DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING, MIT MANIPAL

M. Tech. MICRO ELECTRONICS

Program Structure (Applicable to 2019 admission onwards)

YEAR	FIRST SEMESTER						SECOND SEMESTER					
	SUB CODE	SUBJECT NAME	L	T	P	C	SUB CODE	SUBJECT NAME	L	T	P	C
I	MAT 5151	PROBABILITY, RANDOM VARIABLES AND STOCHASTIC PROCESSES	4	0	0	4	ECE 5271	CMOS MIXED SIGNAL DESIGN	4	0	0	4
	HUM 5151	RESEARCH METHODOLOGY AND TECHNICAL COMMUNICATION	1	0	3	2	ECE 5272	LOW POWER VLSI DESIGN	4	0	0	4
	ECE 5152	DIGITAL VLSI DESIGN	4	0	0	4	ECE****	Elective I	4	0	0	4
	ECE 5154	PROCESSOR ARCHITECTURE AND APPLICATIONS	4	0	0	4	ECE****	Elective II	4	0	0	4
	ECE 5171	ANALOG AND RF VLSI DESIGN	4	0	0	4	ECE****	Elective III	4	0	0	4
	ECE 5172	SEMICONDUCTOR PROCESS TECHNOLOGY	3	1	0	4	*** ****	Open Elective	3	0	0	3
	ECE 5163	ANALOG AND RF LAB	0	0	3	1	ECE 5261	RESEARCH LAB	0	0	6	2
	ECE 5164	MICRO ELECTRONICS LAB	0	0	6	2						
		TOTAL	20	1	12	25		TOTAL	23	0	6	25
	THIRD AND FOURTH SEMESTER											
	ECE 6098	PROJECT WORK							0	0	0	25
		TOTAL							0	0	0	75

PROGRAMME ELECTIVES:

1. ECE 5001 ADVANCED DIGITAL SIGNAL PROCESSING
2. ECE 5002 ADVANCES IN CIRCUIT ELEMENTS
3. ECE 5003 ANALOG VLSI FOR SIGNAL PROCESSING
4. ECE 5004 CAD TOOLS FOR VLSI
5. ECE 5005 CODING THEORY
6. ECE 5006 CRYPTOGRAPHY & NETWORK SECURITY
7. ECE 5007 DATA COMPRESSION
8. ECE 5008 DETECTION AND ESTIMATION THEORY
9. ECE 5009 DIGITAL IMAGE PROCESSING
10. ECE 5010 DIGITAL SPEECH PROCESSING
11. ECE 5011 EMBEDDED SYSTEM DESIGN
12. ECE 5012 HIGH SPEED DIGITAL DESIGN
13. ECE 5013 LARGE AREA MICRO ELECTRONICS
14. ECE 5014 MEMS TECHNOLOGY
15. ECE 5015 MICROWAVE AND MILLIMETER WAVE ANTENNA
16. ECE 5016 NANO - PHOTONICS
17. ECE 5017 NONLINEAR FIBER OPTICS
18. ECE 5018 PRINTED ELECTRONICS
19. ECE 5019 QUANTUM INFORMATION SCIENCE
20. ECE 5020 RADAR SYSTEMS
21. ECE 5021 RF MICROELECTRONICS CHIP DESIGN
22. ECE 5022 SEMICONDUCTOR DEVICE PHYSICS
23. ECE 5023 SPREAD SPECTRUM COMMUNICATION
24. ECE 5024 SYSTEM ON CHIP DESIGN
25. ECE 5025 TIME-FREQUENCY & WAVELET TRANSFORMS
26. ECE 5026 VLSI PHYSICAL DESIGN AND VERIFICATION
27. ECE 5027 VLSI TESTING & TESTABILITY

OPEN ELECTIVES:

ECE 5051 ARM PROCESSOR AND APPLICATION

ECE 5052 NANO ELECTRONICS

ECE 5053 NEURAL NETWORKS AND FUZZY LOGIC

M.Tech in MICROELECTRONICS

SEMESTER I

MAT 5151 PROBABILITY, RANDOM VARIABLES AND STOCHASTIC PROCESSES [4 0 0 4]

CO1	Apply the concepts relevant to Statistical Inference such as Random Sampling and Sampling distributions.
CO2	Estimate the Parameters of the distributions based on the sample and carry out Hypothesis Testing, Regression analysis, Correlation and Analysis of Variance.
CO3	Apply comprehensive knowledge of mathematics and statistics to solve problems on Static probabilities, Dynamic probability.
CO4	Using the knowledge of stochastic processes, formulate the real life problems and determine the long term probabilities.
CO5	Based on Poison Processes, estimate the various performance measures of a queueing system

