M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: M.Tech. in VLSI and Nanotechnology

Programme Code: 120

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Program Educational Objectives (PEO)

Course Outcomes (CO)

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M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Faculty of Engineering and Technology (FET)

Programme Name: M.Tech. (VLSI and Nanotechnology)

Programme Outcomes (POs)

M.Tech. graduates will be able to:

PO-1. Acquire, comprehensive knowledge and understanding of the methodologies, principles, practices and technologies of the engineering domain to solve complex problems with technical competence

PO-2. Conceptualize, apply, analyze, synthesize and evaluate information related to complex engineering problems using principles of mathematics, science and engineering to create new and innovative solutions

PO-3. Provide solutions to engineering problems by designing systems, components or processes to meet the specified needs considering public health, safety, societal and the environmental considerations

PO-4. Review research literature, standards, guidelines, best practices, research methods and laboratory techniques to solve engineering problems through experimental investigations, analysis and interpretation of results

PO-5. Create, select and apply appropriate techniques and IT tools to model and solve complex engineering activities and utilize available resources effectively

PO-6. Understand the effect of engineering solutions on legal, cultural, social, public health and safety aspects and the consequent responsibilities

PO-7. Develop sustainable engineering solutions and assess their effect on society and environment

PO-8. Understand and apply ethical principles to engineering practices and professional responsibilities

PO-9. Function effectively as an individual or a team player to handle diverse problems in multi-disciplinary settings

PO-10. Make oral and written presentations to communicate technical ideas effectively to engineering community and society at large

PO-11. Apply the knowledge of engineering and management principles to manage projects in multi-disciplinary environments with consideration to cost and time

PO-12. Engage in lifelong learning and adapt to changing engineering/technology and societal requirements

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Program Educational Objectives (PEOs)

The Programme educational objectives of the M.Tech. (VLSI & Nanotechnology) Programme are:

PEO-1. To provide in-depth knowledge in the specialized engineering domain to enable them to deliver efficient solutions for complex engineering problems by critical thinking

PEO-2. To enable students to design and develop sustainable innovative solutions for industry and societal requirements through applied research by conducting engineering investigations through experimentation and usage of modern tools

PEO-3. To inculcate ethics, communication, leadership, soft, managerial and entrepreneurial skills for successful career in industries and to engage in lifelong learning

Programme Specific Outcomes (PSOs)

At the end of the M.Tech. (VLSI & Nanotechnology) program, the graduate will be able to:

PSO-1. Apply the knowledge and principles of analog, digital and mixed signal circuits & nano-electronic devices, to conceptualize and provide efficient and customized solutions through critical analysis for electronic system development

PSO-2. Design and develop sustainable VLSI and Nanotechnology solutions to industry and societal requirements through applied research, concepts and techniques of FPGA Implementation, ASIC Design, Embedded Systems, SoCs, Quantum mechanics, Nanomaterials, involving simulation analysis and usage of modern EDA tools

PSO-3. Demonstrate ethics, leadership qualities, communication, entrepreneurial skills and involvement in lifelong learning for the betterment of organization, environment and society

Course Outcomes (COs)

Course Title & Code: Full Custom IC Design **(**19VLC501A**)**

After the successful completion of this course, the student will be able to:

CO-1. Discuss the concepts of MOS transistors, micro and macro level Integrated Circuits
CO-2. Analyze, evaluate and recommend appropriate CMOS circuits for development of standard cell libraries and IPs
CO-3. Model, simulate and analyze the static and dynamic properties of CMOS circuits
CO-4. Design and optimize CMOS circuits for high performance applications
CO-5. Use EDA tools to model, design, simulate, analyze and implement the micro and macro level CMOS ICs

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Course Outcomes (COs)

Course Title & Code: Quantum Mechanics and Nano-electronics **(19VLC502A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Perform theoretical studies and calculations with applications on atomic and subatomic phenomena
- **CO-2.** Gain knowledge on various Nano devices and their working principle
- **CO-3.** Simulate the basic notion behind quantum mechanics
- **CO-4.** Evaluate experimental results in terms of quantum mechanics
- **CO-5.** Apply the knowledge of mathematics, science, and engineering to develop Nano structures and devices

Course Outcomes (COs)

