Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
Phone : 07104 – 236381, 237307, Fax : 07104 – 237681,
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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

Session 2020 -21

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

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Domain 1: VLSI / Embedded Systems

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	

R.T.M. Nagpur universityScheme of Examination for
M. Tech. (VLSI) First Semester

PGVLS101T	VLSI Subsystem Design

Course Objectives:

1. To study the fundamentals of MOS devices and their characteristics.
2. To lay good foundation on the design and analysis of CMOS analog integrated circuits.
3. To study Transient Optimization techniques.
4. To learn and understand clocking strategies.

Course Outcome: By the end of the course, the students shall be able to

1. Design different CMOS based circuits.
2. Analyze the model parameters of CMOS based circuits.

UNIT I: Electrical Properties of MOS Transistors

(9) Electrical Properties, Junction Diode, MOS Transistor: Operation Modes: Threshold Voltage:Metal and Polysilicon; Trapped Charge; Implants, Strong Inversion: Charge Modeling; ConstantVt model: NMOS/PMOS transistors: I/V characteristics, Parasitic Bipolar Transistors: CMOSLatch-up, Analysis (D.C. and Transient).

UNIT II: **(9)**

Device Capacitances and Charge Storage in MOS: NMOS/CMOS circuit analysis, Small signal amplifier model; Miller Effect, Layout / Fabrication, Diffusion / Implants / Wires, NMOS/CMOS processes, SCMOS Design Rules - special derivation; self-aligned processes, Logic Level Design, Realization of Duals for CMOS, Euler path layout, Topological Considerations.

UNIT III: **(8)**

Don't Cares and Redundancy, Layout Parasitic Reduction, I/V for MOS Logic Families, Prop. Delay for CMOS/NMOS/PNMOS, Layout Capacitance/Resistance Estimation; Gain effects; MOS Performance Estimation, Buffers/Capacitive Loading, Power Dissipation.

UNIT IV: **(9)**

Transient Optimization, Sidewall/2-d and 3-d effects: Cross-talk, Fringing, Ball-Park numbers for process Estimation: Scaling CMOS Design Optimization: High-Speed Logic Strategies, Interconnection, Distributed R/C, Cross-Talk, Noise

UNIT V: **(9)**

Clocking Strategies, Sub-System Design and Partitioning Dynamic Logic, Dynamic Circuits, Stored Charge and timing, Domino Logic, Switched Capacitor and Charge Flow Circuits, Pass- Transistor Logic (CPL) Data-Path and Memory Circuits: Static/Dynamic Memories, Ancillary Memory Analog Circuits.

TEXT BOOKS:

1. Weste, "Principles of CMOS VLSI Design(2nd Edition)
2. Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Systems and Circuits", Prentice Hall of India , 1993
3. Wayne Wolf,"Modern VLSI Desin" 2nd Edition, Prentice Hall 1998

REFERENCE BOOK:

1. Sung-Mo-Kang, Yusuf Labelbici,"CMOS Digital Integrated Circuits" 3rd Ed, Mc Graw Hill

PGVLS103T	VLSI Circuits

Course Objectives:

1. To study basics of VLSI Design methodologies.
2. To study different VLSI design rules.
3. To study in depth the flow of VLSI System Design.
4. To study VLSI Design Modeling and it's synthesis.

Course Outcome: By the end of the course, the students shall be able to

1. Describe and formulate the flow of VLSI Design for any application.
2. Simulate and Analyze the VLSI Circuits.

UNIT I: VLSI Design Methodologies (9)

Introduction to VLSI Design Methodologies – Review of Data Structures and algorithms - Review of VLSI Design Automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – General Purpose methods for combinatorial optimization.

UNIT II: Design Rules (9)

Layout Compaction – Design Rules – Problem Formulation – Algorithms for constraint graphcompaction – placement and partitioning – Circuit representation – Placement algorithms
-partitioning

UNIT III: Floor Planning (8)

Floor planning concepts – shape functions and floor plan sizing – Types of local routingproblems – Area Routing – Channel Routing – Global Routing – Algorithm for Global Routing.

UNIT IV: Simulation (9)

Simulation – Gate-Level modeling and simulation – Switch-level modeling and simulation – Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.

Unit V: Modeling and Synthesis (9)

High Level Synthesis – Hardware models – Internal representation – Allocation – assignment and scheduling – Simple Scheduling algorithm – Assignment problem – High level transformations.

Text Books:

1. S. H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N. A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.

References Books:

1. Sadiq M. Sait, Habib Youssef, " VLSI Physical Design Automation: Theory and Practice", World Scientific 1999.
2. Steven M. Rubin, " Computer Aids for VLSI Design", Addison Wesley Publishing 1987.

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS201T	Analog VLSI Design

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and to examine the basic building blocks of large-scale circuits.
2. To learn about Device Modeling- Various types of analog systems- CMOS amplifiers and Comparators.

Course Outcome: By the end of the course, the students shall be able to

1. Understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I: **(9)**

Device modeling and simulation Modeling, MOS Models Diode model, Bipolar modes BSIM Spice models, Circuit simulations using Spice, Basic Building Blocks: Switches, Current sources and sinks, Current mirrors, Voltage and current references.

UNIT II: **(9)**

Amplifiers: MOS Inverting amplifier, Cascade amplifiers, Feedback amplifiers, Differential amplifiers, Frequency response, noise performance in Diff amplifiers, Output amplifiers.

UNIT III: **(8)**

CMOS Two stage OPAMP Design, Cascade OPAMPs, Simulation and Measurement of OPAMPs,Comparators.

UNIT IV: **(9)**

Analog signal processing, CMOS Digital to analog converters, Scaling and serial, cyclic, Analogto digital converters Serial, SAR, Parallel, Pipelined, sigma-delta converters.

UNIT V: **(9)**

Mixed signal Layout issues, Continuous time filters, Switched capacitor filters, Modulator andmultipliers,PLL, Advance topics on Analog VLSI.

TEXT BOOKS:

1. VLSI Design Techniques for analog and digital circuits, R.L.Geiger, P.E.Allen, McGRaw Hill,2008, 4th Edition
2. CMOS circuit design, Layout and simulation, J.Baker, D.E.Boyce, IEEE Press, 2003, 1stEdition

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits , McGraw-Hill, 2001

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS202T	VLSI Testing

Course Objectives:

1. To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome: By the end of the course, the students shall be able to

1. Do testing of various Memory Modules and Combinational & sequential logic Circuits.

UNIT I: INTRODUCTION TO TESTING (9)

Faults in digital circuits, Modeling of faults, Logical Fault Models, Fault detection, Fault location, Fault dominance, Logic Simulation, Types of simulation, Delay models, Gate level Event-driven simulation.

UNITII:TESTGENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (9)

Test generation for combinational logic circuits, Testable combinational logic circuit design,Testgeneration for sequential circuits, design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (8)

Design for Testability, Ad-hoc design, Generic scan based design, Classical scan based design,System level DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (9)

Built-In Self Test, Test pattern generation for BIST, Circular BIST, BIST Architectures, TestableMemory Design, Test algorithms, Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (9)

Logic Level Diagnosis, Diagnosis by UUT reduction, Fault Diagnosis for CombinationalCircuits Self-checking design, System Level Diagnosis.

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design",Jaico Publishing House, 2002.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory andMixed -Signal VLSI Circuits", Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice all International, 2002

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS203T	Modeling of Digital System and Testing

Course Objectives:

1. To learn different styles of modeling in Verilog.
2. To Study simulation of digital circuits.
3. To study basics of FPGA and its applications.
4. To learn fundamentals of testing of logic circuits.

Course Outcome: By the end of the course, the students shall be able to

1. Simulate different combinational and sequential circuits.
2. Test different logic circuits.

UNIT I: Verilog for System Design **(9)**

Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Writing Test bench.

UNIT II: Digital Circuit Simulation **(9)**

Design of combinational circuit building blocks: synthesis of logic functions using multiplexers, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, SRAM Model
Design of Sequential Circuit Building block, Flip flops, registers with enable input, design of bit counting circuit.

UNIT III: Sequential Circuit Simulation **(9)**

Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, UART Model, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, Design example - bus structure.

UNIT IV: Field Programmable Gate Arrays **(8)**

Introduction to FPGA, Logic Block Architecture, Routing Architecture, ProgrammableInterconnections, DesignFlow, Xilinx Spartan architecture, Xilinx Virtex Architecture,Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hotencoding, Hardware-software co-simulation, Bus function models, Bus Functional Model (BFM)Simulation, Case Study: Xilinx Spartan III.

UNIT V: Testing of logic circuits **(9)**

Testing Philosophy, Role of Testing, fault model, complexity of a test set, Detection of single Multiple Faults in Combinational Logic Circuits, techniques for testing of sequential circuits, Design for testability.

TEXT BOOKS:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
3. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier

REFERENCE BOOKS:

1. Brown, Vranesic ―Fundamentals of digital logic design with VHDL, McGraw Hill
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester Elective-I (Discipline Specific):

PGVLS104/3T	Embedded Systems

Course Objectives:

1. To study fundamentals of 8051 microcontroller, PIC-16c6x/7x and ARM-7.
2. To study interfacing of different peripherals with microcontrollers based upon theembedded application.

Course Outcome: By the end of the course, the students shall be able to

1. Program an embedded system
2. Design, implement and test an embedded system.

UNIT I: (8)

Introduction to controllers, 8051 controller, Block Diagram &Architecture, 8051 Instruction Set, Addressing modes & programming, 8051 Timers, Serial I/O, Interrupts programming,

UNIT II: (10)

Memory Interfacing, Programming, Real time interfacing with LED, LED display, LCD display Enhanced Features: Dallas HSM & Atmel Micro-controllers, Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators.

UNIT III: (9)

RISC Controller: PIC Micro-controllers–overview; features, PIC 16c6x/7x–architecture, file selection register, Memory organization, Addressing modes, Instruction set, Programming, PIC- 18 Flash Micro- controllers. STATUS, OPTION_REG, PCON registers

UNIT IV: (9)

Memory Organization: Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/Oports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT V: (8)

ARM Micro-controllers overview; features, ARM 7 –architecture, Thumb, Register Model, Addressing modes, Introduction to Embedded C Programming.

TEXT BOOKS:

1. Embedded system Design ,Steve Heath, Butterworth Helneman,2008,4th
2. The 8051 Microcontroller-architecture, Programming & Applications, Kenneth J.Ayala,Penram International & Thomson Aisa,2003,2nd
3. The 8051 Microcontroller and Embedded Systems, Mazidi and McKinley, Pearson Education,2010, 2nd Edition.

REFERENCE BOOKS:

1. Programming Embedded Systems with C and GNU Development Tools, Michael Barr,Anthony Massa, O'Reilly publishers, 2nd Edition
2. Real Time Interfacing to ARM, Cortex-M Microcontrollers, Embedded systems, JonathanValvano,5th Edition

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second SemesterElective-III (Discipline Specific):

PGVLS204/2T	Micro Electro Mechanical Switches (MEMS)

Course Objectives:

1. To understand Standard microfabrication techniques and the issues surrounding them.
2. To understand Major classes, components, and applications of MEMS devices/systems andto demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. To understand microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem**.**

Course Outcome: By the end of the course, the students shall be able to

1. Understand working principles of currently available microsensors, actuators used in Microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devicesand systems.
3. Understand the basic principles and applications of micro-fabrication processes.

UNIT I: **(8)**

Micro-fabrication and Micromachining : Integrated Circuit Processes, Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

UNIT II: **(8)**

Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT III: **(9)**

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

UNIT IV: **(10)**

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems: Success Stories, Micromotors, Gear trains, Mechanisms.

UNIT V: **(9)**

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. MEMS for RF Applications: Need for RF MEMS components in communications, space and defense applications.

TEXT BOOKS:

1. Sensor Technology and Devices: Ristic L (ed), Artech House, London, 1994.
2. Semiconductor Sensors: Sze S.M. (ed), John Wiley, New York, 1994.
3. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

REFERENCE BOOKS :

1. Integrated Sensors, Micro actuators and micro-systems (MEMS): K.D. Wise, Special Issue of proceedings of IEEE, Vol. 86, No.8, August 1998
2. RF MEMS: Theory, Design, and Technology: Gabriel M. Rebeiz, Wiley, 2003.
3. Fundamentals of Microfabrication: Marc Madou, CRC Press, 1997.

“A Low Power and High Speed Voltage Level Shifter Based on a Regulated Cross Coupled Pull Up Network”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

By

Priyanka M.Chimegaokar

Guide

Prof. Dr. P. R. Rothe

Department of Electronics EngineeringPriyadarshini

College of Engineering Nagpur 440 019

Year 2021

INTRODUCTION

The use of multiple voltages increases circuit complexity, and therefore requires throughout performance and reliability analysis. Level shifters need to be embedded for interfacing of separate voltage domains, and digital logic segments need to be designed for their dedicated voltage supply. The utilization of dynamic voltage scaling empowers for further enhancement among execution and power sparing by varying the supply voltage based on the speed necessities of the integrated circuit (IC) at any point of time Many sensorinterfaces. need high voltage actuation. Applications include electrostatic actuation or ultrasonic transducers[1], [2], where typical operating voltage varies from above 10V for piezo-electric transducers and Piezo- electric Micromachined Ultrasonic Transducers (PMUT) to above 50V for Capacitive Micro-machined Ultrasonic Transducers(CMUT). Furthermore, the high resolution requirements necessities above 10MHz driving frequency for the transducers with over 10pF parasitic capacitance. To address the requirements we are presenting a driver capable of both high voltage and high band-width operation.

Typical layout explains the circuit we proposed for efficient high-voltage level-shifting. There are several high-voltage processes available from various foundries. For example, the TSMC 32V/0.18um process, consists of normal transistors operating at nominal VDD=1.8V, and special-designed high-voltage transducers operating at a relatively high supply voltage HV VDD=32V. Due to potential latch-up problems, the high-voltage transistors is inside highvoltage wells isolated with high-voltage guard-ring and highvoltage bottom isolation layer.The high-voltage MOSFET (HVMOS) has thicker oxide thickness to prevent oxide breakdown from high gate voltage. A clear drawback is reduced Cox and turn-on current. Further Fig. 1.1 Typical layout for high-voltage process (a)topview (b)sideview. more, the minimum gate length of HVMOS in this process is limited to 1.5µm. Also HV devices need to be spaced further than LV transistors, not to mention area consumed by guardring itself. These several drawback make it challengingto design a high-speed high voltage circuit efficiently without large area or power penalty. To minimize the area and power overhead, typical high voltage sensor interface circuits perform most of the signal processing such as delay and frequency control in low voltage domain, following by a level-shifter to shift up the signal to high-voltage domain as illustrated.

The efficient and very low power voltage level shifter is briefly discussed in the paper, the switching speed is increased day by day in analog and digital signal processing applications while the dynamic power consumption also decreased by adopting a new regulated cross coupled method of pull up network. The proposed level shifter may transform input signal with voltage levels far lower than a MOS device threshold voltage to greater nominal supply voltage levels. Even though to low number of components, the proposed level shifter method occupies a tiny silicon area with ultra low power consumptions by making it appropriate low power applications such as implanted medical devices and wireless sensor networks. the results of this work analyzed in Tanner EDA tool at 180 nm and 45 nm CMOS technology.

