 2: Analyze electric and magnetic fields at the interface of different media CO3: Derive maxwells equations for static and time varying fields CO4: Analogy between electric and magnetic fields CO5: Describe about the transmission lines
19A04402T	Electronic Circuit Analysis and Design	CO1: Understand the working principle of different amplifiers. CO 2: Analyze multistage type of amplifiers CO3: Analyze about multivibrators CO4: Design tuned amplifiers for given specifications CO5: Evaluate efficiency of large signal amplifiers and voltage regulators
19A02404	Control Systems	CO1: Understand the concepts of control system. CO 2: Understand the concept of state space analysis CO3: Understand the block diagram reduction, SFH. CO4: Analyse time response analysis and error constants. CO5: Design and develop different compensators and controllers
19A04403T	Analog Communication	CO1: Understand the concepts of various amplitude, Angle and

	s	<p>pulse modulation</p> <p>CO 2: Understand the pulse modulation schemes</p> <p>CO3: Analysis of analog communication system in the presence of noise</p> <p>CO4: Compare and contrast design issues in analog communication systems</p> <p>CO5: Understand the concept of information theory with random processes.</p>
19A05304T	Python Programming	<p>CO1: Apply the features of python language in various real applications</p> <p>CO 2: Select appropriate data structure of python for solving a problem</p> <p>CO3: Design object oriented programs using python</p> <p>CO4: Apply modularity to programs.</p>
19A04404	Computer Architecture & Organization	<p>CO1: Understand the basics of organizational and architectural issues of a digital computer</p> <p>CO 2: Representation of data types, numbers, binary coding of symbols used in data processing</p> <p>CO3: Develop low level programs to perform different basic instructions</p> <p>CO4: Evaluate various modes of data transfer between CPU and I/O devices</p> <p>CO5: Analyze various issues related to memory hierarchy</p>
19A04402P	Electronic Circuit Analysis and Design Lab	<p>CO1: Understand characteristics and frequency response of various amplifiers</p> <p>CO 2: Analyze different types of circuits</p> <p>CO3: Determine the efficiencies of power amplifiers</p> <p>CO4: Design RC and LC oscillators</p> <p>CO5: Simulate all the circuits and compare the performance</p>
19A04403P	Analog Communication Lab	<p>CO1: Understand different analog modulation techniques</p> <p>CO 2: Analyze different analog modulation techniques</p> <p>CO3: Design and implement different modulation and demodulation techniques</p> <p>CO4: Observe the performance of system by plotting graphs</p> <p>CO5: Simulate all digital modulation and demodulation techniques</p>
19A99301	Environmental Science	<p>CO1: Grasp multidisciplinary nature of environmental studies</p> <p>CO 2: Understand flow and bio-geo-chemical cycles and ecological pyramids</p> <p>CO3: Understand various causes of pollution and solid waste management</p> <p>CO4: Understand the rain water harvesting, watershed management, ozone layer depletion.</p> <p>CO5: Causes of population explosion, value education and welfare programmes</p>

		III-I SEMESTER R 19
19A04501T	Integrated Circuits And Applications	<ul style="list-style-type: none"> • Understand DC and AC characteristics of operational amplifiers & Op amp parameters and functionality of specialized ICs such as 555 TIMER, VCO, PLL & Voltage regulators. • Make use of Op-Amps and specialized ICs to design circuits for various applications. • Analyze Op-Amp based Comparators, Waveform generators, Active filters, Converters. • Design of Op amp based Comparators, Waveform Generators, Active filters, Converters, design various multi-vibrator circuits using IC 555 timer • Compare different types of A/D and D/A Converter circuits.
19A04502	Antennas And Wave Propagation	<ul style="list-style-type: none"> • Understand various antenna parameters, principle of operation of various antennas viz. wired, aperture, micro strip antennas. • Discuss various EM wave propagation methods in ionosphere and troposphere • Analyze mathematical aspects of wave propagation, Derive expressions related to radiation mechanisms for antennas • Design various antennas namely array, micro strip, horn, lens and aperture antennas, etc., for a given application. • Compare performance of various antennas.
19A52601T	English Language Skills	<ul style="list-style-type: none"> • Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English • Apply grammatical structures to formulate sentences and correct word forms • Analyze discourse markers to speak clearly on a specific topic in informal discussions • Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. • Create a coherent paragraph interpreting a figure/graph/chart/table
19A04503T	Digital Communications	<ul style="list-style-type: none"> • Understand the elements of digital communication system, baseband pulse transmission, pass band digital modulation, geometric representation of signals, basics of information theory and error correcting codes. • Apply the knowledge of signals and system & statistical theory to evaluate the performance of digital communication systems. • Analyze the different coding, modulation techniques, Probability of error performance of digital system. • Compare the performance of different modulation schemes& error correcting codes.
19a04504a	Data Communications And Networking	<ul style="list-style-type: none"> • Understand the requirement of theoretical & practical aspects of computer networks, functions of various layers involved in data communications, building the skills of sub netting and routing mechanisms. • Explain the role of protocols in networking. • Analyze the services and features of the various layers in the protocol stack.