Statistical Inference: Random Sampling, Sampling distributions, Parameter Estimation and Hypothesis Testing, Regression, Correlation and Analysis of Variance - Examples.
Static probabilities, Dynamic probability. Classification of states, chains of Markov process. Stability of Markov systems, limiting behavior, random walk.
Poisson Processes: assumptions and derivations, related distributions, birth and death processes. Queuing System, general concepts, Model M/M/1 and M/M/S, steady state behavior, transient behavior.

References:

1. Hogg & Craig (1975), “Introduction to Mathematical Statistics”, 4thEdn., MacMillan,
2. J.Medhi, “Stochastic Processes”.
3. A. Papoulis and S.U. Pillai, Probability, Random Variables and Stochastic Processes, McGraw Hill, 2002.
4. P. Z. Peebles Jr., Probability, Random Variables and Random Signal Principles, McGraw Hill International Edition, 2001, Singapore.

HUM 5151 RESEARCH METHODOLOGY AND TECHNICAL COMMUNICATION

CO1	Recognize the concepts of research and identify the types of research
CO2	Identify the problem and develop the research design to a problem
CO3	Demonstrate effective mechanics of writing reports/manuscripts
CO4	Exhibit effective technical presentation skills
CO5	Develop a good research proposal

Mechanics of Research Methodology: Basic concepts: Types of research, Significance of research, Research framework, Case study method, Experimental method, Sources of data, Data collection using questionnaire, Interviewing, and experimentation. Research formulation: Components, selection and formulation of a research problem, Objectives of formulation, and Criteria of a good research problem. Research hypothesis: Criterion for hypothesis construction, Nature of hypothesis, need for having a working hypothesis, Characteristics and Types of hypothesis, Procedure for hypothesis testing, Sampling methods- Introduction to various sampling methods and their applications. Data Analysis: Sources of data, Collection of data, Measurement and scaling technique, and Different techniques of Data analysis. Thesis Writing and Journal Publication: thesis writing, journal and conference papers writing, IEEE and Harvard styles of referencing, Effective Presentation, Copyrights, and avoiding plagiarism.

References:

1. Dr Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE, 2005.
2. Geoffrey R. Marczyk, David DeMatteo & David Festinger, Essentials of Research Design and Methodology, John Wiley & Sons, 2004.
3. John W. Creswel , Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE, 2004
4. Suresh C. Sinha and Anil K. Dhiman, Research Methodology (2 Vols-Set), Vedam Books, 2006.
5. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Publisher, 2008.
6. Donald R Cooper & Pamela S Schindler , Business Research Methods, McGraw Hill International, 2007.
7. R. Pannershelvam, Research Methodology, Prentice Hall, India, 2006
8. Manfred Max Bergman, Mixed Methods Research, SAGE Books, 2006.
9. Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin, The Research Imagination, Cambridge University press, 2007.
10. Cochrain & Cox, Experimental Designs, II Edn. Wiley Publishers, 2006.

ECE 5152 DIGITAL VLSI DESIGN [4 0 0 4]

CO1	Design combinational and sequential circuits for VLSI and evaluate their performance
CO2	Describe the fabrication of MOS and CMOS circuits in silicon and discuss the related issues
CO3	Develop layouts for VLSI circuits as per the design specifications and estimate the parasitic values
CO4	Discuss the design issues related to subsystems and memory circuits
CO5	Discuss the issues related to interconnect in VLSI and their impact on performance

MOS Transistor theory, Inverters, Digital circuit design, VLSI Fabrication and Layouts, CMOS/Bulk technology, SOI technology. Basic circuit concepts and performance estimation:

Design Margins and Reliability; Pseudo-NMOS circuits, Dynamic CMOS logic, Domino CMOS structure and design, CCMOS, BiCMOS; Subsystems and Building Blocks; Semiconductor memories. Interconnects in VLSI

References:

1. Neil Weste and K. Eshragian, Principles of CMOS VLSI Design: A System Perspective, Pearson Education, 2000.
2. Jan M, Rabaey, et al, Digital Integrated Circuits: A Design Perspective, Prentice Hall, 2003.
3. Wayne, Wolf, Modern VLSI design: System on Silicon Pearson Education, 2005.
4. Sung, Mo Kang and Yosuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, TMH, 2003
5. Douglas A Pucknell and Kamran Eshraghian, Basic VLSI Design *PHI*, 2005.