“Design of single precision floating Point Arithmetic Unit”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of TechnologyIn

Electronics Engineering (VLSI)

By:

Devyani Ravindra Kamale

Guide:

Mrs.P.J. Suryawanshi

Ms.S.G. Mungale

Department of Electronics Engineering

Priyadarshini College of Engineering

Nagpur 440019

Year 2021

INTRODUCTION

1.1 OVERVIEW

The floating-point operations have found intensive applications in the various fields for the requirements for high precious operation due to its great dynamic range, high precision and easy operation rules. High attention has been paid on the design and research of the floating- point processing units. With the increasing requirements for the floating-point operations for the high-speed data signal processing and the scientific operation, the requirements for the high-speed hardware floating point arithmetic units have become more and more exigent. The implementation of the floating-point arithmetic has been very easy and convenient in the floating-point high-level languages, but the implementation of the arithmetic by hardware has been very difficult. With the development of the very large-scale integration (VLSI) technology, a kind of devices like Field Programmable Gate Arrays (FPGAs) have become the best options for implementing floating hardware arithmetic units because of their high integration density, low price, high performance and flexible applications requirements for high precious operation. Floating-point implementation on FPGAs has been the interest of many researchers. The use of custom floating-point formats in FPGAs has been investigated in a long series of work. In most of the cases, these formats are shown to be adequate for some applications that require significantly less area to implement than IEEE formats and to run significantly faster than IEEE formats. Moreover, these efforts demonstrate that such customized formats enable significant speedups for certain chosen applications. The earliest work on IEEE floating-point focused on single precision although found to be feasible but it was extremely slow. Eventually, it was demonstrated that while FPGAs were uncompetitive with CPUs in terms of peak FLOPs, they could provide competitive sustained floating-point performance. Since then, a variety of work has demonstrated the growing feasibility of IEEE compliant, single precision floating point arithmetic and other floating-point formats of approximately same complexity. The details of the floating-point format are varied to optimize performance. The specific issues of implementing floating-point division in FPGAs have been studied.

“Design of Efficient Adder For High Speed”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

By

Sarita Shambharkar

Guide

Mrs. Archana Khandait

Department of Electronics Engineering

Priyadarshini College of EngineeringNagpur 440 019

Year 2021

INTRODUICTION

1.1 High Speed Adder

In many computer arithmetic algorithms, adders play a critical role. Not just in computers, but also in processors for various activities, one of which is the incrementing of the program counter. It is practically a need for most cognitive programmers, and it is also thought to be pliant. Adders reduce the number of transistors in any circuit. Although adders are critical, the choice of adder varies from programmer to programmer based on speed, power dissipation, and area use. Any digital circuit must meet the following requirements: s low power consumption low power dissipation small space high speed because a single adder cannot have all of the above characteristics, certain adders take precedence over others depending on the user's needs. The comparison of several 4 bit, 8 bit, 16 bit and 32 bit adders has been carried out carefully to choose adders appropriate and not difficult. The addition of two n bit number operations in a digital circuit is used to reduce the circuit's intricacy, and it is an operation.

1.2 Overview of Adder

Ripple carry adder, Carry skip adder, Kogee stone adder these adder are going to study on this project these are the some most popular adder. This particularly focuses on the analysis of dynamic power consumption of each adder and area consume by the device get analyze. Three adder we used to compare with each other to find which adder is better in performance. The adoption of an adder with the required qualities ensures the circuit's smooth running. The adders that have been analyzed are all 4bit and 8bit and 32bit adders that have a been generated and simulated using Xilinx synthesis tools. The results of synthesis reports and circuit simulations aid in the discovery of various attributes. Area consumed power and speed may be determined for a prototype. Based on power and area the three different adder we compare to which adder are best. Different adder have a different own properties

Adders are particularly classified into serial and parallel prefix adders on a broader range. Kogge- Stone adder is a parallel prefix adder. In simple words, it uses parallel carry-lookahead addition to achieve even lower delay in the order of O (Log N). It uses a technique called recursive doubling in an algorithm for solving a large class of recurrence problems on parallel computers. Recursive doubling involves the splitting of the computation of a function into two equally complex sub functions whose evaluation can be performed simultaneously. The kogge-stone adder has log 2N stages and a fanout of 2 at each stage. This comes at the cost of many long wires that must be routed between stages.

Domain 2: Signal Processing/ Networks

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology

PGVLS102T	Advanced Digital Signal Processing

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applicationsand retrieval of information from signals.
3. To study designing of digital filters and its realization.
4. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
5. To Study Power Spectrum Estimation.
6. To study the application of Wavelet Transforms.

Course Outcome: By the end of the course the students shall be able to:

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regardto sampling andreconstruction.
3. Design and implement digital filter for various applications.
4. Estimation of Power Spectrum
5. Describe the concept of multi rate signal processing and how to apply it for the wavelettransform.
6. Describe the various transforms for analysis of signals and systems.

UNIT I: Multirate Digital Signal Processing: **(9)**

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass SignalsLinear Prediction and Optimum Linear

UNIT II: Filters: **(8)**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linearprediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT III: Power Spectral Estimation: **(9)**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman,Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT IV: Parametric Method of Power Spectrum Estimation: **(10)**

Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation andModel Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

UNIT V: **(8)**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet,Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets

.TEXT BOOKS:

1. Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms andApplication, PHI.
2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

REFERENCE BOOKS:

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.

2. ES Gopi. “Algorithm collections for Digital Signal Processing Applicationsusing Matlab”,Springer.
3. Taan S.Elali, “Discrete Systems and Digital Signal Processing with Matlab, “ CRCPress,2005.

“Design of an efficient multiplier using Kogge-Stone Adder”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of TechnologyIn

Electronics Engineering (VLSI)

By:

Komal Ganer

Guide:

Dr.S.S.Shriramwar

Department of Electronics Engineering

Priyadarshini College of EngineeringNagpur 440019

Year 2021

Introduction:

Multipliers play an important role in today's digital signal processing and various other applications. Essential design targets of multiplier include high speed, low power consumption, regularity of layout and hence less area or even combination of them in one multiplier are required thereby making them suitable for various VLSI implementations. The multipliers are the heart of any high-speed computational devices. The multipliers are fully made up of combinational circuits. They have a large circuit design with high gate density, in fact high transistor density. This large active area provides space to have large power dissipation. Obviously, this provides a concern to reduce power dissipation in the multipliers.

A configurable multiplier designed for single 32-bit multiplication operations, either single 16-bit multiplication or twin parallel 16-bit multiplication. for low power consumption and high speed operation, Therefore, the proposed multiplier surpasses existing multipliers in terms of speed and power efficiency. The basic tasks associated with Digital Signal Processing systems are Multiplication, Addition and Accumulation. Additions are an integral part of a Digital, DSP or control system. Therefore, the accurate and fast operations of digital systems rely on the performance of the adders. Therefore ,improving adder performance is a major area of research in VLSI system design. Because multiplication plays an important role in digital signal processing (DSP) and various other applications, we have described the vedic multiplication algorithm for digital multiplication. With the update of technological advances, many researchers and scholars are attempting to design, develop, or implement multipliers that provide either high speed, low power consumption, regularity of layout, and thus reduction in area, or a combination thereof. multiplier. It'll be utilised to create a variety of high-speed, low-power, miniature VLSI circuits.

In this work a high-speed multiplier is designed based on the fast-parallel prefix adder as Kogge stone adder. Different adders are compared with respect to the speed of operation and Kogge stoneis the best among the different adders. As Vedic multiplier is considered as the fast multiplier, the adder part in this Vedic multiplier is replaced by Kogge stone adder to form the hybrid high speed Vedic multiplier. This Proposed hybrid Vedic multiplier proved to be efficient in terms of power, delay and Power delay product.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Biomedical Systems Engineering

Subject codes:- PGOPENETX024

Course Objectives: The objective of this course is to provide students with the understanding of
1.An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system2.Biomedical sensing and measuring devices.
3. Analysis of Biomedical Signals.
4. Application of Artificial Intelligence for Medical Decision Making.

Course Outcome: Upon the completion of this course, students shall be able to:
1. Understand application of electronics in Medical field.
2. Identify various sensing devices and their applications in medical field
3. Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.

UNIT I:
Biomedical signals: origins and dynamic characteristics, Biomedical signal acquisition and processing

UNIT II:
Compression of biomedical signals, Analysis of biomedical signal using advanced techniques (e.g. neural networks,orthogonal transformations including singular value decomposition) and wavelet transformation, higher order spectra).

UNIT III:
Nonlinear dynamical analysis of biomedical signals, Physiological modelling, identification and simulation. Control of physiological processes and computer controlled drug infusion medical signaling (including CT Scan, MRI and Ultrasound).

UNIT IV:
Medical Informatics, Artificial intelligence methods for medical decision making

UNIT V:
Study of biological sensors: Sensors / receptors in the human body, basic organization of nervous system-neural mechanism and circuit processing. Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste. Sensor models in the time and frequency domains.

TEXT BOOKS:
1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.
2. Carr & Brown, “Introduction to Biomedical EquipmentTechnology” Pearson Education, Asia.3. Cromwell, Weibell &Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall,
India

REFERENCES BOOKS:
1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.
2. J.Webster, “Bioinstrumentation”, Wiley & Sons.
3. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.

“Comparative Analysis of Different Image Segmentation Techniques”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

By

Subodh Meshram

Guide

Prof.C. N. Bhoyar

Department of Electronics Engineering

Priyadarshini College of Engineering

Nagpur 440019

Year 2021

INTRODUCTION

1.1 Introduction of Image segmentations

An image is a best way of transferring any information, and the image contains lots of useful information. Important area of an image is understanding and extracting information from the image. The First step of understanding the image is image segmentation. Image segmentation is one of key point in image processing and computer vision.

For Detecting objects in images, We have to understand image segmentation. We have to partition or divide the image into various parts called segments. A collection or set of different pixels is called an image. We can make a group together the pixels so that pixels having similar attributes using image segmentation. Image segmentation works like firstly divide the image into segments then we can use the important segments for processing the image. Image segmentation is technique of division and partition on an image into regions. Inthat regions contains objects, parts of objects or group of objects which appears in the image. There are different types of image segmentation techniques like edge based, pixel based, region based, and model based which partition the image into several parts based on certain image features like color, pixel intensity value, texture, etc. Object detection builds a rough box for each group in the image, it gives nothing about the shape of the objects. We need more information to get our purposes.

Image segmentation methods give a more understanding of the objects in the images,sometimes images are corrupted due to external noise, in that area we have to put down thecomputational complexity, signal-to-noise ratio, and improve image quality and performanceanalysis also. The segmentation method is used to identify important regions in medical images, it is a unique technique for partitioning an image into meaningful sub- regions or object with the same attribute.

Pre-processing is the first step of the segmentation process. The reason for performing preprocessing is to remove unwanted disturbances in the image. There are few methods for improving the quality of the image.

i. Uses a Gaussian function to smoothen the image and removes noise.
ii. Background removal, by using the technique called rolling ball, eliminatesall ofthe low frequency components from the background of the image.
iii. Dilate expands the binary image by checking the threshold withneighboringpixels and pixels are never changed if they are high.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Elective-IV (Open):Wireless Sensor Network

Subject code:- PGOPENETX031

Objectives:

1. To enable the student to understand the role of sensors and the networking of sensed data for differentapplications.
2. To expose the students to the sensor node essentials and the architectural details, the medium access and routing issues and the energy constrained operational scenario.
3. To enable the student to understand the challenges in synchronization and localization of sensor nodes, topology management for effective and sustained communication, data management and security aspects.

Outcome: By the end of the course, the students shall be able

1. The student would be able to appreciate the need for designing energy efficient sensor nodes andprotocols for prolonging network lifetime.
2. The student would be able to demonstrate an understanding of the different implementationchallenges and the solution approaches.

UNIT I: OVERVIEW OF WIRELESS SENSOR NETWORKS (9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- case study, Enabling Technologies for Wireless Sensor Networks.

UNIT II: ARCHITECTURES (8)

Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes ,Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Considerations

UNIT III: MAC AND ROUTING (9)

MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts, S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, Geographic Routing.

UNIT IV: INFRASTRUCTURE ESTABLISHMENT (9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V: DATA MANAGEMENT AND SECURITY (9)

Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TEXT BOOKS:

1. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.
2. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.
3. Mohammad Ilyas and Imad Mahgaob, Handbook Of Sensor Networks: Compact Wireless And WiredSensing Systems, CRC Press, 2005.
4. Wayne Tomasi, Introduction To Data Communication And Networking, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, “Wireless Sensor Networks” John Wiley, 2010
2. Yingshu Li, My T. Thai,Weili Wu, “ Wireless Sensor Networks and Applications” Springer 2008 3.Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
4. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach",Elsevier, 2007.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks”.

“AN ENERGY EFFICIENT SECURE DATA ROUTING IN WIRELESS SENSOR NETWORKS”

Thesis submitted in partial fulfillment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

By

Ms. Madhuri N. Khuspare

Guide

Dr. Mrs. A. S. Khobragade

Department of Electronics Engineering

Priyadarshini College of EngineeringNagpur 440019

Year 2021

INTRODUCTION

In wireless sensor the cost of energy is required for performing the operation on node is equal to the sending the single bit of information along with the distance to which it is sending. Therefore, data transmission in wireless sensor network reduce the network lifetime, while broadcasting the data inthe sensor network, it is necessary to enhance the network lifetime by reducing the energy consumption.

1.1 Overview

Wireless sensor networks are kind of ad hoc networks. During last decade, area of WSNs has attracted the attention of researcher, scientific and industrial community. WSNs are highly distributed and consist of many number of less cost, less power, less memory and self-organizing sensor nodes [1]. The sensor nodes sense the temperature, pressure, vibration, motion, humidity, sound etc [2]. A Sensor node in WSN consists of a sensor unit, a processing unit, data storage unit, a wireless trans-receiver, anantenna and a power management unit [14]. Each node must able to gather and process the data fromsensor environment and transmit these data to the sink node or base station. Wireless sensor node consisting one or mode sensor node, one base station and a number of sensor nodes. Sensors of WSNs have become increasingly very small in terms of size, more intelligent and less expensive. Sensor nodes have easily deployment characteristics in WSNs make very popular and highly suitable for emergencies,natural disaster and military operation. Wireless Sensor Networks (WSNs) consists of any number of sensor nodes which are not bounded in any type of infrastructure. Nodes in WSN can communicate with each other by any type of data aggregation architecture. Data aggregation is used to collect data efficiently. For the data collection from the sensor environment data aggregation is used in sensor environment. WSNs are deployed in remote and open environment to transmit the sensitive information, and sensor nodes are easily prone to malicious activity of the attackers so security is mostimportant. Hence, wireless sensor networks protocols must be designed with security in mind. Security with data aggregation minimize the computational power of sensor networks, hence lifetime of network can be increase.

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
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email : principal.pce.ngp@gmail.com, www.pcenagpur.edu.in

Domain 3: Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course I : Research Methodology

Course objective

1. Introduction to philosophy of research.
2. Understand process to formulate research questions / idea
3. Understand process of planning of research time, resource
4. Understand different statistical analysis methods
5. Develop thesis and report writing.

Course outcome

1. Knowledge on various kinds of research questions and research designs
2. Formulate research problems (task) and develop a sufficiently coherent research design
3. Assess the appropriateness of different kinds of research designs
4. Knowledge on qualitative, quantitative and mixed methods of research, as well asrelevant ethical and philosophical considerations
5. Develop independent thinking for critically analyzing research reports

Unit 1 Research Foundation

What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Importance of research methodology in scientific research

Unit 2 Review of Literature

Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation

Unit 3 Planning of Research

The planning process ,Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurement, Research Design/Plan

Unit 4 Processing of Data and Statistical Analysis of Data

Introduction to Statistical Software, MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, MATLAB and Neural Network based optimization, Optimization of fuzzy systems, Error Analysis, Results and their discussions

Unit 5 Report and Thesis writing

Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out ofthesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Reference Book:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New AgeInternational Publishers, ISBN:81-224-1522-9
2. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, NewDelhi

ISBN:81-307-0128-6

3. Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN:0471260088
4. MINITAB online manual
5. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M.Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
6. SPSS online manual

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course II

PROJECT PLANNING, EVALUATION & MANAGEMENT

Project Management (PM) will provide students with the opportunity to gain a systematic and comprehensive understanding of key concepts and skills essential to project management in international affairs. By examining the project cycle using potential projects, students will learn techniques and tools used in formulating and managing projects and programs for desired impact.
By course end, students will be familiar with aid and development of project works, language and terminology used, different project structures, implementation practices, and strategies to address potential conflicts and obstacles. More importantly, students will have developed skills - strategic design, needs assessment, implementation, proposal and report writing, budgeting, monitoring and evaluation, advocacy, and others - that practitioners need to be effective in a range of professional contexts.

Course Philosophy: This is a course that will utilize learning techniques to provide students with opportunities to practice and process what they learn. This course attempts to cover skills that are relevant and current in international program work.