Course Title & Code: Semi-Custom IC Design **(19VLC503A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss concepts of logical and physical designs in semi-custom ASIC design flow
- **CO-2.** Develop an efficient Register Transfer Logic (RTL) code for a given digital design
- **CO-3.** Synthesize optimized RTL code for timing, area and power applying suitable constraints
- **CO-4.** Analyze physical implementation, optimization and verification of synthesized RTL code
- **CO-5.** Use EDA tools for simulation, synthesis, Static Timing Analysis and Physical implementation of semi-custom ASIC design

Course Outcomes (COs)

Course Title & Code: Nano Scale Device Modelling and Simulation **(19VLC504A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the device physics, theory, models and quantum mechanical effects of MOSFETs and FinFETs
- **CO-2.** Apply device physics and models to analyze the device characteristics and short channel effects
- **CO-3.** Model, analyze and evaluate device parameters, characteristics and performance
- **CO-4.** Model and simulate device characteristics at different technology nodes
- **CO-5.** Analyze and evaluate device short channel effects using SPICE and BSIM models
- **CO-6.** Design, simulate, analyze and compare the performance of MOSFET and FinFET based digital circuits using SPICE tools

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Course Outcomes (COs)

Course Title & Code: Signal Integrity and High-Speed Design **(19VLE511A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the concepts of high-speed interconnects and Printed Circuit Board (PCB)
- **CO-2.** Analyze and solve signal integrity issues in terms of crosstalk, SSN, signal return path, groundbounce, differential signaling, EMI and integration issues of PCB
- **CO-3.** Identify and apply appropriate design optimization to overcome signal integrity issues
- **CO-4.** Develop components library and arrive at schematic for a given design
- **CO-5.** Design, create, capture and develop a layout for the schematic and perform componentplacement, and routing to realize PCB for a given application
- **CO-6.** Use standard software tools to implement and analyze reflection, crosstalk and EMI for highspeed PCB

Course Outcomes (COs)

Course Title & Code: Sensors and Systems Design **(19VLE521A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Choose and discuss the working principle of sensors for various applications
- **CO-2.** Design electronic interface circuits for reading data from sensors
- **CO-3.** Analyze various methods /steps in the fabrication of Nano sensors
- **CO-4.** Design high performance data converters suitable for sensor-based systems
- **CO-5.** Apply the concepts of sensors and signal processing to design a sensor-based data acquisition system
- **CO-6.** Design, develop and simulate a sensor-based system

Course Outcomes (COs)

Course Title & Code: Research Methodology and IPR **(19FET508A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research, Nature of Intellectual Property.
- **CO-2.** Discuss the guidelines to progress from the choice of broad field of research to specific topic of research, patent rights, process of patenting at National and International level, New Developments in IPR.
- **CO-3.** Demonstrate the application and utility of the Systematic approach and out of box thinking concepts for research to be effective.
- **CO-4.** Adapt, analyze and prepare well-structured research proposal and research paper invoking clearly outlined principles.

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Course Outcomes (COs)

Course Title & Code: Professional Communication **(**19FET509A**)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Compose effective written business communication
- **CO-2.** Practice the techniques of presentation

Course Outcomes (COs)

Course Title & Code: FPGA System Design and Implementation **(**19VLC511A**)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the methodologies involved in design, verification and implementation of digital designs on reconfigurable hardware platform (FPGA)
- **CO-2.** Discuss and analyze different FPGA Architectures and significance of components of architectures.
- **CO-3.** Develop optimized design for area, timing and power by applying suitable constraints
- **CO-4.** Develop efficient synthesizable HDL code for hardware realization of a given digital design
- **CO-5.** Use EDA tools to develop, verify and implement digital design on reconfigurable

Course Outcomes (COs)

Course Title & Code: Nano Materials and Devices **(**19VLC512A**)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the working principles of various Nano devices
- **CO-2.** Design electronic circuits using Nano devices
- **CO-3.** Analyze the Nano circuits design and optimize it for high performance
- **CO-4.** Acquire knowledge on the fabrication of nanostructures from materials
- **CO-5.** Apply the knowledge of device physics in nanoscale engineering

Course Outcomes (COs)