ECE 5154 PROCESSOR ARCHITECTURE AND APPLICATIONS [4 0 0 4]

CO1	Describe processor data path and control with simple and multicycle implementation
CO2	Analyze memory hierarchy, cache optimization, MMU and I/O Interfacing
CO3	Illustrate instruction level parallelism with advanced techniques for instruction delivery
CO4	Apply different protocols for enforcing coherence in multiprocessor parallel architectures
CO5	Discuss architecture of digital signal processors and its features, apply processors for real time problem solving like filtering, speech and image processing etc.

Processor Data Path and Control, Pipelining, pipeline hazards, Memory hierarchy, Memory and I/O interface, multiprocessors, parallel processors, performance, Digital Signal Processors, architecture and applications

References:

1. David A.Patterson & John L.Hennessy, Computer Organization and Design-The Hardware/Software Interface, Third Edition, Elsevier, 2005
2. John L.Hennessy and David A.Patterson, Computer Architecture-A Quantitative Approach, Fourth Edition, Elsevier,2007
3. Phil Lapsley, DSP Processor Fundamentals, IEEE Press, 1997
4. Sen M. Kuo, Woon-Seng Gan Digital Signal Processors, Pearson, 2005
5. Andrew N.Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide Elsevier,2004

ECE 5163 ANALOG AND RF VLSI LAB [0 0 3 1]

CO1	Use EDA tools for Analog and RF circuit simulation
CO2	Design and simulate Analog circuits to verify their working principle
CO3	Design and simulate RF circuits to verify their working principle

Design and simulation of Analog circuits using Cadence software: High-performance current mirror circuits, Amplifiers, OTA, Gilbert cell. Design and simulation of RF blocks using Cadence software: RF continuous-time filters, RF mixer, Quadrature oscillator, RF oscillator, VCO, RF power amplifier.

References:

1. Cadence lab Manual.
2. Design of Analog CMOS Integrated Circuits, Behzavi Razavi, Tata McGraw-Hill Publishing Company Ltd,2002.
3. Philip E. Allen and Douglas Holberg, CMOS Analog Circuit design, Second Edition, OXFORD UNIVERSITY PRESS, 2012

ECE 5164 MICROELECTRONICS LABORATORY [0 0 6 2]

CO1	Perform Digital circuit simulation using EDA tools.
CO2	Design Digital VLSI circuits and validate their performance.
CO3	Model digital circuits in Verilog HDL using different modeling styles and simulate using EDA tools.

Design and simulation of digital circuits using Cadence software, and various types of modeling styles using Verilog language. Design synthesis using GENUS, and physical design using INNOVUS tool. Identify a research problem and develop a mini-project.

References:

1. Charles Roth, Lizy Kurian John, ByeongKil Lee, Digital System Design Using Verilog, 1st Edition, 2016.
2. Michael D. Ciletti, Advanced Digital Design with the Verilog HDL, Prentice Hall Publishing, 2nd edition, 2010.
3. J. Bhasker, Verilog HDL synthesis A practical primer, Star Galaxy Publishing, Allentown, 1997.
4. Digital Lab Manual, Revision 2.0, University Support Team, Cadence, Bengaluru, 2017.
5. VLSI Lab manual (Part B- Digital), Entuple Technologies Pvt. Ltd. Bengaluru, 2022.

ECE 5171 ANALOG AND RF VLSI DESIGN [4 0 0 4]

CO1	Discuss the characteristics and issues involved in analog and RF design
CO2	Analyse MOS circuits using low-frequency and high-frequency small-signal ac models
CO3	Analyze and design analog circuits like current mirror, cascode amplifier, differential amplifier, opamp, OTA
CO4	Draw CMOS layout for analog and RF circuits using techniques to minimize process errors

CO5	Design RF blocks like LNA, mixer, filter, oscillator, power amplifier.