Learning Objectives: By course end students will be able to, within the above-stated limitations:

1. Conduct a basic needs assessment for a proposed project
2. Develop a project proposal
3. Develop a logical framework
4. Develop measureable indicators
5. Have ability to insert Monitoring and Evaluation into a project
6. Develop a grant proposal
7. Develop a project budget

As part of comprehensive preparation for the subject, by end of semester students will prepare ananalytical and operational concept note that demonstrates:

1. Comprehensive understanding of the *context* in which they will work, including socio-political, economic, and cultural aspects.
2. Understanding of the *issue* they will work on, the causes, and its variations across contexts.
3. Strategies that have been used to tackle the problem(s) - the usual ones, and innovative ones.Students can introduce also other possible solutions worth exploring.

Benefits

- Establish measures of success
- Quantify value commensurate with cost
- Optimize use of organizational resources
- Incorporate quality principles
- Put strategic plans into practice
- Ensure fast time-to-market Project Manager
- Reduced cost to deliver solutions
- Lower risk of slipping schedule
- Repeatable successes on projects
- Crisis prevention
- Early problem identification and risk mitigation
- Structured approach to Project Management
- More predictable results
- Improved resource productivity and satisfaction
- Project success that builds business success

Course Contents

Unit 1 : ***Basics of Project Management:*** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, ProjectManagement Principles

Unit 2 : Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point

Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Organisational Structure and Organisational Issues: Introduction, Concept of Organisational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team

Unit 3: Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks

Unit 4 : ***Project Quality Management and Value Engineering:*** Introduction, Quality, Quality Concepts, Value Engineering

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Purchasing and Contracting for Projects: Introduction, Purchase Cycle, Contract Management, Procurement Process

Unit 5 : ***Project Performance Measurement and Evaluation:*** Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control

Project Close-out, Termination and Follow-up: Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up

Project Management Software: Introduction, Advantages of Using Project Management Software, Common Features Available In Most of the Project Management Software, Project 2000.

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W.Creswell, 2nd Edition , Sage Publication, 2003
2. Qualitative Inquiry and Research Design: Choosing among Five Approaches, by John W. Creswell, 3rd Edition , Sage publication, 2013.
3. Evaluation: A Systematic Approach, Peter H. Rossi, Mark W. Lipsey, and Howard E. Freeman, 7th edition , Sage publications, 2007.
4. Handbook of Practical Program Evaluation, Joseph S. Wholey, Harry P. Hatry, Kathryn E. Newcomer. 4th edition, Wiley, 2015
5. Program Evaluation and Performance Measurement: An Introduction to Practice, James C. McDavid and Laura R. L. Hawthorn, Sage Publication, 2013.
6. Evaluation, Carol H. Weiss, 2nd Edition, ABE books, 1997.
7. Case Study Research: Design and Methods, Robert K. Yin, 3rd Edition, Sage Publications, 2011

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

Session 2019-20

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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Domain 1: VLSI / Embedded Systems

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6.	Embedded Systems	PGVLS104/3T	
7.	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	

R.T.M. Nagpur university Scheme of Examination for
M. Tech. (VLSI) First Semester

PGVLS101T	VLSI Subsystem Design

Course Objectives:

1. To study the fundamentals of MOS devices and their characteristics.
2. To lay good foundation on the design and analysis of CMOS analog integrated circuits.
3. To study Transient Optimization techniques.
4. To learn and understand clocking strategies.

Course Outcome: By the end of the course, the students shall be able to

1. Design different CMOS based circuits.
2. Analyze the model parameters of CMOS based circuits.

UNIT I: Electrical Properties of MOS Transistors

(9) Electrical Properties, Junction Diode, MOS Transistor: Operation Modes: Threshold Voltage:Metal and Polysilicon; Trapped Charge; Implants, Strong Inversion: Charge Modeling; ConstantVt model: NMOS/PMOS transistors: I/V characteristics, Parasitic Bipolar Transistors:CMOSLatch-up, Analysis (D.C. and Transient).

UNIT II: **(9)**

Device Capacitances and Charge Storage in MOS: NMOS/CMOS circuit analysis, Small signal amplifier model; Miller Effect, Layout / Fabrication, Diffusion / Implants / Wires, NMOS/CMOS processes, SCMOS Design Rules - special derivation; self-aligned processes, Logic Level Design, Realization of Duals for CMOS, Euler path layout, Topological Considerations.

UNIT III: **(8)**

Don't Cares and Redundancy, Layout Parasitic Reduction, I/V for MOS Logic Families, Prop. Delayfor CMOS/NMOS/PNMOS, Layout Capacitance/Resistance Estimation; Gain effects; MOS Performance Estimation, Buffers/Capacitive Loading, Power Dissipation.

UNIT IV: **(9)**

Transient Optimization, Sidewall/2-d and 3-d effects: Cross-talk, Fringing, Ball-Park numbers for process Estimation: Scaling CMOS Design Optimization: High-Speed Logic Strategies, Interconnection, Distributed R/C, Cross-Talk, Noise

UNIT V: **(9)**

Clocking Strategies, Sub-System Design and Partitioning Dynamic Logic, Dynamic Circuits, Stored Charge and timing, Domino Logic, Switched Capacitor and Charge Flow Circuits, Pass-Transistor Logic (CPL) Data-Path and Memory Circuits: Static/Dynamic Memories, Ancillary Memory Analog Circuits.

TEXT BOOKS:

1. Weste, "Principles of CMOS VLSI Design(2nd Edition)
2. Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Systems and Circuits", PrenticeHall of India , 1993
3. Wayne Wolf,"Modern VLSI Desin" 2nd Edition, Prentice Hall 1998

REFERENCE BOOK:

1. Sung-Mo-Kang, Yusuf Labelbici,"CMOS Digital Integrated Circuits" 3rd Ed, Mc Graw Hill

PGVLS103T	VLSI Circuits

Course Objectives:

1. To study basics of VLSI Design methodologies.
2. To study different VLSI design rules.
3. To study in depth the flow of VLSI System Design.
4. To study VLSI Design Modeling and it's synthesis.

Course Outcome: By the end of the course, the students shall be able to

1. Describe and formulate the flow of VLSI Design for any application.
2. Simulate and Analyze the VLSI Circuits.

UNIT I: VLSI Design Methodologies (9)

Introduction to VLSI Design Methodologies – Review of Data Structures and algorithms - Review of VLSI Design Automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – General Purpose methods for combinatorial optimization.

UNIT II: Design Rules (9)

Layout Compaction – Design Rules – Problem Formulation – Algorithms for constraint graph compaction – placement and partitioning – Circuit representation – Placement algorithms -partitioning

UNIT III: Floor Planning (8)

Floor planning concepts – shape functions and floor plan sizing – Types of local routing problems – Area Routing – Channel Routing – Global Routing – Algorithm for Global Routing.

UNIT IV: Simulation (9)

Simulation – Gate-Level modeling and simulation – Switch-level modeling and simulation – Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.

Unit V: Modeling and Synthesis (9)

High Level Synthesis – Hardware models – Internal representation – Allocation – assignment and scheduling – Simple Scheduling algorithm – Assignment problem – High level transformations.

Text Books:

1. S. H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N. A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer AcademicPublishers, 2002.

References Books:

1. Sadiq M. Sait, Habib Youssef, " VLSI Physical Design Automation: Theory and Practice", World Scientific 1999.
2. Steven M. Rubin, " Computer Aids for VLSI Design", Addison Wesley Publishing 1987.

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS201T	Analog VLSI Design

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and to examine the basic buildingblocks of large-scale circuits.
2. To learn about Device Modeling- Various types of analog systems- CMOS amplifiers andComparators.

Course Outcome: By the end of the course, the students shall be able to

1. Understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I: **(9)**

Device modeling and simulation Modeling, MOS Models Diode model, Bipolar modes BSIM Spice models, Circuit simulations using Spice, Basic Building Blocks: Switches, Current sources and sinks, Current mirrors, Voltage and current references.

UNIT II: **(9)**

Amplifiers: MOS Inverting amplifier, Cascade amplifiers, Feedback amplifiers, Differential amplifiers, Frequency response, noise performance in Diff amplifiers, Output amplifiers.

UNIT III: **(8)**

CMOS Two stage OPAMP Design, Cascade OPAMPs, Simulation and Measurement of OPAMPs,Comparators.

UNIT IV: **(9)**

Analog signal processing, CMOS Digital to analog converters, Scaling and serial, cyclic, Analogto digitalconverters Serial, SAR, Parallel, Pipelined, sigma-delta converters.

UNIT V: **(9)**

Mixed signal Layout issues, Continuous time filters, Switched capacitor filters, Modulator andmultipliers, PLL, Advance topics on Analog VLSI.

TEXT BOOKS:

1. VLSI Design Techniques for analog and digital circuits, R.L.Geiger, P.E.Allen, McGRaw Hill,2008, 4th Edition
2. CMOS circuit design, Layout and simulation, J.Baker, D.E.Boyce, IEEE Press, 2003, 1st Edition

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits , McGraw-Hill, 2001

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS202T	VLSI Testing

Course Objectives:

1. To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome: By the end of the course, the students shall be able to

1. Do testing of various Memory Modules and Combinational & sequential logic Circuits.

UNIT I: INTRODUCTION TO TESTING (9)

Faults in digital circuits, Modeling of faults, Logical Fault Models, Fault detection, Fault location, Fault dominance, Logic Simulation, Types of simulation, Delay models, Gate level Event-driven simulation.

UNITII:TESTGENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (9)

Test generation for combinational logic circuits, Testable combinational logic circuit design,Test generation for sequential circuits, design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (8)

Design for Testability, Ad-hoc design, Generic scan based design, Classical scan based design,System level DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (9)

Built-In Self Test, Test pattern generation for BIST, Circular BIST, BIST Architectures, TestableMemory Design, Test algorithms, Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (9)

Logic Level Diagnosis, Diagnosis by UUT reduction, Fault Diagnosis for CombinationalCircuitsSelf-checking design, System Level Diagnosis.

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design",JaicoPublishing House, 2002.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory andMixed - SignalVLSI Circuits", Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice allInternational, 2002

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS203T	Modeling of Digital System and Testing

Course Objectives:

1. To learn different styles of modeling in Verilog.
2. To Study simulation of digital circuits.
3. To study basics of FPGA and its applications.
4. To learn fundamentals of testing of logic circuits.

Course Outcome: By the end of the course, the students shall be able to

1. Simulate different combinational and sequential circuits.
2. Test different logic circuits.

UNIT I: Verilog for System Design (9)

Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Writing Test bench.

UNIT II: Digital Circuit Simulation (9)

Design of combinational circuit building blocks: synthesis of logic functions using multiplexers, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, SRAM Model

Design of Sequential Circuit Building block, Flip flops, registers with enable input, design of bit counting circuit.

UNIT III: Sequential Circuit Simulation (9)

Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, UART Model, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, Design example - bus structure.

UNIT IV: Field Programmable Gate Arrays (8)

Introduction to FPGA, Logic Block Architecture, Routing Architecture, ProgrammableInterconnections, DesignFlow, Xilinx Spartan architecture, Xilinx Virtex Architecture,Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hotencoding, Hardware-software co-simulation, Bus function models, Bus Functional Model (BFM)Simulation, Case Study: Xilinx Spartan III.

UNIT V: Testing of logic circuits (9)

Testing Philosophy, Role of Testing, fault model, complexity of a test set, Detection of single Multiple Faults in Combinational Logic Circuits, techniques for testing of sequential circuits, Design for testability.

TEXT BOOKS:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
3. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier

REFERENCE BOOKS:

1. Brown, Vranesic —Fundamentals of digital logic design with VHDL, McGraw Hill
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester Elective-I (Discipline Specific):

PGVLS104/3T	Embedded Systems

Course Objectives:

1. To study fundamentals of 8051 microcontroller, PIC-16c6x/7x and ARM-7.
2. To study interfacing of different peripherals with microcontrollers based upon theembedded application.

Course Outcome: By the end of the course, the students shall be able to

1. Program an embedded system
2. Design, implement and test an embedded system.

UNIT I: (8)

Introduction to controllers, 8051 controller, Block Diagram &Architecture, 8051 Instruction Set, Addressing modes & programming, 8051 Timers, Serial I/O, Interrupts programming,

UNIT II: (10)

Memory Interfacing, Programming, Real time interfacing with LED, LED display, LCD display Enhanced Features: Dallas HSM & Atmel Micro-controllers, Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators.

UNIT III: (9)

RISC Controller: PIC Micro-controllers–overview; features, PIC 16c6x/7x–architecture, file selection register, Memory organization, Addressing modes, Instruction set, Programming, PIC- 18 Flash Micro-controllers. STATUS, OPTION_REG, PCON registers

UNIT IV: (9)

Memory Organization: Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT V: (8)

ARM Micro-controllers overview; features, ARM 7 –architecture, Thumb, Register Model, Addressing modes, Introduction to Embedded C Programming.

TEXT BOOKS:

1. Embedded system Design ,Steve Heath, Butterworth Helneman,2008,4th
2. The 8051 Microcontroller-architecture, Programming & Applications, Kenneth J.Ayala,PenramInternational & Thomson Aisa,2003,2nd
3. The 8051 Microcontroller and Embedded Systems, Mazidi and McKinley, Pearson Education,2010, 2ndEdition.

REFERENCE BOOKS:

1. Programming Embedded Systems with C and GNU Development Tools, Michael Barr,Anthony Massa, O'Reillypublishers, 2nd Edition
2. Real Time Interfacing to ARM, Cortex-M Microcontrollers, Embedded systems, JonathanValvano,5th Edition

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester Elective-III (Discipline Specific):

PGVLS204/2T	Micro Electro Mechanical Switches (MEMS)

Course Objectives:

1. To understand Standard microfabrication techniques and the issues surrounding them.
2. To understand Major classes, components, and applications of MEMS devices/systems andto demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. To understand microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem**.**

Course Outcome: By the end of the course, the students shall be able to

1. Understand working principles of currently available microsensors, actuators used in Microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devicesand systems.
3. Understand the basic principles and applications of micro-fabrication processes.

UNIT I: **(8)**

Micro-fabrication and Micromachining : Integrated Circuit Processes, Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

UNIT II: **(8)**

Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT III: **(9)**

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

UNIT IV: **(10)**

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems: Success Stories, Micromotors, Gear trains, Mechanisms.

UNIT V: **(9)**

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. MEMS for RF Applications: Need for RF MEMS components in communications, space and defense applications.

TEXT BOOKS:

1. Sensor Technology and Devices: Ristic L (ed), Artech House, London, 1994.
2. Semiconductor Sensors: Sze S.M. (ed), John Wiley, New York, 1994.
3. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

REFERENCE BOOKS :

1. Integrated Sensors, Micro actuators and micro-systems (MEMS): K.D. Wise, Special Issue

ofproceedings of IEEE, Vol. 86, No.8, August 1998
2. RF MEMS: Theory, Design, and Technology: Gabriel M. Rebeiz, Wiley, 2003.
3. Fundamentals of Microfabrication: Marc Madou, CRC Press, 1997.

Domain 2: Signal Processing/ Networks

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

PGVLS102T	Advanced Digital Signal Processing

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applications and retrieval ofinformation from signals.
3. To study designing of digital filters and its realization.
4. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
5. To Study Power Spectrum Estimation.
6. To study the application of Wavelet Transforms.

Course Outcome: By the end of the course the students shall be able to:

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regardto sampling andreconstruction.
3. Design and implement digital filter for various applications.
4. Estimation of Power Spectrum
5. Describe the concept of multi rate signal processing and how to apply it for the wavelettransform.
6. Describe the various transforms for analysis of signals and systems.

UNIT I: Multirate Digital Signal Processing: **(9)**

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass SignalsLinear Prediction and Optimum Linear

UNIT II: Filters: **(8)**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linear prediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT III: Power Spectral Estimation: **(9)**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT IV: Parametric Method of Power Spectrum Estimation: **(10)**

Parametric Methods for power spectrum estimation, Relationship between Auto- Correlation andModel Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance

Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

UNIT V: **(8)**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet,Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets

.TEXT BOOKS:

1. Proakis JG and Manolakis DG Digital Signal ProcessingPrinciples,Algorithms andApplication, PHI.

2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

REFERENCE BOOKS:

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applicationsusing Matlab",Springer.
3. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, "CRCPress,2005.