Course Title & Code: VLSI Verification and Testing **(**19VLE512A**)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss different functional verification methodologies and different aspects of hardwareverification language
- **CO-2.** Discuss need of IC testing, fault modelling and simulations and different techniques for testing
- **CO-3.** Develop and analyze functional verification environment using hardware verification languages and different components of functional verification
- **CO-4.** Analyze different testing approaches and DFT techniques at various design hierarchies
- **CO-5.** Perform verification of an IC and apply designs for testing and optimize the design usingstandard CAD tools

Course Outcomes (COs)

Course Title & Code: Analog and Mixed Signal Circuit Design (19VLE513A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Gain knowledge on the working and design principles of analog and mixed signalcircuits
- **CO-2.** Design and analyze CMOS mixed signal circuits for a given specification
- **CO-3.** Acquire knowledge on design different architectures in mixed signal mode.
- **CO-4.** Analyze and optimize the circuits for achieving high performance
- **CO-5.** Use EDA tools to model, design, simulate, analyze and implement analog, digital,and mixed signal circuits

Course Outcomes (COs)

Course Title & Code: Programmable Embedded SoCs (19VLE514A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the principles of SOC design flow, reconfigurable computing and reusable cores principles.
- **CO-2.** Discuss the SOC verification methodologies and the Hardware/ Software co-design methodologies
- **CO-3.** Discuss the design principles of IOT for Embedded platform
- **CO-4.** Analyse and develop different layer and communication protocols
- **CO-5.** Design and prototype the IOT on Embedded platform

Course Outcomes (COs)

Course Title & Code: MEMS and NEMS (19VLE522A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Gain the physical knowledge underlying the operation principles and design of micro and Nano- systems
- **CO-2.** Acquire the basics of design and fabrication techniques in MEMS and NEMS
- **CO-3.** Model and design different types of MEMS and NEMS
- **CO-4.** Analyze the issues in packaging and choose a suitable packaging technique for various needs
- **CO-5.** Apply the design and fabrication knowledge for various applications such as Nano machines and robots

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Course Outcomes (COs)

Course Title & Code: Advanced Nano Materials and Applications **(19VLE523A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Elucidate on advantages of nanotechnology-based applications in each industry
- **CO-2.** Provide instances of contemporary industrial applications of nanotechnology
- **CO-3.** Provide an overview of future technological advancements and increasing role of nanotechnology in textile industry
- **CO-4.** Provide an overview of future technological advancements and increasing role of nanotechnology in defence industry
- **CO-5.** Provide an overview of future technological advancements and increasing role of nanotechnology in electrical and electronics industry

Course Outcomes (COs)

Course Title & Code: Quantum Computing and Communication **(19VLE524A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the theory, concepts and challenges of quantum mechanics as applied to computing and communications.
- **CO-2.** Design and simulate the quantum circuits and algorithms
- **CO-3.** Discuss the fundamentals of quantum computation identify the requirements for physical systems to be used as quantum computers;
- **CO-4.** Design and simulate the behavior of quantum communication networks
- **CO-5.** Analyze and determine the performance of a quantum network through specific performance metrics

Course Outcomes (COs)

Course Title & Code: Value Education **(19FET510A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the role of Values and Ethics in Self-Development
- **CO-2.** Appreciate the importance of Universal Brotherhood

Course Outcomes (COs)

Course Title & Code: Internship/other activities **(19VLP521A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Write a report on experiences during internship.
- **CO-2.** Make a presentation to a panel of examiners.

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Course Outcomes (COs)

Course Title & Code: Group Project **(19VLP522A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Define aim and objectives of the chosen project idea and explain its applications
- **CO-2.** Arrive at various technical specifications to be targeted while executing the project
- **CO-3.** Specify the methodologies/procedure/methods for the design and implementation of the project
- **CO-4.** Demonstrate /present a prototype of the implemented project
- **CO-5.** Work as team, develop leadership and project management skills

Course Outcomes (COs)

Course Title & Code: Dissertation and Publication **(19VLP523A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Critically review scholarly literature collected from various sources for the project purpose and formulate a research problem
- **CO-2.** Prepare and present a research proposal
- **CO-3.** Conduct research to achieve research objectives
- **CO-4.** Propose new ideas/methodologies or procedures for further improvement
- **CO-5.** Create research document and write research papers for publications
- **CO-6.** Defend the research findings in front of scholarly audiences

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