Review of MOS device, Second-order effect, Long-channel and short-channel devices, Low-frequency and high-frequency MOS models, Noise, Analog Design flow, Design issues, Current sources and sinks; CMOS Amplifiers; Operational Trans conductance Amplifiers(OTA). Analog Layout considerations, CMOS RF Circuit Design, Frequency Synthesizers; Layout considerations for Analog and RF

References:

1. Behzad Razavi,:Design of Analog CMOS Integrated Circuits, 2nd edition, Tata McGraw-Hill, 2017.
2. David A. Johns, Ken Martin, : Analog Integrated Circuit Design, 2nd edition, Johns Wiley & Sons, 2013.
3. R. Jacob Baker, Harry W. Li, David E. Boyce, CMOS circuit design, Layout, and Simulation, 3rd edition, IEEE Press, PHI Pvt. Ltd, 2010.
4. Phillip. E. Allen, and Douglas R. Holberg, CMOS Analog Circuit Design, 3rd edition, Oxford University Press, 2012.
5. Behzad Razavi, RF Microelectronics, 2nd edition, Prentice Hall, 2011.
6. Thomas H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, Cambridge University Press, 2004.

ECE 5172 SEMICONDUCTOR PROCESS TECHNOLOGY [4 0 0 4]

CO1	Discuss the properties of materials and crystal growth techniques employed in IC fabrication.
CO2	Explain the oxidation and lithographic process.
CO3	Analyze various processes used for doping of the substrate.
CO4	Describe deposition and epitaxial growth process.
CO5	Discuss the fabrication processes of components, devices and IC assembly techniques.

Material Properties; Crystal Growth; Silicon Oxidation; Kinetics of Growth, Deal-Grove Model, Next generation lithography; Diffusion, ion stopping and channeling; etching. Realizing resistor, capacitor, diode, BJT, MOSFET, CMOS structures, Twin Tub process, High-k Dielectrics, electro-migration. Single and Double Damascene process. IC assembly techniques. Statistical Process Control and Process Monitoring in Semiconductor Fabrication

References:

1. Stephen A. Campbell, The Science & Engineering of Microelectronic Fabrication, Second Edition, Oxford University Press, 2005.
2. Gary S. May and S. M. Sze, Fundamentals of Semiconductor Fabrication, Wiley Student edition, 2004.
3. James D. Plummer, Michael D. Deal and Peter B. Griffin Silicon VLSI Technology: Fundamentals, Practice and Modeling, Pearson, 2000.
4. S.K. Gandhi, VLSI Fabrication Principles, John Wiley & Sons, 1983.
5. S. M. Sze, VLSI Technology, Second Edition, McGraw Hill, 1988

SEMESTER II

ECE 5271 CMOS MIXED SIGNAL DESIGN [4 0 0 4]

CO1	Explain the basic building blocks and circuits used in CMOS mixed-signal design (MSD)
CO2	Analyze and design switched-capacitor (SC), active-RC and different types of OTA-C filters
CO3	Design digital to analog converters and analog to digital converters for given specifications
CO4	Design current-mode circuits for filtering and sensor interfacing applications
CO5	Discuss mixed-signal layout issues

Analog and Mixed-mode Building Blocks; current mode circuit design; Discrete-time Filters; Continuous-time (CT) Filters; Data Converters; Analog circuits for Sensor Interfacing Applications; Mixed Signal Layout Issues

References:

1. R. Jacob Baker, CMOS: Mixed-Signal Circuit Design, Volume II, Wiley, 2002.
2. Rudy van de Plassche, CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters, Springer, 2003.
3. P. V. Anand Mohan, Current-mode VLSI Analog Filters: Design and Applications , Birkhauser, 2003.
4. T Deliyanis, Y Sun and J K Fidler, Continuos-Time Active Filter Design, CRC Press, 1999.
5. De Marcellis, Andrea, Ferri, Giuseppe, Analog Circuits and Systems for Voltage-Mode and Current-Mode Sensor Interfacing Applications, Analog Circuits and Signal Processing series, Springer, 2011.

ECE 5273 LOW POWER VLSI DESIGN [4 0 0 4]

CO1	Identify the issues involved in reduction of dynamic power in VLSI circuits and suggest solutions.
CO2	Estimate the switching activity in CMOS logic circuits and describe techniques for reduction of switching activity.
CO3	Analyze the impact of interconnects and repeaters in power dissipation and delay.
CO4	List the sources of leakage current in MOS devices and suggest techniques for reduction of leakage power.
CO5	Discuss system level power reduction techniques.