Project Report

on
"FIR Filter Design"

Submitted in the partial fulfillment of the requirements for the Degree of

Master of Technology in VLSI

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Under the guidance of

Prof. P. Suryawanshi

Submitted by:

Ms. Akansha Karmarkar

Department of Electronics

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR

2019-2020

INTRODUCTION

As the word indicates, a filter separates a desired signal from unwanted disturbances. For example, when we want to remove a disturbance such as noise from an audio signal, we design an appropriate filter that passes only the desires signal. But only in a few cases can we remove the disturbance completely and recover the desired signal; most of the time we have to settle for a compromise, most of the disturbance is rejected, most of the signal is recovered. The first candidate in filter is a linear filter. The main reason for this choice is that we have a good understanding of how a linear system operates. It is only when a linear design fails or it yieldsunsatisfactory results that we look for other solutions, such as nonlinear or, adaptive techniques, for example. Digital filters include infinite impulse response (UR) digital filter and finite impulse response (FIR) digital filter. As the FIR system have a lot of good features, such as only zeros, the system stability, operation speed quickly, linear phase characteristics and design flexibility, so that FIR has been widely used in the digital audio,image processing, data transmission, biomedical and other areas.

OBJECTIVES

The project introduces structure characteristics and the basic principles of the finite impulse response (FIR) digital filter, and gives an efficient FIR filter design. Use MATLAB FDA Tool to determine filter coefficients, and designed a 16-order constant coefficient FIR filter by VHDL language, take use of QuartuslI to simulate filters, the results meet performance requirements.

DESIGN METHODOLOGY

A FIR filter is used to implement almost any type of digital frequency response. Usually these filters are designed with a multiplier, adders and a series of delays to create the output of the filter. The following figure shows the basic FIR filter diagram with N length. The result of delays operates on input samples. The values ofh and k are the coefficients which are used for multiplication. So that the o/p at a time and that is the summationof all the delayed samples multiplied by the appropriate coefficients.

Rashtrasant Tukdoji Maharaj Nagpur University, NagpurFaculty of Engineering & Technology

Biomedical Systems Engineering

Subject codes:- PGOPENETX024

Course Objectives: The objective of this course is to provide students with the understanding of
1. An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system
2. Biomedical sensing and measuring devices.
3. Analysis of Biomedical Signals.
4. Application of Artificial Intelligence for Medical Decision Making.

Course Outcome: Upon the completion of this course, students shall be able to:
1. Understand application of electronics in Medical field.
2. Identify various sensing devices and their applications in medical field
3. Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.

UNIT I:
Biomedical signals: origins and dynamic characteristics, Biomedical signal acquisition and processing

UNIT II:
Compression of biomedical signals, Analysis of biomedical signal using advanced techniques (e.g. neural networks,orthogonal transformations including singular value decomposition) and wavelet transformation, higher order spectra).

UNIT III:
Nonlinear dynamical analysis of biomedical signals, Physiological modelling, identification and simulation. Control of physiological processes and computer controlled drug infusion medical signaling (including CT Scan, MRI and Ultrasound).

UNIT IV:
Medical Informatics, Artificial intelligence methods for medical decision making

UNIT V:
Study of biological sensors: Sensors / receptors in the human body, basic organization of nervous system-neural mechanism and circuit processing. Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste. Sensor models in the time and frequency domains.

TEXT BOOKS:
1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.
2. Carr & Brown, “Introduction to Biomedical EquipmentTechnology” Pearson Education, Asia.3. Cromwell, Weibell &Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall, India

REFERENCES BOOKS:
1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.
2. J.Webster, “Bioinstrumentation”, Wiley & Sons.
3. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Elective-IV (Open):Wireless Sensor Network

Subject code:- PGOPENETX031

Objectives:

1. To enable the student to understand the role of sensors and the networking of sensed data for different applications.
2. To expose the students to the sensor node essentials and the architectural details, the medium access and routing issues and the energy constrained operational scenario.
3. To enable the student to understand the challenges in synchronization and localization of sensor nodes, topology management for effective and sustained communication, data management and security aspects.

Outcome: By the end of the course, the students shall be able

1. The student would be able to appreciate the need for designing energy efficient sensor nodes and protocols for prolonging network lifetime.
2. The student would be able to demonstrate an understanding of the different implementation challenges and the solution approaches.

UNIT I: OVERVIEW OF WIRELESS SENSOR NETWORKS (9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- case study, Enabling Technologies for Wireless Sensor Networks.

UNIT II: ARCHITECTURES (8)

Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes ,Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Considerations

UNIT III: MAC AND ROUTING (9)

MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts, S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, GeographicRouting.

UNIT IV: INFRASTRUCTURE ESTABLISHMENT (9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V: DATA MANAGEMENT AND SECURITY (9)

Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TEXT BOOKS:

1. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.
2. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.
3. Mohammad Ilyas and Imad Mahgaob, Handbook Of Sensor Networks: Compact Wireless And WiredSensing Systems, CRC Press, 2005.
4. Wayne Tomasi, Introduction To Data Communication And Networking, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, “Wireless Sensor Networks” John Wiley, 2010
2. Yingshu Li, My T. Thai,Weili Wu, “ Wireless Sensor Networks and Applications” Springer 2008 3.Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", JohnWiley, 2005.
4. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach",Elsevier, 2007.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks”.

Domain 3: Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course I : Research Methodology

Course objective

1. Introduction to philosophy of research.
2. Understand process to formulate research questions / idea
3. Understand process of planning of research time, resource
4. Understand different statistical analysis methods
5. Develop thesis and report writing.

Course outcome

1. Knowledge on various kinds of research questions and research designs
2. Formulate research problems (task) and develop a sufficiently coherent research design
3. Assess the appropriateness of different kinds of research designs
4. Knowledge on qualitative, quantitative and mixed methods of research, as well asrelevant ethical and philosophical considerations
5. Develop independent thinking for critically analyzing research reports

Unit 1 Research Foundation

What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Importance of research methodology in scientific research

Unit 2 Review of Literature

Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation

Unit 3 Planning of Research

The planning process ,Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurement, Research Design/Plan

Unit 4 Processing of Data and Statistical Analysis of Data

Introduction to Statistical Software, MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, MATLAB and Neural Network based optimization, Optimization of fuzzy systems, Error Analysis, Results and their discussions

Unit 5 Report and Thesis writing

Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out ofthesis,Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Reference Book:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9
2. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, NewDelhi ISBN:81-307-0128-6
3. Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088
4. MINITAB online manual
5. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M. Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
6. SPSS online manual

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course II

PROJECT PLANNING, EVALUATION & MANAGEMENT

Project Management (PM) will provide students with the opportunity to gain a systematic and comprehensive understanding of key concepts and skills essential to project management in international affairs. By examining the project cycle using potential projects, students will learn techniques and tools used in formulating and managing projects and programs for desired impact.
By course end, students will be familiar with aid and development of project works, language and terminology used, different project structures, implementation practices, and strategies to address potential conflicts and obstacles. More importantly, students will have developed skills - strategic design, needs assessment, implementation, proposal and report writing, budgeting, monitoring and evaluation, advocacy, and others - that practitioners need to be effective in a range of professional contexts.

Course Philosophy: This is a course that will utilize learning techniques to provide students with opportunities to practice and process what they learn. This course attempts to cover skills that are relevant and current in international program work.

Learning Objectives: By course end students will be able to, within the above-stated limitations:

1. Conduct a basic needs assessment for a proposed project
2. Develop a project proposal
3. Develop a logical framework
4. Develop measureable indicators
5. Have ability to insert Monitoring and Evaluation into a project
6. Develop a grant proposal
7. Develop a project budget

As part of comprehensive preparation for the subject, by end of semester students will prepare an analytical and operational concept note that demonstrates:

1. Comprehensive understanding of the *context* in which they will work, including socio-political, economic, and cultural aspects.
2. Understanding of the *issue* they will work on, the causes, and its variations across contexts.
3. Strategies that have been used to tackle the problem(s) - the usual ones, and innovative ones. Students can introduce also other possible solutions worth exploring.

Benefits

- Establish measures of success
- Quantify value commensurate with cost
- Optimize use of organizational resources
- Incorporate quality principles
- Put strategic plans into practice
- Ensure fast time-to-market Project Manager
- Reduced cost to deliver solutions
- Lower risk of slipping schedule
- Repeatable successes on projects
- Crisis prevention
- Early problem identification and risk mitigation
- Structured approach to Project Management
- More predictable results
- Improved resource productivity and satisfaction
- Project success that builds business success

Course Contents

Unit 1 : ***Basics of Project Management:*** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles

Unit 2 : Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point

Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Organisational Structure and Organisational Issues: Introduction, Concept of Organisational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team

Unit 3: Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks

Unit 4 : ***Project Quality Management and Value Engineering:*** Introduction, Quality, Quality Concepts, Value Engineering

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Purchasing and Contracting for Projects: Introduction, Purchase Cycle, Contract Management, Procurement Process

Unit 5 : ***Project Performance Measurement and Evaluation:*** Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control

Project Close-out, Termination and Follow-up: Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up

Project Management Software: Introduction, Advantages of Using Project Management Software, Common Features Available In Most of the Project Management Software, Project 2000.

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell, 2nd Edition , Sage Publication, 2003
2. Qualitative Inquiry and Research Design: Choosing among Five Approaches, by John W.Creswell, 3rd Edition , Sage publication, 2013.
3. Evaluation: A Systematic Approach, Peter H. Rossi, Mark W. Lipsey, and Howard E. Freeman, 7thedition , Sage publications, 2007.
4. Handbook of Practical Program Evaluation, Joseph S. Wholey, Harry P. Hatry, Kathryn E. Newcomer. 4th edition, Wiley, 2015

5. Program Evaluation and Performance Measurement: An Introduction to Practice, James C. McDavid and Laura R. L. Hawthorn, Sage Publication, 2013.
6. Evaluation, Carol H. Weiss, 2nd Edition, ABE books, 1997.
7. Case Study Research: Design and Methods, Robert K. Yin, 3rd Edition, Sage Publications, 2011

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

Session 2018 -19

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

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Domain 1: VLSI / Embedded Systems

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	

R.T.M. Nagpur universityScheme of Examination for

M. Tech. (VLSI) First Semester

PGVLS101T	VLSI Subsystem Design

Course Objectives:

1. To study the fundamentals of MOS devices and their characteristics.
2. To lay good foundation on the design and analysis of CMOS analog integrated circuits.
3. To study Transient Optimization techniques.
4. To learn and understand clocking strategies.

Course Outcome: By the end of the course, the students shall be able to

1. Design different CMOS based circuits.
2. Analyze the model parameters of CMOS based circuits.

UNIT I: Electrical Properties of MOS Transistors

(9) Electrical Properties, Junction Diode, MOS Transistor: Operation Modes: Threshold Voltage:Metal and Polysilicon; Trapped Charge; Implants, Strong Inversion: Charge Modeling; ConstantVt model: NMOS/PMOS transistors: I/V characteristics, Parasitic Bipolar Transistors:CMOSLatch-up, Analysis (D.C. and Transient).

UNIT II: **(9)**

Device Capacitances and Charge Storage in MOS: NMOS/CMOS circuit analysis, Small signal amplifier model; Miller Effect, Layout / Fabrication, Diffusion / Implants / Wires, NMOS/CMOS processes, SCMOS Design Rules - special derivation; self-aligned processes, Logic Level Design, Realization of Duals for CMOS, Euler path layout, Topological Considerations.

UNIT III: **(8)**

Don't Cares and Redundancy, Layout Parasitic Reduction, I/V for MOS Logic Families, Prop. Delay for CMOS/NMOS/PNMOS, Layout Capacitance/Resistance Estimation; Gain effects; MOS Performance Estimation, Buffers/Capacitive Loading, Power Dissipation.

UNIT IV: **(9)**

Transient Optimization, Sidewall/2-d and 3-d effects: Cross-talk, Fringing, Ball-Park numbers for process Estimation: Scaling CMOS Design Optimization: High-Speed Logic Strategies, Interconnection, Distributed R/C, Cross-Talk, Noise

UNIT V: **(9)**

Clocking Strategies, Sub-System Design and Partitioning Dynamic Logic, Dynamic Circuits, Stored Charge and timing, Domino Logic, Switched Capacitor and Charge Flow Circuits, Pass- Transistor Logic (CPL) Data-Path and Memory Circuits: Static/Dynamic Memories, Ancillary Memory Analog Circuits.

TEXT BOOKS:

1. Weste, "Principles of CMOS VLSI Design(2nd Edition)
2. Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Systems and Circuits", PrenticeHall of India , 1993
3. Wayne Wolf,"Modern VLSI Desin" 2nd Edition, Prentice Hall 1998

REFERENCE BOOK:

1. Sung-Mo-Kang, Yusuf Labelbici,"CMOS Digital Integrated Circuits" 3rd Ed, Mc Graw Hill

PGVLS103T	VLSI Circuits

Course Objectives:

1. To study basics of VLSI Design methodologies.
2. To study different VLSI design rules.
3. To study in depth the flow of VLSI System Design.
4. To study VLSI Design Modeling and it's synthesis.

Course Outcome: By the end of the course, the students shall be able to

1. Describe and formulate the flow of VLSI Design for any application.
2. Simulate and Analyze the VLSI Circuits.

UNIT I: VLSI Design Methodologies (9)

Introduction to VLSI Design Methodologies – Review of Data Structures and algorithms - Review of VLSI Design Automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – General Purpose methods for combinatorial optimization.

UNIT II: Design Rules (9)

Layout Compaction – Design Rules – Problem Formulation – Algorithms for constraint graph compaction – placement and partitioning – Circuit representation – Placement algorithms

-partitioning

UNIT III: Floor Planning (8)

Floor planning concepts – shape functions and floor plan sizing – Types of local routing problems – Area Routing – Channel Routing – Global Routing – Algorithm for Global Routing.

UNIT IV: Simulation (9)

Simulation – Gate-Level modeling and simulation – Switch-level modeling and simulation – Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.

Unit V: Modeling and Synthesis (9)

High Level Synthesis – Hardware models – Internal representation – Allocation – assignment and scheduling – Simple Scheduling algorithm – Assignment problem – High level transformations.

Text Books:

1. S. H. Gerez, “Algorithms for VLSI Design Automation”, John Wiley & Sons, 2002.

2. N. A. Sherwani, “Algorithms for VLSI Physical Design Automation”, Kluwer AcademicPublishers, 2002.

References Books:

1. Sadiq M. Sait, Habib Youssef, “ VLSI Physical Design Automation: Theory and Practice”,World Scientific 1999.

2. Steven M. Rubin, “ Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.

R.T.M. Nagpur UniversityScheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS201T	Analog VLSI Design

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and to examine the basic buildingblocks of large-scale circuits.
2. To learn about Device Modeling- Various types of analog systems- CMOS amplifiers andComparators.

Course Outcome: By the end of the course, the students shall be able to

1. Understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I: **(9)**

Device modeling and simulation Modeling, MOS Models Diode model, Bipolar modes BSIM Spice models, Circuit simulations using Spice, Basic Building Blocks: Switches, Current sources and sinks, Current mirrors, Voltage and current references.

UNIT II: **(9)**

Amplifiers: MOS Inverting amplifier, Cascade amplifiers, Feedback amplifiers, Differential amplifiers, Frequency response, noise performance in Diff amplifiers, Output amplifiers.

UNIT III: **(8)**

CMOS Two stage OPAMP Design, Cascade OPAMPs, Simulation and Measurement of OPAMPs,Comparators.

UNIT IV: **(9)**

Analog signal processing, CMOS Digital to analog converters, Scaling and serial, cyclic, Analogto digitalconverters Serial, SAR, Parallel, Pipelined, sigma-delta converters.

UNIT V: **(9)**

Mixed signal Layout issues, Continuous time filters, Switched capacitor filters, Modulator andmultipliers, PLL, Advance topics on Analog VLSI.