19a52506a	Technical Communication And Presentation Skills	<ul style="list-style-type: none"> • Understand the importance of effective technical communication • • Apply the knowledge of basic skills to become good orators • Analyze non-verbal language suitable to different situations in professional life • Evaluate different kinds of methods used for effective presentations • Create trust among people and develop employability skills
19a04501p	Integrated Circuits And Applications Lab	<ul style="list-style-type: none"> • Understand the working of Op amp ICs & Application specific analog ICs. • Analyze operational amplifier based circuits for linear and non-linear applications. • Design Operational amplifiers for linear and nonlinear application, Multivibrator circuits using 555 & application specific ICs. • Simulate all linear and nonlinear application based Op amp Circuits and circuits based on application specific ICs. • Compare theoretical, practical & simulated results in integrated circuits.
19a52601p	English Language Skills Lab	<ul style="list-style-type: none"> • Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills • Apply communication skills through various language learning activities • Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. • Evaluate and exhibit acceptable etiquette essential in social and professional settings • Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.
19A04503P	Digital Communications Lab	<ul style="list-style-type: none"> • Understand real time behavior of different digital modulation schemes and technically visualize spectra of different digital modulation schemes. • Design and implement different modulation and demodulation techniques. • Analyze digital modulation & demodulation techniques. • Simulate all digital modulation and demodulation techniques in MATLAB.
19A99601	Research Methodology	<ul style="list-style-type: none"> • Understand basic concepts and its methodologies • Demonstrate the knowledge of research processes • Read, comprehend and explain research articles in their academic discipline • Analyze various types of testing tools used in research • Design a research paper without any ethical issues
III-II SEMESTER R 19		
19A04601T	Microprocessors And Microcontrollers	<ul style="list-style-type: none"> • Understand instruction set of 8086 microprocessor and ARM architecture. • Explain addressing modes of 8086, develop assembly language programs for various problems, describe interfacing of 8086 with peripheral devices, architecture and addressing modes of ARM Cortex M0+, assembly instruction set of ARM Cortex M0+. • Distinguish between microprocessor and microcontroller, 8085& 8086 microprocessors, design applications using microcontrollers.

19A04602T	Digital Signal Processing	<ul style="list-style-type: none"> • Understand the basic concepts of IIR and FIR filters, DSP building blocks to achieve high speed in DSP processor, DSP TMS320C54XX architecture and instructions. • Compute the fast Fourier transforms and find the relationship with other transforms. Realization of digital filter structures. • Design of FIR and IIR digital filters. • Compare FIR and IIR filters
19A04603	Digital System Design Through Vhdl	<ul style="list-style-type: none"> • Understand the architecture of FPGAs, tools used in modelling of digital design and modelling styles in VHDL. • Learn the IEEE Standard 1076 Hardware Description Language (VHDL). • Analyze and design basic digital circuits with combinatorial and sequential logic circuits using VHDL. • Model complex digital systems at several levels of abstractions, behavioural, structural. • Design complex digital CPU, vending machine and washing machines etc and analyze the case studies.
19A04605e	Principles And Techniques Of Modern Radar Systems	<ul style="list-style-type: none"> • Understand the basic principles of RADAR and its variants, RADAR based Microwave imaging. • Apply the fundamental knowledge of various RADARs, Matched Filter and to find the range between the target and RADAR, frequency and phase of the received signal. • Analyze the received data from the target using CW RADAR & MTI RADAR and to find the distance, tracking range for clutter analysis
19A52604a	Soft Skills	<ul style="list-style-type: none"> • Recognize the importance of verbal and non verbal skills • Develop the interpersonal and intrapersonal skills • Apply the knowledge in setting the SMART goals and achieve the set goals • Analyze difficult situations and solve the problems in stress-free environment • Create trust among people and develop employability skills
19A52602b	Managerial Economics And Financial Analysis	<ul style="list-style-type: none"> • Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets • Apply concepts of production , cost and revenues for effective business decisions • Students can analyze how to invest their capital and maximize returns • Evaluate the capital budgeting techniques • Prepare the accounting statements and evaluate the financial performance of business entity.
19A04602P	Digital Signal Processing Lab	<ul style="list-style-type: none"> • Ability to design-test, to verify, to evaluate, and to benchmark a real-time DSP system. • Ability to calculate discrete time domain and frequency domain of signals using discrete Fourier series and Fourier transform. • Ability to design, using MATLAB-based filter design techniques, FIR and IIR digital filters and Determine the frequency response of filters. • Implementation of basic signal processing algorithms such as convolution, difference equation implementation and application of them in the construction of FIR and IIR filters. • Design DSP based real time processing systems to meet desired needs of the society