Sources of power dissipation. Hierarchical Low Power Design Methodologies. probabilistic power analysis; Architecture Level Power reduction techniques; Switching activity reduction techniques; Interconnect Power; Static Power reduction technique; Low power Clock Distribution; System level power reduction techniques

References

1. Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP, 2002.
2. Christian Piguet, Low-Power CMOS Circuits: Technology, Logic Design and CAD Tools, CRC press, 2005
3. Kaushik Roy, Sharat Prasad, Low Power CMOS VLSI Circuit Design Wiley, 2000.
4. Kiat, Samir S, Rofail-Seng Yeo, Wang-Ling Goh, CMOS/BiCMOS ULSI Low Voltage Low Power, Pearson, 2002.
5. Ajith Pal, Low-Power VLSI Circuits and Systems, Springer, 2015.

ECE 5261 RESEARCH LAB [0 0 6 2]

CO1	Study the literature to know the recent technological developments and understand the same.
CO2	Identify the research gap and apply the theoretical knowledge to fill the research gap.
CO3	Analyze and record the obtained results.
CO4	Demonstrate the writing skills in drafting the research article and publication of the work carried out.

Student is assigned under a Faculty for specific research area like VLSI, Signal Processing, Wireless communication, Real time embedded systems, Biomedical engineering. Students are evaluated based on synopsis presentation, mid-term and final evaluation along with report. The evaluation is conducted by the assigned Faculty in consultation with program coordinator and lab coordinator.

References:

1. Scopus and web of science indexed journals.
2. Scopus indexed conference proceedings and review articles.

PROGRAM ELECTIVES

ECE 5004 CAD TOOLS FOR VLSI [4 0 0 4]

CO1	Explain the different types of Programmable logic devices architecture.
CO2	Explain the steps of high level synthesis(HLS) and the algorithms pertaining to scheduling, allocation and binding
CO3	Minimize two level combinational circuits using exact and heuristic method
CO4	Explain the concept of BDD, ROBDD algorithms for combinational and sequential circuits
CO5	Explain the concept of Cell Library Mapping

Graph Theory, Graph optimization Problems and Algorithms. Programmable logic devices, FPGA Classification. Architectural Synthesis, Scheduling, Different types of scheduling with and without resource constraint algorithms. Two level combinational logic synthesis and optimization; Exact and heuristic method. Fault Simulation - Automatic test pattern generation (ATPG) techniques, Design for Testability.

References:

1. Giovanni De Michelli : Synthesis and Optimisation of Digital Circuits, Tata-McGraw Hill, New Delhi,2008.
2. Gary D. Hachtel, Fabio Somenzi , Logic Synthesis and Verification Algorithm, Kluwer Academic Publication, Boston,2002.
3. M.J.S.Smith , Application Specific ICs, Addison Wesley,2002.

ECE 5025 VLSI PHYSICAL DESIGN AND VERIFICATION [4 0 0 4]

CO1	Discuss various types of ASICs and their design methodologies.
CO2	Analyze and evaluate timing and clocking issues in digital circuits.
CO3	Apply graph theory to discuss the various algorithms of VLSI backend design flow.
CO4	Analyze various verification principles and verification methodologies.
CO5	Discuss the simulator architecture and operation of event-driven and cycle-based simulators.

ASICs, design flow, Transistor resistance and capacitance, timing analysis; Synopsys Prime time tool for STA, Clock tree Synthesis, Power grid analysis. Physical design, Algorithms for design automation, Clustering, System partitioning. Chip planning, Floor Planning, Placement & Routing, Algorithms, Transmission line effects and Interconnect modeling. Verification, Verilog scheduling and execution semantics. Combinational equivalence checking, modeling sequential systems, model checking, Simulator architectures.

References:

1. Weste N. and Harris D, CMOS VLSI Design: A Circuits and Systems Perspective, 4th ed. Pearson, 2010.
2. S. Sait, H. Youssef, VLSI Physical Design Automation: Theory and Practice, World Scientific, 1999
3. William K. Lam, Hardware Design Verification: Simulation and Formal Method-Based Approaches, Prentice hall PTR, 2005
4. Pallab Dasgupta, A Roadmap for Formal Property Verification, Springer, Neetherland, 2006
5. Smith M.J.S, Application Specific Integrated Circuits, Addison Wesley, 1997

ECE 5026 VLSI TESTING & TESTABILITY [4 0 0 4]

CO1	Describe the different types of testing, testing process and its significance
CO2	Discuss and analyze different types of faults and prepare models for the same
CO3	Derive test vectors for finding stuck at faults in combinational and sequential circuit using various types of structural and algebraic algorithms
CO4	Discuss and compare various Design for Testability techniques.
CO5	Describe various BIST architectures for improving testability

Digital and analog testing, Controllability and observability, Design-for-test, Test process and ATE, Fault modeling. Testing of combinational and sequential circuits. Test optimization and fault coverage. Testability - adhoc and structured approaches, Boundary scan. Signatures and Built-in self test, Reed-Muller and spectral coefficients, Signature analysis and Online self test.