TEXT BOOKS:

1. VLSI Design Techniques for analog and digital circuits, R.L.Geiger, P.E.Allen, McGRaw Hill,2008, 4th Edition

2. CMOS circuit design, Layout and simulation, J.Baker, D.E.Boyce, IEEE Press, 2003, 1st Edition

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits , McGraw-Hill, 2001

R.T.M. Nagpur UniversityScheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS202T	VLSI Testing

Course Objectives:

1. To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome: By the end of the course, the students shall be able to

1. Do testing of various Memory Modules and Combinational & sequential logic Circuits.

UNIT I: INTRODUCTION TO TESTING (9)

Faults in digital circuits, Modeling of faults, Logical Fault Models, Fault detection, Fault location, Fault dominance, Logic Simulation, Types of simulation, Delay models, Gate level Event-driven simulation.

UNITII:TESTGENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (9)

Test generation for combinational logic circuits, Testable combinational logic circuit design,Test generation for sequential circuits, design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (8)

Design for Testability, Ad-hoc design, Generic scan based design, Classical scan based design,Systemlevel DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (9)

Built-In Self Test, Test pattern generation for BIST, Circular BIST, BIST Architectures, TestableMemory Design, Test algorithms, Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (9)

Logic Level Diagnosis, Diagnosis by UUT reduction, Fault Diagnosis for CombinationalCircuitsSelf-checking design, System Level Diagnosis.

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design",JaicoPublishing House, 2002.

2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory andMixed - SignalVLSI Circuits", Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice allInternational, 2002

R.T.M. Nagpur University Scheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS203T	**Modeling of Digital System and Testing**

Course Objectives:

1. To learn different styles of modeling in Verilog.
2. To Study simulation of digital circuits.
3. To study basics of FPGA and its applications.
4. To learn fundamentals of testing of logic circuits.

Course Outcome: By the end of the course, the students shall be able to

1. Simulate different combinational and sequential circuits.
2. Test different logic circuits.

UNIT I: Verilog for System Design **(9)**

Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Writing Test bench.

UNIT II: Digital Circuit Simulation **(9)**

Design of combinational circuit building blocks: synthesis of logic functions using multiplexers, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, SRAM Model

Design of Sequential Circuit Building block, Flip flops, registers with enable input, design of bit counting circuit.

UNIT III: Sequential Circuit Simulation **(9)**

Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, UART Model, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, Design example - bus structure.

UNIT IV: Field Programmable Gate Arrays **(8)**

Introduction to FPGA, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow, Xilinx Spartan architecture, Xilinx Virtex Architecture,Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hotencoding, Hardware-software co-simulation, Bus function models, Bus Functional Model (BFM)Simulation, Case Study: Xilinx Spartan III.

UNIT V: Testing of logic circuits **(9)**

Testing Philosophy, Role of Testing, fault model, complexity of a test set, Detection of single Multiple Faults in Combinational Logic Circuits, techniques for testing of sequential circuits, Design for testability.

TEXT BOOKS:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
3. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier

REFERENCE BOOKS:

1. Brown, Vranesic ―Fundamentals of digital logic design with VHDL, McGraw Hill
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

R.T.M. Nagpur University Scheme of Examination for

M. Tech. (VLSI) Second Semester Elective-I (Discipline Specific):

PGVLS104/3T	Embedded Systems

Course Objectives:

1. To study fundamentals of 8051 microcontroller, PIC-16c6x/7x and ARM-7.
2. To study interfacing of different peripherals with microcontrollers based upon theembedded application.

Course Outcome: By the end of the course, the students shall be able to

1. Program an embedded system
2. Design, implement and test an embedded system.

UNIT I: (8)

Introduction to controllers, 8051 controller, Block Diagram &Architecture, 8051 Instruction Set, Addressing modes & programming, 8051 Timers, Serial I/O, Interrupts programming,

UNIT II: (10)

Memory Interfacing, Programming, Real time interfacing with LED, LED display, LCD display Enhanced Features: Dallas HSM & Atmel Micro-controllers, Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators.

UNIT III: (9)

RISC Controller: PIC Micro-controllers–overview; features, PIC 16c6x/7x–architecture, file selection register, Memory organization, Addressing modes, Instruction set, Programming, PIC- 18 Flash Micro-controllers. STATUS, OPTION_REG, PCON registers

UNIT IV: (9)

Memory Organization: Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT V: (8)

ARM Micro-controllers overview; features, ARM 7 –architecture, Thumb, Register Model, Addressing modes, Introduction to Embedded C Programming.

TEXT BOOKS:

1. Embedded system Design ,Steve Heath, Butterworth Helneman,2008,4th
2. The 8051 Microcontroller-architecture, Programming & Applications, Kenneth J.Ayala,PenramInternational & Thomson Aisa,2003,2nd
3. The 8051 Microcontroller and Embedded Systems, Mazidi and McKinley, Pearson Education,2010, 2ndEdition.

REFERENCE BOOKS:

1.Programming Embedded Systems with C and GNU Development Tools, Michael Barr,Anthony Massa, O'Reillypublishers, 2nd Edition

2. Real Time Interfacing to ARM, Cortex-M Microcontrollers, Embedded systems, JonathanValvano,5th Edition

R.T.M. Nagpur University Scheme of Examination for M. Tech. (VLSI) Second Semester
Elective-III (Discipline Specific):

PGVLS204/2T	Micro Electro Mechanical Switches (MEMS)

Course Objectives:

1. To understand Standard microfabrication techniques and the issues surrounding them.
2. To understand Major classes, components, and applications of MEMS devices/systems andto demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. To understand microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem**.**

Course Outcome: By the end of the course, the students shall be able to

1. Understand working principles of currently available microsensors, actuators used in Microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devicesand systems.
3. Understand the basic principles and applications of micro-fabrication processes.

UNIT I: **(8)**

Micro-fabrication and Micromachining : Integrated Circuit Processes, Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

UNIT II: **(8)**

Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT III: **(9)**

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

UNIT IV: **(10)**

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems: Success Stories, Micromotors, Gear trains, Mechanisms.

UNIT V: **(9)**

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. MEMS for RF Applications: Need for RF MEMS components in communications, space and defense applications.

TEXT BOOKS:

1. Sensor Technology and Devices: Ristic L (ed), Artech House, London, 1994.
2. Semiconductor Sensors: Sze S.M. (ed), John Wiley, New York, 1994.
3. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

REFERENCE BOOKS :

1. Integrated Sensors, Micro actuators and micro-systems (MEMS): K.D. Wise, Special Issue ofproceedings of IEEE, Vol. 86, No.8, August 1998
2. RF MEMS: Theory, Design, and Technology: Gabriel M. Rebeiz, Wiley, 2003.
3. Fundamentals of Microfabrication: Marc Madou, CRC Press, 1997.

1. INTRODUCTION

For a conventional discrete component-based design of transceiver, it is not possible to vary the functionality of the system beyond certain range of specification. But a SDR based on FPGA enhances the capability of the platform so as to design a system with re-configurability and flexibility. It can flexibly alter the radio waves by changing software and without changing SDR platform. SDR can be implemented in different platform. Here, SDR based telecommunication operation is realized in FPGA, using high level programming language. The main application of digital transceiver lies at the test facility of newly developed flight vehicle. A newly developed flight vehicle needs testing. Termination of flight vehicle is mandatory if the high speed vehicle deviates from its preset trajectory due to unpredictable failures of onboard system. FPGA implementation of digital transceiver in SDR platform System is used for termination of high speed flight vehicle under test. Hence at test facility, this system is utilized to secure property and human life. In such cases, specific commands are transmitted from transmitter for termination of test vehicle. The command transmitted is received and decoded by onboard command reception system at flight vehicle and the commanded operation is done accordingly.

In conventional radio systems, parameters defining the modulation/demodulation methods, waveforms , signal generation and link layer protocols are based on a fixed hardware where a set of hardware elements perform signal processing functions . The SDR technology aims to overcome these limitations by offering flexible radio systems that can be upgraded efficiently by providing software control of a variety of modulation/demodulation techniques. Thus this technology offers potentially longer product life and the radio can be upgraded efficiently, where efficiency can be measured by the cost and the physical volume consumed per information bit.

1.1 Digital Communication System

There are many advantages of Digital Communications. The most important among them is the fact that digital circuits are subjects to lesser distortion and interference than analogs. Since binary digital works in one of two states – ON or OFF, '1' or '0'. A disturbance must be large enough to change the circuit operating point from '1' to '0' or vice versa. Such two state operations

prevent noise and other disturbances from affecting the transmission. Due to this reason regeneration of digital information can be performed easily unlike the analog signal where the signal regeneration cannot be performed perfectly even when small amount of noise and distortion are present.

Moreover, digital circuits are more reliable and less expensive as compared to analog circuits. Also digital hardware is more flexible to implement as compared to analog circuits because digital circuits make use of digital hardware such as microprocessors, VLSI chips, digital switching, Field Programmable Gate Arrays(FPGAs), Digital Signal Processors (DSP) etc .All these hardware are extensively available at lower costs.

A basic digital communication system is shown in figure1.

On the transmitter side information source may already consists of Analog to Digital conversion. Source coding may involve one of the following: predictive coding, block coding, variable length coding, synthesis/analysis coding etc.

Data encryption involves the encryption key which is used to modify the digital word and is unique and random key. Channel encoding involves the following: linear block codes, cyclic codes, convolution codes etc. Modulation involves one of the following: Phase Shift Keying (PSK),

Frequency Shift Keying (FSK), Amplitude Shift Keying (ASK), and Quadrature Amplitude Modulation (QAM) etc. After the modulation the signal is passed onto the IF stage where there is frequency Up-Conversion. Then this signal passes through RF front-end and through the antenna is transmitted in air.

Domain 2: Signal Processing/ Networks

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

PGVLS102T	Advanced Digital Signal Processing

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applications and retrieval ofinformation from signals.
3. To study designing of digital filters and its realization.
4. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
5. To Study Power Spectrum Estimation.
6. To study the application of Wavelet Transforms.

Course Outcome: By the end of the course the students shall be able to:

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regard to sampling andreconstruction.
3. Design and implement digital filter for various applications.
4. Estimation of Power Spectrum
5. Describe the concept of multi rate signal processing and how to apply it for the wavelettransform.
6. Describe the various transforms for analysis of signals and systems.

UNIT I: Multirate Digital Signal Processing: **(9)**

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals Linear Prediction and Optimum Linear

UNIT II: Filters: **(8)**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linear prediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT III: Power Spectral Estimation: **(9)**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT IV: Parametric Method of Power Spectrum Estimation: **(10)**

Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

UNIT V: **(8)**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet,Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets

.TEXT BOOKS:

1. Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms andApplication, PHI.
2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

REFERENCE BOOKS:

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab",Springer.
3. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, " CRCPress,2005.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Biomedical Systems Engineering

Subject codes:- PGOPENETX024

Course Objectives: The objective of this course is to provide students with the understanding of

1.An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system
2.Biomedical sensing and measuring devices.

3. Analysis of Biomedical Signals.

4. Application of Artificial Intelligence for Medical Decision Making.

Course Outcome: Upon the completion of this course, students shall be able to:

1. Understand application of electronics in Medical field.

2. Identify various sensing devices and their applications in medical field

3. Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.

UNIT I:

Biomedical signals: origins and dynamic characteristics, Biomedical signal acquisition and processing

UNIT II:

Compression of biomedical signals, Analysis of biomedical signal using advanced techniques (e.g. neural networks,orthogonal transformations including singular value decomposition) and wavelet transformation, higher orderspectra).

UNIT III:

Nonlinear dynamical analysis of biomedical signals, Physiological modelling, identification and simulation. Control of physiological processes and computer controlled drug infusion medical signaling (including CT Scan, MRI and Ultrasound).

UNIT IV:

Medical Informatics, Artificial intelligence methods for medical decision making

UNIT V:

Study of biological sensors: Sensors / receptors in the human body, basic organization of nervous system-neural mechanism and circuit processing. Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste. Sensor models in the time and frequency domains.

TEXT BOOKS:

1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.

2. Carr & Brown, “Introduction to Biomedical EquipmentTechnology” Pearson Education, Asia.3. Cromwell, Weibell &Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall,

India

REFERENCES BOOKS:

1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.

2. J.Webster, “Bioinstrumentation”, Wiley & Sons.

3. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Elective-IV (Open):Wireless Sensor Network

Subject code:- PGOPENETX031

Objectives:

1. To enable the student to understand the role of sensors and the networking of sensed data for different applications.

2. To expose the students to the sensor node essentials and the architectural details, the medium access and routing issues and the energy constrained operational scenario.

3. To enable the student to understand the challenges in synchronization and localization of sensor nodes, topology management for effective and sustained communication, data management and security aspects.

Outcome: By the end of the course, the students shall be able

1. The student would be able to appreciate the need for designing energy efficient sensor nodes and protocols for prolonging network lifetime.

2. The student would be able to demonstrate an understanding of the different implementationchallenges and the solution approaches.

UNIT I: OVERVIEW OF WIRELESS SENSOR NETWORKS (9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- case study, Enabling Technologies for Wireless Sensor Networks.

UNIT II: ARCHITECTURES (8)

Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes ,Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Considerations

UNIT III: MAC AND ROUTING (9)

MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts, S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, Geographic Routing.

UNIT IV: INFRASTRUCTURE ESTABLISHMENT (9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V: DATA MANAGEMENT AND SECURITY (9)

Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TEXT BOOKS:

1. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.

2. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.

3.Mohammad Ilyas and Imad Mahgaob, Handbook Of Sensor Networks: Compact Wireless And WiredSensing Systems, CRC Press, 2005.

4.Wayne Tomasi, Introduction To Data Communication And Networking, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, “Wireless Sensor Networks” John Wiley, 2010

2. Yingshu Li, My T. Thai,Weili Wu, “ Wireless Sensor Networks and Applications” Springer 2008 3.Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

4. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach",Elsevier, 2007.

5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks”.

"DETECTION OF BRAIN TUMOR IN MRI IMAGES, USING COMBINATION OF BFCM AND ELM"

Thesis submitted as a partial fulfilment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

Submitted By

Ms. Sonali. R. Gadekar

Under the Guidance of

Mrs. A. P. Khandait

Department of Electronics Engineering
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Year 2018-19

INTRODUCTION

Image processing is a process of analyzing, manipulating an image in order to perform some operation to extract the information from it. For detection of brain tumor, first it reads the MRI image of brain and then it applies segmentation of the image. This research presents an efficient method for removing noise from the MRI image also for brain tumor detection. A tumor can be defined as any mass caused by abnormal or uncontrolled growth of cells. This mass of tumor grows within the skull due to which normal brain activity is hampered which if not detected in earlier stage, can take away the life of person. Hence, it is very important to detect the brain tumor as early as possible.

In image processing, images convey the information, where input image is processed to get output also an image. In today's world, the images used are in digital format. In recent times, the introduction of information technology and e-healthcare system in medical field helps clinical experts to provide better health care for patients. This study reveals the problem segmentation of abnormal and normal tissues from MRI images using gray-level co-occurrence matrix (GLCM) feature extraction and probabilistic neural network (PNN) classifier. The brain tumor is an abnormal growth of uncontrolled cancerous tissues in the brain. A brain tumor can be benign and malignant. The benign tumor has uniformity structures and contains non-active cancer cells. The malignant tumor has non-uniformity structures and contains active cancer cells that spread all over parts. The Brain tumor is a life threatening disease. The brain contains more than 10 billion working brain cells. Brain tumor can be said as abnormal growth of neurons in brain. The growth of neurons can vary from person to person. There are different types of tumors according to growth it may be Benign or Malignant. If tumor is at its origin then it is benign and if part of tumor spreads and grows on another place then it is malignant. Normally brain tumor affects CSF (Cerebral Spinal Fluid). It causes strokes. So detection of tumor is important for that treatment. These patients are not confirmed with cancer &treated wrongly in early stages due to lack of experts, clinical interpreters. To overcome this problem many techniques are developed. Brain

tumor analysis is done by doctors but its grading gives different conclusions which may vary from one doctor to another. Diagnosis of brain tumor can be delayed because its symptom is similar to symptom of other condition also the tumor size, position, texture and appearance are very different in different patient. To overcome this many techniques have been developed. Some of these are histogram equalization, image segmentation, image enhancement, morphological operation, feature selection and extraction and classification. Automated and accurate classification of MRI brain images is extremely important for medical analysis and interpretation. For brain tumor detection image segmentation and classification has played a vital role in medical image processing over the last few decades. In brain tumor detection after finding out the image is normal or abnormal, it is necessary to classify the tumor type so that doctors can give the proper treatment to patient. If tumor is at its origin then it is benign and if part of tumor spreads and grows on another place then it is malignant. So we proposed method which classifies a given abnormal MRI brain image as benign or malignant. The proposed method first employed K-means clustering for MRI image segmentation. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images.