19A04601P	Microprocessors And Microcontrollers Lab	<ul style="list-style-type: none"> • Understand historical background of the constitution making and its importance for building a democratic India. • Understand the functioning of three wings of the government i.e., executive, legislative and judiciary. • Understand the value of the fundamental rights and duties for becoming good citizen of India. • Analyze the decentralization of power between central, state and local selfgovernment • Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
IV-I SEMESTER R 19		
19A04701T	Microwave Engineering And Optical Communications	<ul style="list-style-type: none"> • Understand the wave propagation in waveguides, principle of operation of optical sources, detectors, microwave active and passive devices. Also remember various types of fibers, modes, configurations and signal degradations • Apply the boundary conditions of the waveguides to solve for field expressions in waveguides. <ul style="list-style-type: none"> • Derive the field expressions for different modes of the waveguides, and Scattering matrix for passive microwave devices. Analyze signal degradation in optical fibers and compare the performance of various optical sources and detectors • Differentiate Linear beam tubes and crossed field tubes in terms of operation and performance.
19A04702T	Vlsi Design	<ul style="list-style-type: none"> • Identify the design for testability methods for combinational & sequential CMOS circuits. Understand CMOS fabrication flow, technology scaling, sheet resistance, square capacitance and propagation delays in CMOS circuits. • Apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits. • Analyze the behavior of amplifier circuits with various loads, static and dynamic logic circuits, various test generation methods for static and dynamic CMOS circuits. • Design MOSFET based logic circuit, Amplifier circuits using MOS transistors and MOSFET based logic circuits using various logic styles like static and dynamic CMOS
19A04703a	Satellite Communications	<ul style="list-style-type: none"> • Understand the basic concepts of satellite communications, orbital mechanics and launchers, various subsystems of a satellite and earth station, multiple access techniques low earth orbit and geo-stationary satellite systems • Apply frequency allocation standards, reliability techniques, multiple access techniques power test methods to satellite systems • Analyze satellite navigation and global positioning system • Design Uplink and Downlink of a satellite • Choosing different kinds of transmitter and receiver antennas to provide Uplink and Down Link Frequency
19A05704b	Cyber Security	<ul style="list-style-type: none"> • Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain securityprotection (L2) • Assess the vulnerabilities and threats posed by criminals, terrorist and nation statesto nationalinfrastructure (L5) • Identify the nature of secure software development and operatingsystems (L3) • Demonstrate the role security management in cyber security

		<p>defense (I2)</p> <ul style="list-style-type: none"> • Adapt the legal and social issues at play in developing solutions. (L6)
(19A52701b)	Management Science	<ul style="list-style-type: none"> • Understand the concepts & principles of management and designs of organization in a practical world • Apply the knowledge of Work-study principles & Quality Control techniques in industry • Analyze the concepts of HRM in Recruitment, Selection and Training & Development. • Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT. • Create Modern technology in management science
19A04701P	Microwave And Optical Communications Lab	<ul style="list-style-type: none"> • Understand the mode characteristics of Reflex Klystron oscillator and negative resistance characteristics of Gunn Oscillator. • Determine the Scattering matrix of given passive device experimentally and verify the same theoretically. Also determine numerical aperture and bending losses of a given optical fiber • Analyze the radiation characteristics to find the directivity and HPBW of a given antenna. • Establish optical link between transmitter and receiver experimentally to find attenuation and signal strength of the received signal
19A04702P	Vlsi Design Laboratory	<ul style="list-style-type: none"> • Understand how to use FPGA/CPLD hardware tools in the lab. • Develop HDL source code for the given problem/experiment, and simulate the given circuit with suitable simulator and verify the results. • Analyze the obtained results of the given experiment/problem. • Design and implement the experiments using FPGA/CPLD hardware tools.
IV-II SEMESTER R 19		
19A04801a	Advanced 3g And 4g Wireless Mobile Communications	<ul style="list-style-type: none"> • Understand the concepts of wireless communications and standards (L1). • Apply a wireless technique to solve engineering problem (L2). • Analyze working of wireless technologies (L3). • Evaluate a wireless technique in a given situation (L4). • Plan a wireless system for deployment (L5).
19A04802b	Principles Of Cellular And Mobile Communications	<ul style="list-style-type: none"> • Understand the concepts and operation of cellular systems (L1) • Apply the concepts of cellular systems to solve engineering problems (L2). • Analyse cellular systems for meaningful conclusions, Evaluate suitability of a cellular system in real time applications (L3). • Design cellular patterns based on frequency reuse factor (L4).
(19A04H02)	Low Power Vlsi Design	<ul style="list-style-type: none"> • Distinguish impact of various power reduction techniques at different levels of VLSI Design (L2) • Identify sources of power dissipation and apply leakage reduction techniques to reduce static power consumption in CMOS circuits (L2) • Analyze different power reduction techniques for VLSI systems at Design time, Run-time and Stand-by modes (L4) • Apply simple software power estimation and optimization techniques for low power VLSI system design (L3) • Apply low power circuit and architectural techniques such as capacitance reduction, gated clocking, VDD and Vth scaling, DVS

		etc in digital systems and SRAM designs (L3)
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