References:

1. M. L. Bushnell and V. D. Agrawal, Essentials of testing for digital, memory and mixed-signal VLSI circuits, Boston: Kluwer Academic Publishers, 2013.
2. Miczo, Digital Logic Testing and simulation. New York: Harper & Row, 2003.
3. P.K. Lala, Fault Tolerant & Fault Testable hardware Design, BS Publications, 2013
4. Stanley L. Hurst, VLSI Testing: digital and mixed analogue digital techniques Inspec/IEEE, 1999.
5. M. Abramovici, M. A. Breuer, and A.D. Friedman, Digital Systems Testing and Testable Design, IEEE Press, 1994

OPEN ELECTIVES

ECE5051 ARM PROCESSOR AND APPLICATIONS [3 0 03]

CO1	Describe the ARM architecture and programmers model
CO2	Discuss the ARM and THUMB instruction set
CO3	Appriciate ARM organization and system architecture
CO4	Program using real time operating sytems
CO5	Analyze different kernel objects and interprocess communication for simple appications.

ARM Embedded systems, Processor Fundamentals, Instruction Set, Thumb Instruction Set. Cortex-M0 architecture- Memory System, MMU, Interrupts and Exceptions. Cortex-M0 OS support features; Cortex-M0 fault handling; Application programming.

References:

1. Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software, Elsevier, Morgan Kaufmann publisher, 2004.
2. Steve Furber, ARM System-on-Chip Architecture, 2nd Edition, Additon-Wesley professional, 2001.
3. Joseph Yiu, The Definitive Guide to the ARM Cortex-M0, Elsevier, Newnes, 2011.
4. Dr Alexander G. Dean, Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, ARM Education Media, 2017.

ECE 5052 NANO ELECTRONICS [3 0 0 3]

CO1	Explain the basic of Nanoelectronics and principles behind it.
CO2	Analyze the different type of nanostructures and its transport mechanisms.
CO3	Describe the various characterization techniques of nanomaterials.
CO4	Apply the knowledge to synthesis the nanomaterials and fabricate Nano devices.
CO5	Apply various principles of nanomaterials for biological systems.

Nanomaterials, Nanostructured materials, Capabilities, physical fundamentals. Scaling principles, limits to scaling, power constrained scaling limits. Electronic transport in 1,2 and 3 dimensions- Quantum confinement. Electronic and optoelectronic properties of molecular materials. Spin tunneling devices, Ferroelectric random access memory, semiconductor sensor array. Nanotechnology for biological system & bio-sensor applications.

References:

1. V. Mitin, V. Kochelap, M. Stroscio, Introduction to Nano-electronics, Cambridge University Press, 2008.
2. Rainer Waser,Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH,2003.
3. Karl Goser, Peter Glosekotter, Jan Dienstuhl, Nano-electronics and Nano-systems, Springer, 2004.
4. Sadamichi Maekawa, Concepts in Spin Electronics, Oxford University Press, 2006.
5 Edward L. Wolf, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience‖, Wiley-VCH, 2006.

SECOND YEAR

ECE 6098 PROJECT WORK [0 0 0 25]

CO1	Apply a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems
CO2	Formulate and analyze complex problems, select and apply appropriate computational and analytical techniques
CO3	Select and critically evaluate technical literature and other sources of information to solve complex problems, design solutions for complex problems
CO4	Evaluate the environmental and societal impact for solution to complex problems
CO5	Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance, communicate effectively on complex engineering matters

Students are expected to work for about 40 to 50 weeks under a guide from the department on a project relevant to the curent research trends and/or to the industry requirements. The work is expected to showcase the knowledge gained by them through two semesters of coursework as well as through a literature survey pertaining to the project. The work can be carried out in the home institution, an industry, any research laboratory of repute, or other premier institutions.

References:

1. Lab manuals associated with EDA tools/Soft computing tools etc.
3. Company/Industry user manual and their internal document.
4. IEEE Xplore/Scopus/WOS Indexed Journal articles/review articles/case studies/conference proceedings etc.
5. Associated Reference books.