Due to the tremendous advancement in image acquisition devices, the data is quite large (moving to big data), that makes it challenging and interesting for image analysis. This rapid growth in medical images and modalities requires extensive and tedious efforts by medical expert that is subjective, prone to human error and may have large variations across different expert. Alternative solution is using machine learning techniques to automate diagnosis process however, traditional machine learning methods are not sufficient to deal with complex problem. Happy marriage of high performance computing with machine learning promise the capacity to deal big medical image data for accurate and efficient diagnosis[2]. Deep learning will not only help to select and extract features but also construct new ones, furthermore, it does not only diagnose the disease but also measure predictive target and provides actionable prediction models to help physician efficiently. Machine Learning (ML) and Artificial

Intelligence (AI) have progressed rapidly in recent years. Techniques of ML and AI have played important role in medical field like medical image processing, computer-aided diagnosis, image interpretation, image fusion, image registration, image segmentation, image guided therapy, image retrieval and analysis Techniques of ML extract information from the images and represents information effectively and efficiently. The ML and AI facilitate and assist doctors that they can diagnose and predict accurate and faster the risk of diseases and prevent them in time. These techniques enhance the abilities of doctors and researchers to under-stand that how to analyze the generic variations which will lead to disease. These techniques composed of conventional algorithms without learning like Support Vector Machine (SVM), Neural Network (NN), KNN etc. and deep learning algorithms such as Convolution Neural Network (CNN), Recurrent neural Network (RNN), Long Short term Memory (LSTM), Extreme Learning Machine (ELM), Generative Adversarial Networks (GANs) etc. Former algorithms are limited in processing the natural images in their raw form, time consuming, based on expert knowledge and requires a lot time for tuning the features. The later algorithms are fed with raw data, automatic features learner and fast. These algorithms try to learn multiple levels of abstraction, representation and information automatically from large set of images that exhibit the desired behavior of data.

Although automated detection of diseases based on conventional methods in medical imaging has been shown significant accuracies around for decades, but new advances in machine learning techniques have ignited a boom in the deep learning. Deep learning based algorithms showed promising performance as well speed in different do-mains like speech recognition, text recognition, lips reading, computer-aided diagnosis, face recognition, drug discovery [3].

1.1 Brain Tumor

A brain tumor is an abnormal growth of tissue in the brain or central spine that can disrupt proper brain function and creates an increasing pressure in the brain. Due to increased pressure on the brain, some brain tissues are shifted, pushed against the skull or are responsible for the damage of the nerves of the other healthy brain

Domain 3: Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

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Foundation Course I : Research Methodology

Course objective

1. Introduction to philosophy of research.
2. Understand process to formulate research questions / idea
3. Understand process of planning of research time, resource
4. Understand different statistical analysis methods
5. Develop thesis and report writing.

Course outcome

1. Knowledge on various kinds of research questions and research designs
2. Formulate research problems (task) and develop a sufficiently coherent research design
3. Assess the appropriateness of different kinds of research designs
4. Knowledge on qualitative, quantitative and mixed methods of research, as well asrelevant ethical and philosophical considerations
5. Develop independent thinking for critically analyzing research reports

Unit 1 Research Foundation

What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Importance of research methodology in scientific research

Unit 2 Review of Literature

Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation

Unit 3 Planning of Research

The planning process ,Selection of a Problem for Research, Formulation of the Selected

Problems, Hypothesis formation, Measurement, Research Design/Plan

Unit 4 Processing of Data and Statistical Analysis of Data

Introduction to Statistical Software, MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, MATLAB and Neural Network based optimization, Optimization of fuzzy systems, Error Analysis, Results and their discussions.

Unit 5 Report and Thesis writing

Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out of thesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Reference Book:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New AgeInternational Publishers, ISBN:81-224-1522-9
2. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, NewDelhi ISBN:81-307-0128-6
3. Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088
4. MINITAB online manual
5. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M.Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
6. SPSS online manual

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Foundation Course II

PROJECT PLANNING, EVALUATION & MANAGEMENT

Project Management (PM) will provide students with the opportunity to gain a systematic and comprehensive understanding of key concepts and skills essential to project management in international affairs. By examining the project cycle using potential projects, students will learn techniques and tools used in formulating and managing projects and programs for desired impact.

By course end, students will be familiar with aid and development of project works, language and terminology used, different project structures, implementation practices, and strategies to address potential conflicts and obstacles. More importantly, students will have developed skills - strategic design, needs assessment, implementation, proposal and report writing, budgeting, monitoring and evaluation, advocacy, and others - that practitioners need to be effective in a range of professional contexts.

Course Philosophy: This is a course that will utilize learning techniques to provide students with opportunities to practice and process what they learn. This course attempts to cover skills that are relevant and current in international program work.

Learning Objectives: By course end students will be able to, within the above-stated limitations:

1. Conduct a basic needs assessment for a proposed project
2. Develop a project proposal
3. Develop a logical framework
4. Develop measureable indicators
5. Have ability to insert Monitoring and Evaluation into a project
6. Develop a grant proposal
7. Develop a project budget

As part of comprehensive preparation for the subject, by end of semester students will prepare an analytical and operational concept note that demonstrates:

1. Comprehensive understanding of the *context* in which they will work, including socio-

political, economic, and cultural aspects.

2. Understanding of the *issue* they will work on, the causes, and its variations across contexts.
3. Strategies that have been used to tackle the problem(s) - the usual ones, and innovative ones. Students can introduce also other possible solutions worth exploring.

Benefits

- Establish measures of success
- Quantify value commensurate with cost
- Optimize use of organizational resources
- Incorporate quality principles
- Put strategic plans into practice
- Ensure fast time-to-market Project Manager
- Reduced cost to deliver solutions
- Lower risk of slipping schedule
- Repeatable successes on projects
- Crisis prevention
- Early problem identification and risk mitigation
- Structured approach to Project Management
- More predictable results
- Improved resource productivity and satisfaction
- Project success that builds business success

Course Contents

Unit 1 : ***Basics of Project Management:*** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, ProjectManagement Principles

Unit 2 : Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point

Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles,

Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Organisational Structure and Organisational Issues: Introduction, Concept of Organisational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team

Unit 3: Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks

Unit 4 : ***Project Quality Management and Value Engineering:*** Introduction, Quality, Quality Concepts, Value Engineering

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Purchasing and Contracting for Projects: Introduction, Purchase Cycle, Contract Management, Procurement Process

Unit 5 : ***Project Performance Measurement and Evaluation:*** Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control

Project Close-out, Termination and Follow-up: Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up

Project Management Software: Introduction, Advantages of Using Project Management Software, Common Features Available In Most of the Project Management Software, Project 2000.

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell, 2nd Edition , Sage Publication, 2003
2. Qualitative Inquiry and Research Design: Choosing among Five Approaches, by John W.Creswell, 3rd Edition , Sage publication, 2013.
3. Evaluation: A Systematic Approach, Peter H. Rossi, Mark W. Lipsey, and Howard E. Freeman, 7th edition , Sage publications, 2007.
4. Handbook of Practical Program Evaluation, Joseph S. Wholey, Harry P. Hatry, Kathryn E. Newcomer. 4th edition, Wiley, 2015
5. Program Evaluation and Performance Measurement: An Introduction to Practice, James C. McDavid and Laura R. L. Hawthorn, Sage Publication, 2013.
6. Evaluation, Carol H. Weiss, 2nd Edition, ABE books, 1997.
7. Case Study Research: Design and Methods, Robert K. Yin, 3rd Edition, Sage Publications, 2011

Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

Session 2017-18

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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Domain 1: VLSI / Embedded Systems

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	

R.T.M. Nagpur universityScheme of Examination for

M. Tech. (VLSI) First Semester

PGVLS101T	VLSI Subsystem Design

Course Objectives:

1. To study the fundamentals of MOS devices and their characteristics.
2. To lay good foundation on the design and analysis of CMOS analog integrated circuits.
3. To study Transient Optimization techniques.
4. To learn and understand clocking strategies.

Course Outcome: By the end of the course, the students shall be able to

1. Design different CMOS based circuits.
2. Analyze the model parameters of CMOS based circuits.

UNIT I: Electrical Properties of MOS Transistors

(9) Electrical Properties, Junction Diode, MOS Transistor: Operation Modes: Threshold Voltage:Metal and Polysilicon; Trapped Charge; Implants, Strong Inversion: Charge Modeling; ConstantVt model: NMOS/PMOS transistors: I/V characteristics, Parasitic Bipolar Transistors:CMOSLatch-up, Analysis (D.C. and Transient).

UNIT II: **(9)**

Device Capacitances and Charge Storage in MOS: NMOS/CMOS circuit analysis, Small signal amplifier model; Miller Effect, Layout / Fabrication, Diffusion / Implants / Wires, NMOS/CMOS processes, SCMOS Design Rules - special derivation; self-aligned processes, Logic Level Design, Realization of Duals for CMOS, Euler path layout, Topological Considerations.

UNIT III: **(8)**

Don't Cares and Redundancy, Layout Parasitic Reduction, I/V for MOS Logic Families, Prop. Delay for CMOS/NMOS/PNMOS, Layout Capacitance/Resistance Estimation; Gain effects; MOS Performance Estimation, Buffers/Capacitive Loading, Power Dissipation.

UNIT IV: **(9)**

Transient Optimization, Sidewall/2-d and 3-d effects: Cross-talk, Fringing, Ball-Park numbers for process Estimation: Scaling CMOS Design Optimization: High-Speed Logic Strategies,

Interconnection, Distributed R/C, Cross-Talk, Noise

UNIT V: **(9)**

Clocking Strategies, Sub-System Design and Partitioning Dynamic Logic, Dynamic Circuits, Stored Charge and timing, Domino Logic, Switched Capacitor and Charge Flow Circuits, Pass-Transistor Logic (CPL) Data-Path and Memory Circuits: Static/Dynamic Memories, Ancillary Memory Analog Circuits.

TEXT BOOKS:

1. Weste, “Principles of CMOS VLSI Design(2nd Edition)
2. Douglas A.Pucknell and Kamran Eshraghian, “Basic VLSI Systems and Circuits”, PrenticeHall of India , 1993
3. Wayne Wolf,”Modern VLSI Desin” 2nd Edition, Prentice Hall 1998

REFERENCE BOOK:

1. Sung-Mo-Kang, Yusuf Labelbici,”CMOS Digital Integrated Circuits” 3rd Ed, Mc Graw Hill

PGVLS103T	VLSI Circuits

Course Objectives:

1. To study basics of VLSI Design methodologies.
2. To study different VLSI design rules.
3. To study in depth the flow of VLSI System Design.
4. To study VLSI Design Modeling and it's synthesis.

Course Outcome: By the end of the course, the students shall be able to

1. Describe and formulate the flow of VLSI Design for any application.
2. Simulate and Analyze the VLSI Circuits.

UNIT I: VLSI Design Methodologies (9)

Introduction to VLSI Design Methodologies – Review of Data Structures and algorithms - Review of VLSI Design Automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – General Purpose methods for combinatorial optimization.

UNIT II: Design Rules (9)

Layout Compaction – Design Rules – Problem Formulation – Algorithms for constraint graph compaction – placement and partitioning – Circuit representation – Placement algorithms

-partitioning

UNIT III: Floor Planning (8)

Floor planning concepts – shape functions and floor plan sizing – Types of local routing problems – Area Routing – Channel Routing – Global Routing – Algorithm for Global Routing.

UNIT IV: Simulation (9)

Simulation – Gate-Level modeling and simulation – Switch-level modeling and simulation – Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.

Unit V: Modeling and Synthesis (9)

High Level Synthesis – Hardware models – Internal representation – Allocation – assignment

and scheduling – Simple Scheduling algorithm – Assignment problem – High level transformations.

Text Books:

1. S. H. Gerez, “Algorithms for VLSI Design Automation”, John Wiley & Sons, 2002.

2. N. A. Sherwani, “Algorithms for VLSI Physical Design Automation”, Kluwer AcademicPublishers, 2002.

References Books:

1. Sadiq M. Sait, Habib Youssef, “ VLSI Physical Design Automation: Theory and Practice”,World Scientific 1999.

2. Steven M. Rubin, “ Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.

DESIGN & ANALYSIS OF 16-BIT RISC PROCESSOR USING LOW POWER PIPELINING

Thesis submitted as a partial fulfilment of requirement for the degree of

Master of Technology

In

Electronics Engineering (VLSI)

Submitted By

Ms. Shweta S. Chimurkar

Under the Guidance of

Mrs. Pradnya J. Suryawanshi

Department of Electronics Engineering

Priyadarshini College of Engineering

Nagpur 440 019

Year 2017-18

DEPARTMENT OF ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the thesis entitled **"DESIGN & ANALYSIS OF 16 BIT RISC PROCESSOR USING LOW POWER PIPELINING"** is a bonafide work done by **Shweta S. Chimurkar** and is submitted to R.T.M Nagpur University, Nagpur as a partial fulfilment of requirement for the Degree of Master of Technology in Electronics Engineering (VLSI).

Mrs P. J. Suryawanshi
(Guide)

Dr S. S. Shriramwar
(H.O.D, Electronics Engineering)

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Dr.M.P.Singh
Principal
(Principal, PCE, Nagpur)

Priyadarshini College of Engg.
Nagpur.

INTRODUCTION

In the early stage devices such as desktop PC, efforts in VLSI design were primarily focused on improvement in the speed. To meet our computation and entertainment demands, semiconductor ICs which offer various complex signals processing modules and graphical processing units. The real-time problem have been taken care of with such solutions, but problems such as increasing demand for portable operation have not been taken care, where the requirement is to pack all with less power consumption. The drawback on power dissipation in handy electronics gazettes such as smart phones and tablet computers must be handled by the VLSI designer while still meeting the complex requirements.

To maximize the run time with least reduction in size, battery life and battery weight the power consumed by such system plays a vital role. This project describes a 4-stage pipelined 16 bit RISC processor core. The key points of this processor are low power consumption, increase in speed due to the 4-stage pipeline approach. The principle theme in today's electronic industry is low power. The power dissipation has become an important consideration as performance and area. The proposed processor will follow the RISC architecture as it supports a pre-defined set of instructions. RISC processors were first developed in 80's. RISC is meant to be a simple, fast and effective processor.

The main advantage of RISC over CISC is simplicity, simple to design, simple operations and simple to execute. In this all the instructions have same length. Embedded processors demand instruction sets suitable for the specific application, fast interrupt handling operations, low power consumption and so on. For these properties RISC is more efficient in comparison with CISC. Other features of RISC are uniform instruction format, identical general purpose registers, simple addressing modes, few data types in hardware.

R.T.M. Nagpur UniversityScheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS201T	Analog VLSI Design

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and to examine the basic buildingblocks of large-scale circuits.
2. To learn about Device Modeling- Various types of analog systems- CMOS amplifiers andComparators.

Course Outcome: By the end of the course, the students shall be able to

1. Understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I: **(9)**

Device modeling and simulation Modeling, MOS Models Diode model, Bipolar modes BSIM Spice models, Circuit simulations using Spice, Basic Building Blocks: Switches, Current sources and sinks, Current mirrors, Voltage and current references.

UNIT II: **(9)**

Amplifiers: MOS Inverting amplifier, Cascade amplifiers, Feedback amplifiers, Differential amplifiers, Frequency response, noise performance in Diff amplifiers, Output amplifiers.

UNIT III: **(8)**

CMOS Two stage OPAMP Design, Cascade OPAMPs, Simulation and Measurement of OPAMPs,

Comparators.

UNIT IV: **(9)**

Analog signal processing, CMOS Digital to analog converters, Scaling and serial, cyclic, Analogto digitalconverters Serial, SAR, Parallel, Pipelined, sigma-delta converters.

UNIT V: **(9)**

Mixed signal Layout issues, Continuous time filters, Switched capacitor filters, Modulator andmultipliers, PLL, Advance topics on Analog VLSI.

TEXT BOOKS:

1. VLSI Design Techniques for analog and digital circuits, R.L.Geiger, P.E.Allen, McGRaw Hill,2008, 4th Edition

2. CMOS circuit design, Layout and simulation, J.Baker, D.E.Boyce, IEEE Press, 2003, 1st Edition

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits , McGraw-Hill, 2001

R.T.M. Nagpur University Scheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS202T	VLSI Testing

Course Objectives:

1. To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome: By the end of the course, the students shall be able to

1. Do testing of various Memory Modules and Combinational & sequential logic Circuits.

UNIT I: INTRODUCTION TO TESTING (9)

Faults in digital circuits, Modeling of faults, Logical Fault Models, Fault detection, Fault location, Fault dominance, Logic Simulation, Types of simulation, Delay models, Gate level Event-driven simulation.

UNITII:TESTGENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (9)

Test generation for combinational logic circuits, Testable combinational logic circuit design,Test generation for sequential circuits, design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (8)

Design for Testability, Ad-hoc design, Generic scan based design, Classical scan based design,Systemlevel DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (9)

Built-In Self Test, Test pattern generation for BIST, Circular BIST, BIST Architectures, TestableMemory Design, Test algorithms, Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (9)

Logic Level Diagnosis, Diagnosis by UUT reduction, Fault Diagnosis for CombinationalCircuitsSelf-checking design, System Level Diagnosis.

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design",JaicoPublishing House, 2002.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed - SignalVLSI Circuits", Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice allInternational, 2002

R.T.M. Nagpur University Scheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS203T	Modeling of Digital System and Testing

Course Objectives:

1. To learn different styles of modeling in Verilog.
2. To Study simulation of digital circuits.
3. To study basics of FPGA and its applications.
4. To learn fundamentals of testing of logic circuits.

Course Outcome: By the end of the course, the students shall be able to

1. Simulate different combinational and sequential circuits.
2. Test different logic circuits.

UNIT I: Verilog for System Design **(9)**

Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Writing Test bench.

UNIT II: Digital Circuit Simulation **(9)**

Design of combinational circuit building blocks: synthesis of logic functions using multiplexers, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, SRAM Model

Design of Sequential Circuit Building block, Flip flops, registers with enable input, design of bit counting circuit.

UNIT III: Sequential Circuit Simulation **(9)**

Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, UART Model, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, Design example - bus structure.

UNIT IV: Field Programmable Gate Arrays **(8)**

Introduction to FPGA, Logic Block Architecture, Routing Architecture, ProgrammableInterconnections, Design Flow, Xilinx Spartan architecture, Xilinx Virtex Architecture,Boundary Scan, Programming FPGA's, Constraint

Editor, Static Timing Analysis, One hotencoding, Hardware-software co-simulation, Bus function models, Bus Functional Model (BFM)Simulation, Case Study: Xilinx Spartan III.

UNIT V: Testing of logic circuits **(9)**

Testing Philosophy, Role of Testing, fault model, complexity of a test set, Detection of single Multiple Faults in Combinational Logic Circuits, techniques for testing of sequential circuits, Design for testability.

TEXT BOOKS:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
3. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier

REFERENCE BOOKS:

1. Brown, Vranesic ―Fundamentals of digital logic design with VHDL, McGraw Hill
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

R.T.M. Nagpur University Scheme of Examination for

M. Tech. (VLSI) Second Semester

Elective-I (Discipline Specific):

PGVLS104/3T	Embedded Systems

Course Objectives:

1. To study fundamentals of 8051 microcontroller, PIC-16c6x/7x and ARM-7.
2. To study interfacing of different peripherals with microcontrollers based upon theembedded application.

Course Outcome: By the end of the course, the students shall be able to

1. Program an embedded system
2. Design, implement and test an embedded system.

UNIT I: (8)

Introduction to controllers, 8051 controller, Block Diagram &Architecture, 8051 Instruction Set, Addressing modes & programming, 8051 Timers, Serial I/O, Interrupts programming,

UNIT II: (10)

Memory Interfacing, Programming, Real time interfacing with LED, LED display, LCD display Enhanced Features: Dallas HSM & Atmel Micro-controllers, Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators.

UNIT III: (9)

RISC Controller: PIC Micro-controllers–overview; features, PIC 16c6x/7x–architecture, file selection register, Memory organization, Addressing modes, Instruction set, Programming, PIC- 18 Flash Micro-controllers. STATUS, OPTION_REG, PCON registers

UNIT IV: (9)

Memory Organization: Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT V: (8)

ARM Micro-controllers overview; features, ARM 7 –architecture, Thumb, Register Model, Addressing modes, Introduction to Embedded C Programming.

TEXT BOOKS:

1. Embedded system Design ,Steve Heath, Butterworth Helneman,2008,4th
2. The 8051 Microcontroller-architecture, Programming & Applications, Kenneth J.Ayala,PenramInternational & Thomson Aisa,2003,2nd
3. The 8051 Microcontroller and Embedded Systems, Mazidi and McKinley, Pearson Education,2010, 2ndEdition.

REFERENCE BOOKS:

1.Programming Embedded Systems with C and GNU Development Tools, Michael Barr,Anthony Massa, O'Reillypublishers, 2nd Edition

2. Real Time Interfacing to ARM, Cortex-M Microcontrollers, Embedded systems, JonathanValvano,5th Edition

R.T.M. Nagpur UniversityScheme of Examination for

M. Tech. (VLSI) Second SemesterElective-III (Discipline Specific):

PGVLS204/2T	**Micro Electro Mechanical Switches (MEMS)**

Course Objectives:

1. To understand Standard microfabrication techniques and the issues surrounding them.
2. To understand Major classes, components, and applications of MEMS devices/systems andto demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. To understand microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem**.**

Course Outcome: By the end of the course, the students shall be able to

1. Understand working principles of currently available microsensors, actuators used in Microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devicesand systems.
3. Understand the basic principles and applications of micro-fabrication processes.

UNIT I: **(8)**

Micro-fabrication and Micromachining : Integrated Circuit Processes, Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

UNIT II: **(8)**

Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT III: **(9)**

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

UNIT IV: **(10)**

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems: Success Stories, Micromotors, Gear trains, Mechanisms.

UNIT V: **(9)**

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. MEMS for RF Applications: Need for RF MEMS components in communications, space and defense applications.

TEXT BOOKS:

1. Sensor Technology and Devices: Ristic L (ed), Artech House, London, 1994.
2. Semiconductor Sensors: Sze S.M. (ed), John Wiley, New York, 1994.
3. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

REFERENCE BOOKS :

1. Integrated Sensors, Micro actuators and micro-systems (MEMS): K.D. Wise, Special Issue ofproceedings of IEEE, Vol. 86, No.8, August 1998
2. RF MEMS: Theory, Design, and Technology: Gabriel M. Rebeiz, Wiley, 2003.
3. Fundamentals of Microfabrication: Marc Madou, CRC Press, 1997.

Domain 2: Signal Processing/ Networks

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

PGVLS102T	Advanced Digital Signal Processing

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applications and retrieval of information from signals.
3. To study designing of digital filters and its realization.
4. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
5. To Study Power Spectrum Estimation.
6. To study the application of Wavelet Transforms.

Course Outcome: By the end of the course the students shall be able to:

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regardto sampling andreconstruction.
3. Design and implement digital filter for various applications.
4. Estimation of Power Spectrum
5. Describe the concept of multi rate signal processing and how to apply it for the wavelettransform.
6. Describe the various transforms for analysis of signals and systems.

UNIT I: Multirate Digital Signal Processing: **(9)**

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass SignalsLinear Prediction and Optimum Linear

UNIT II: Filters: **(8)**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linear prediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT III: Power Spectral Estimation: **(9)**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use

DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT IV: Parametric Method of Power Spectrum Estimation: **(10)**

Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation andModel Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

UNIT V: **(8)**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet,Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets.

.TEXT BOOKS:

1.Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms andApplication, PHI.

2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

REFERENCE BOOKS:

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.

2. ES Gopi. "Algorithm collections for Digital Signal Processing Applicationsusing Matlab",Springer.

3. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, " CRCPress,2005.

Rashtrasant Tukdoji Maharaj Nagpur University, NagpurFaculty of Engineering & Technology

Biomedical Systems Engineering

Subject codes:- PGOPENETX024

Course Objectives: The objective of this course is to provide students with the understanding of

1.An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system
2.Biomedical sensing and measuring devices.

3. Analysis of Biomedical Signals.

4. Application of Artificial Intelligence for Medical Decision Making.

Course Outcome: Upon the completion of this course, students shall be able to:

1. Understand application of electronics in Medical field.

2. Identify various sensing devices and their applications in medical field

3. Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.

UNIT I:

Biomedical signals: origins and dynamic characteristics, Biomedical signal acquisition and processing

UNIT II:

Compression of biomedical signals, Analysis of biomedical signal using advanced techniques (e.g. neural networks,orthogonal transformations including singular value decomposition) and wavelet transformation, higher orderspectra).

UNIT III:

Nonlinear dynamical analysis of biomedical signals, Physiological modelling, identification and simulation. Control of physiological processes and computer controlled drug infusion medical signaling (including CT Scan, MRI and Ultrasound).

UNIT IV:

Medical Informatics, Artificial intelligence methods for medical decision making

UNIT V:

Study of biological sensors: Sensors / receptors in the human body, basic organization of nervous system-neural mechanism and circuit processing. Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste. Sensor models in the time and frequency domains.

TEXT BOOKS:

1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.

2. Carr & Brown, “Introduction to Biomedical EquipmentTechnology” Pearson Education, Asia.3. Cromwell, Weibell &Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall,

India

REFERENCES BOOKS:

1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.

2. J.Webster, “Bioinstrumentation”, Wiley & Sons.

3. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.

HUMAN SKIN DETECTION USING IMAGE SEGMENTATION

Thesis submitted in partial fulfillment of the requirements for the degree of

Master of Technology

In

Electronics engineering (VlSI)

By

Satish Kumar Pandey

Guide

Dr.S.S Shriramwar

Department of Electronics Engineering

Priyadarshini College of Engineering

Nagpur 440019

Year 2018

CERTIFICATE

This is to certify that the thesis titled " **Human Skin Detection Using Image Segmentation** is a bonafide work done by **Satish Kumar Pandey** and is submitted to RTM NAGPUR University Nagpur in 2017-2018

Partial fulfillment of requirement for the degree of Master of Technology in Electronics Engineering (VlSI). The work is comprehensive complete and fit for evalution.

Dr.S.S Shriramwar

Guide

PCE, Nagpur

Dr.S.S Shriramwar

Head of Department

PCE ,Nagpur

H.O.D. Electronics
Priyadarshini College of
Engg., Nagpur.

Dr.M.P. Singh

Principal

PCE, Nagpur

CHAPTER 1

INTRODUCTION

Introduction

Human skin detection is most important in numerous applications such as facial analysis, gesture analysis, video surveillance, human machine inter skin, cyber crime prosecution, image content filter, content aware video compression, annotation, color balancing applications and image retrieval. Skin detection can be defined as the process of selecting which pixels of a given image correspond to human skin.

Skin detection means detecting image pixels and regions that contain skin tone colour. Instead of using feature based skin detection methods, using skin colour for detection have gained strong popularity. Skin detection using colour information can be seen from two points: one is a problem of 'colour classification' and other is a problem of 'colour image segmentation'. In pixel based method, each pixel is classified as skin and non skin individually, independently from its neighbours. Colour based methods fall on this category. In contrast, region based method is to take the spatial arrangement of skin pixels into account during the detection stage to enhance the methods performance. Additional knowledge such as texture is required. Region based methods are built on top of the pixel based ones. So we focuses on pixel based approaches only. It is a standard binary classification problem where the input is a colour vector and the output will be a skin and non skin.

Skin detection is useful in, for example, skin detection and skin tracking for security and video indexing applications, model-based video coding, etc. There are some difficulties when detecting skin pixels. Skin color is affected by ambient light which is unknown in many situations; different cameras produce different colors, even from the same person, under the same illumination conditions; and finally, skin colors change from person to

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

Elective-IV (Open):Wireless Sensor Network

Subject code:- PGOPENETX031

Objectives:

1. To enable the student to understand the role of sensors and the networking of sensed data for different applications.

2. To expose the students to the sensor node essentials and the architectural details, the medium access and routing issues and the energy constrained operational scenario.

3. To enable the student to understand the challenges in synchronization and localization of sensor nodes, topology management for effective and sustained communication, data management and security aspects.

Outcome: By the end of the course, the students shall be able

1. The student would be able to appreciate the need for designing energy efficient sensor nodes andprotocols for prolonging network lifetime.

2. The student would be able to demonstrate an understanding of the different implementationchallenges and the solution approaches.

UNIT I: OVERVIEW OF WIRELESS SENSOR NETWORKS (9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- case study, Enabling Technologies for Wireless Sensor Networks.

UNIT II: ARCHITECTURES (8)

Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes ,Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Considerations

UNIT III: MAC AND ROUTING (9)

MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts, S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, Geographic Routing.

UNIT IV: INFRASTRUCTURE ESTABLISHMENT (9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V: DATA MANAGEMENT AND SECURITY (9)

Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TEXT BOOKS:

1. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.

2. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.

3.Mohammad Ilyas and Imad Mahgaob, Handbook Of Sensor Networks: Compact Wireless And WiredSensing Systems, CRC Press, 2005.

4.Wayne Tomasi, Introduction To Data Communication And Networking, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, “Wireless Sensor Networks” John Wiley, 2010

2. Yingshu Li, My T. Thai,Weili Wu, “ Wireless Sensor Networks and Applications” Springer 2008 3.Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

4. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach",Elsevier, 2007.

5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks”.

Domain 3: Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course I : Research Methodology

Course objective

1. Introduction to philosophy of research.
2. Understand process to formulate research questions / idea
3. Understand process of planning of research time, resource
4. Understand different statistical analysis methods
5. Develop thesis and report writing.

Course outcome

1. Knowledge on various kinds of research questions and research designs
2. Formulate research problems (task) and develop a sufficiently coherent research design
3. Assess the appropriateness of different kinds of research designs
4. Knowledge on qualitative, quantitative and mixed methods of research, as well asrelevant ethical and philosophical considerations
5. Develop independent thinking for critically analyzing research reports

Unit 1 Research Foundation

What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Importance of research methodology in scientific research

Unit 2 Review of Literature

Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation

Unit 3 Planning of Research

The planning process ,Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurement, Research Design/Plan

Unit 4 Processing of Data and Statistical Analysis of Data

Introduction to Statistical Software, MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, MATLAB and Neural Network based optimization, Optimization of fuzzy systems, Error Analysis, Results and their discussions

Unit 5 Report and Thesis writing

Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out of thesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Reference Book:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New AgeInternational Publishers, ISBN:81-224-1522-9
2. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, NewDelhi ISBN:81-307-0128-6
3. Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088
4. MINITAB online manual
5. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M.Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
6. SPSS online manual

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course II

PROJECT PLANNING, EVALUATION & MANAGEMENT

Project Management (PM) will provide students with the opportunity to gain a systematic and comprehensive understanding of key concepts and skills essential to project management in international affairs. By examining the project cycle using potential projects, students will learn techniques and tools used in formulating and managing projects and programs for desired impact.

By course end, students will be familiar with aid and development of project works, language and terminology used, different project structures, implementation practices, and strategies to address potential conflicts and obstacles. More importantly, students will have developed skills - strategic design, needs assessment, implementation, proposal and report writing, budgeting, monitoring and evaluation, advocacy, and others - that practitioners need to be effective in a range of professional contexts.

Course Philosophy: This is a course that will utilize learning techniques to provide students with opportunities to practice and process what they learn. This course attempts to cover skills that are relevant and current in international program work.

Learning Objectives: By course end students will be able to, within the above-stated limitations:

1. Conduct a basic needs assessment for a proposed project
2. Develop a project proposal
3. Develop a logical framework
4. Develop measureable indicators
5. Have ability to insert Monitoring and Evaluation into a project
6. Develop a grant proposal
7. Develop a project budget

As part of comprehensive preparation for the subject, by end of semester students will prepare an analytical and operational concept note that demonstrates:

1. Comprehensive understanding of the *context* in which they will work, including socio-political, economic, and cultural aspects.
2. Understanding of the *issue* they will work on, the causes, and its variations across contexts.
3. Strategies that have been used to tackle the problem(s) - the usual ones, and innovative ones. Students can introduce also other possible solutions worth exploring.

Benefits

- Establish measures of success
- Quantify value commensurate with cost
- Optimize use of organizational resources
- Incorporate quality principles
- Put strategic plans into practice
- Ensure fast time-to-market Project Manager
- Reduced cost to deliver solutions
- Lower risk of slipping schedule
- Repeatable successes on projects
- Crisis prevention
- Early problem identification and risk mitigation
- Structured approach to Project Management
- More predictable results
- Improved resource productivity and satisfaction
- Project success that builds business success

Course Contents

Unit 1 : ***Basics of Project Management:*** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, ProjectManagement Principles

Unit 2 : Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point

Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Organisational Structure and Organisational Issues: Introduction, Concept of Organisational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team

Unit 3: Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks

Unit 4 : ***Project Quality Management and Value Engineering:*** Introduction, Quality, Quality Concepts, Value Engineering

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Purchasing and Contracting for Projects: Introduction, Purchase Cycle, Contract Management, Procurement Process

Unit 5 : ***Project Performance Measurement and Evaluation:*** Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control

Project Close-out, Termination and Follow-up: Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up

Project Management Software: Introduction, Advantages of Using Project Management Software, Common Features Available In Most of the Project Management Software, Project 2000.

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell, 2nd Edition , Sage Publication, 2003
2. Qualitative Inquiry and Research Design: Choosing among Five Approaches, by John W.Creswell, 3rd Edition , Sage publication, 2013.
3. Evaluation: A Systematic Approach, Peter H. Rossi, Mark W. Lipsey, and Howard E. Freeman, 7th edition , Sage publications, 2007.
4. Handbook of Practical Program Evaluation, Joseph S. Wholey, Harry P. Hatry, Kathryn E. Newcomer. 4th edition, Wiley, 2015
5. Program Evaluation and Performance Measurement: An Introduction to Practice, James C. McDavid and Laura R. L. Hawthorn, Sage Publication, 2013.
6. Evaluation, Carol H. Weiss, 2nd Edition, ABE books, 1997.
7. Case Study Research: Design and Methods, Robert K. Yin, 3rd Edition, Sage Publications, 2011

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

M.Tech – VLSI

Session 2016-17

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
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email : principal.pce.ngp@gmail.com, www.pcenagpur.edu.in

Domain 1: VLSI / Embedded Systems

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	VLSI Subsystem Design	PGVLS101T	VLSI / Embedded Systems
2	VLSI Circuits	PGVLS103T/P	
3	Analog VLSI Design	PGVLS201T/P	
4.	VLSI Testing	PGVLS202T	
5.	Modeling of Digital System and Testing	PGVLS203T/P	
6	Embedded Systems	PGVLS104/3T	
7	Micro Electro Mechanical Switches (MEMS)	PGVLS204/2T	

R.T.M. Nagpur universityScheme of Examination for
M. Tech. (VLSI) First Semester

PGVLS101T	VLSI Subsystem Design

Course Objectives:

1. To study the fundamentals of MOS devices and their characteristics.
2. To lay good foundation on the design and analysis of CMOS analog integrated circuits.
3. To study Transient Optimization techniques.
4. To learn and understand clocking strategies.

Course Outcome: By the end of the course, the students shall be able to

1. Design different CMOS based circuits.
2. Analyze the model parameters of CMOS based circuits.

UNIT I: Electrical Properties of MOS Transistors

(9) Electrical Properties, Junction Diode, MOS Transistor: Operation Modes: Threshold Voltage:Metal and Polysilicon; Trapped Charge; Implants, Strong Inversion: Charge Modeling; ConstantVt model: NMOS/PMOS transistors: I/V characteristics, Parasitic Bipolar Transistors:CMOSLatch-up, Analysis (D.C. and Transient).

UNIT II: **(9)**

Device Capacitances and Charge Storage in MOS: NMOS/CMOS circuit analysis, Small signal amplifier model; Miller Effect, Layout / Fabrication, Diffusion / Implants / Wires, NMOS/CMOS processes, SCMOS Design Rules - special derivation; self-aligned processes, Logic Level Design, Realization of Duals for CMOS, Euler path layout, Topological Considerations.

UNIT III: **(8)**

Don't Cares and Redundancy, Layout Parasitic Reduction, I/V for MOS Logic Families, Prop. Delayfor CMOS/NMOS/PNMOS, Layout Capacitance/Resistance Estimation; Gain effects; MOS Performance Estimation, Buffers/Capacitive Loading, Power Dissipation.

UNIT IV: **(9)**

Transient Optimization, Sidewall/2-d and 3-d effects: Cross-talk, Fringing, Ball-Park numbers for process Estimation: Scaling CMOS Design Optimization: High-Speed Logic Strategies, Interconnection, Distributed R/C, Cross-Talk, Noise

UNIT V: **(9)**

Clocking Strategies, Sub-System Design and Partitioning Dynamic Logic, Dynamic Circuits, Stored Charge and timing, Domino Logic, Switched Capacitor and Charge Flow Circuits, Pass-Transistor Logic (CPL) Data-Path and Memory Circuits: Static/Dynamic Memories, Ancillary Memory Analog Circuits.

TEXT BOOKS:

1. Weste, "Principles of CMOS VLSI Design(2nd Edition)
2. Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Systems and Circuits", PrenticeHall of India , 1993
3. Wayne Wolf,"Modern VLSI Desin" 2nd Edition, Prentice Hall 1998

REFERENCE BOOK:

1. Sung-Mo-Kang, Yusuf Labelbici,"CMOS Digital Integrated Circuits" 3rd Ed, Mc Graw Hill

PGVLS103T	VLSI Circuits

Course Objectives:

1. To study basics of VLSI Design methodologies.
2. To study different VLSI design rules.
3. To study in depth the flow of VLSI System Design.
4. To study VLSI Design Modeling and it's synthesis.

Course Outcome: By the end of the course, the students shall be able to

1. Describe and formulate the flow of VLSI Design for any application.
2. Simulate and Analyze the VLSI Circuits.

UNIT I: VLSI Design Methodologies (9)

Introduction to VLSI Design Methodologies – Review of Data Structures and algorithms - Review of VLSI Design Automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – General Purpose methods for combinatorial optimization.

UNIT II: Design Rules (9)

Layout Compaction – Design Rules – Problem Formulation – Algorithms for constraint graph compaction – placement and partitioning – Circuit representation – Placement algorithms -partitioning

UNIT III: Floor Planning (8)

Floor planning concepts – shape functions and floor plan sizing – Types of local routing problems – Area Routing – Channel Routing – Global Routing – Algorithm for Global Routing.

UNIT IV: Simulation (9)

Simulation – Gate-Level modeling and simulation – Switch-level modeling and simulation – Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.

Unit V: Modeling and Synthesis (9)

High Level Synthesis – Hardware models – Internal representation – Allocation – assignment and scheduling – Simple Scheduling algorithm – Assignment problem – High level transformations.

Text Books:

1. S. H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N. A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer AcademicPublishers, 2002.

References Books:

1. Sadiq M. Sait, Habib Youssef, " VLSI Physical Design Automation: Theory and Practice",World Scientific 1999.
2. Steven M. Rubin, " Computer Aids for VLSI Design", Addison Wesley Publishing 1987.

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS201T	Analog VLSI Design

Course Objectives:

1. To introduce the fundamental principles of VLSI circuit design and to examine the basic buildingblocks of large-scale circuits.
2. To learn about Device Modeling- Various types of analog systems- CMOS amplifiers andComparators.

Course Outcome: By the end of the course, the students shall be able to

1. Understand the concepts of analog design and to design various analog systems including data converters- CMOS amplifiers- Comparators and Switched Capacitor Circuits.

UNIT I: **(9)**

Device modeling and simulation Modeling, MOS Models Diode model, Bipolar modes BSIM Spice models, Circuit simulations using Spice, Basic Building Blocks: Switches, Current sources and sinks, Current mirrors, Voltage and current references.

UNIT II: **(9)**

Amplifiers: MOS Inverting amplifier, Cascade amplifiers, Feedback amplifiers, Differential amplifiers, Frequency response, noise performance in Diff amplifiers, Output amplifiers.

UNIT III: **(8)**

CMOS Two stage OPAMP Design, Cascade OPAMPs, Simulation and Measurement of OPAMPs,Comparators.

UNIT IV: **(9)**

Analog signal processing, CMOS Digital to analog converters, Scaling and serial, cyclic, Analogto digitalconverters Serial, SAR, Parallel, Pipelined, sigma-delta converters.

UNIT V: **(9)**

Mixed signal Layout issues, Continuous time filters, Switched capacitor filters, Modulator andmultipliers, PLL, Advance topics on Analog VLSI.

TEXT BOOKS:

1. VLSI Design Techniques for analog and digital circuits, R.L.Geiger, P.E.Allen, McGRaw Hill,2008, 4th Edition
2. CMOS circuit design, Layout and simulation, J.Baker, D.E.Boyce, IEEE Press, 2003, 1st Edition

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits , McGraw-Hill, 2001

R.T.M. Nagpur UniversityScheme of Examination for

M. Tech. (VLSI) Second Semester

PGVLS202T	VLSI Testing

Course Objectives:

1. To know about the various test Generation Algorithms and Fault Simulation Techniques.

Course Outcome: By the end of the course, the students shall be able to

1. Do testing of various Memory Modules and Combinational & sequential logic Circuits.

UNIT I: INTRODUCTION TO TESTING (9)

Faults in digital circuits, Modeling of faults, Logical Fault Models, Fault detection, Fault location, Fault dominance, Logic Simulation, Types of simulation, Delay models, Gate level Event-driven simulation.

UNITII:TESTGENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (9)

Test generation for combinational logic circuits, Testable combinational logic circuit design,Test generation for sequential circuits, design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY (8)

Design for Testability, Ad-hoc design, Generic scan based design, Classical scan based design,Systemlevel DFT approaches.

UNIT IV: SELF-TEST AND TEST ALGORITHMS (9)

Built-In Self Test, Test pattern generation for BIST, Circular BIST, BIST Architectures, TestableMemory Design, Test algorithms, Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS (9)

Logic Level Diagnosis, Diagnosis by UUT reduction, Fault Diagnosis for CombinationalCircuitsSelf-checking design, System Level Diagnosis.

TEXT BOOKS:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design",JaicoPublishing House, 2002.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed - SignalVLSI Circuits", Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice allInternational, 2002

R.T.M. Nagpur University Scheme of Examination for
M. Tech. (VLSI) Second Semester

PGVLS203T	Modeling of Digital System and Testing

Course Objectives:

1. To learn different styles of modeling in Verilog.
2. To Study simulation of digital circuits.
3. To study basics of FPGA and its applications.
4. To learn fundamentals of testing of logic circuits.

Course Outcome: By the end of the course, the students shall be able to

1. Simulate different combinational and sequential circuits.
2. Test different logic circuits.

UNIT I: Verilog for System Design (9)

Introduction to HDL, Behavioural, Data flow, Structural Models, Simulation Cycles, Process, Concurrent Statements, Sequential Statements, Loops, Delay Models, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Operator Inference, Writing Test bench.

UNIT II: Digital Circuit Simulation (9)

Design of combinational circuit building blocks: synthesis of logic functions using multiplexers, demultiplexers, binary encoders and priority encoders, code converters, arithmetic comparison circuits, SRAM Model

Design of Sequential Circuit Building block, Flip flops, registers with enable input, design of bit counting circuit.

UNIT III: Sequential Circuit Simulation (9)

Registers and counters: shift registers, Asynchronous counters and synchronous counters, reset synchronization, UART Model, shift and add multiplier, divider, clock synchronization, clock skew, switch debouncing, Design example - bus structure.

UNIT IV: Field Programmable Gate Arrays (8)

Introduction to FPGA, Logic Block Architecture, Routing Architecture, ProgrammableInterconnections, Design Flow, Xilinx Spartan architecture, Xilinx Virtex Architecture,Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hotencoding, Hardware-software co-simulation, Bus function models, Bus Functional Model (BFM)Simulation, Case Study: Xilinx Spartan III.

UNIT V: Testing of logic circuits (9)

Testing Philosophy, Role of Testing, fault model, complexity of a test set, Detection of single Multiple Faults in Combinational Logic Circuits, techniques for testing of sequential circuits, Design for testability.

TEXT BOOKS:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
3. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier

REFERENCE BOOKS:

1. Brown, Vranesic ―Fundamentals of digital logic design with VHDL, McGraw Hill
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison Wesley

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second SemesterElective-I (Discipline Specific):

PGVLS104/3T	Embedded Systems

Course Objectives:

1. To study fundamentals of 8051 microcontroller, PIC-16c6x/7x and ARM-7.
2. To study interfacing of different peripherals with microcontrollers based upon theembedded application.

Course Outcome: By the end of the course, the students shall be able to

1. Program an embedded system
2. Design, implement and test an embedded system.

UNIT I: (8)

Introduction to controllers, 8051 controller, Block Diagram &Architecture, 8051 Instruction Set, Addressing modes & programming, 8051 Timers, Serial I/O, Interrupts programming,

UNIT II: (10)

Memory Interfacing, Programming, Real time interfacing with LED, LED display, LCD display Enhanced Features: Dallas HSM & Atmel Micro-controllers, Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators.

UNIT III: (9)

RISC Controller: PIC Micro-controllers–overview; features, PIC 16c6x/7x–architecture, file selection register, Memory organization, Addressing modes, Instruction set, Programming, PIC- 18 Flash Micro-controllers. STATUS, OPTION_REG, PCON registers

UNIT IV: (9)

Memory Organization: Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT V: (8)

ARM Micro-controllers overview; features, ARM 7 –architecture, Thumb, Register Model, Addressing modes, Introduction to Embedded C Programming.

TEXT BOOKS:

1. Embedded system Design ,Steve Heath, Butterworth Helneman,2008,4th
2. The 8051 Microcontroller-architecture, Programming & Applications, Kenneth J.Ayala,PenramInternational & Thomson Aisa,2003,2nd
3. The 8051 Microcontroller and Embedded Systems, Mazidi and McKinley, Pearson Education,2010, 2ndEdition.

REFERENCE BOOKS:

1.Programming Embedded Systems with C and GNU Development Tools, Michael Barr,Anthony Massa, O'Reillypublishers, 2nd Edition

2. Real Time Interfacing to ARM, Cortex-M Microcontrollers, Embedded systems, JonathanValvano,5th Edition

R.T.M. Nagpur UniversityScheme of Examination for
M. Tech. (VLSI) Second SemesterElective-III (Discipline Specific):

PGVLS204/2T	Micro Electro Mechanical Switches (MEMS)

Course Objectives:

1. To understand Standard microfabrication techniques and the issues surrounding them.
2. To understand Major classes, components, and applications of MEMS devices/systems andto demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. To understand microfabrication techniques and applications to the design and Manufacturing of an MEMS device or a microsystem**.**

Course Outcome: By the end of the course, the students shall be able to

1. Understand working principles of currently available microsensors, actuators used in Microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devicesand systems.
3. Understand the basic principles and applications of micro-fabrication processes.

UNIT I: **(8)**

Micro-fabrication and Micromachining : Integrated Circuit Processes, Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)

UNIT II: **(8)**

Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT III: **(9)**

Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors-Microactuator systems : Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector

UNIT IV: **(10)**

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, other compatible materials, Silicon Dioxide, Silicon Nitride, Piezoelectric materials, Surface Micromachined Systems: Success Stories, Micromotors, Gear trains, Mechanisms.

UNIT V: **(9)**

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. MEMS for RF Applications: Need for RF MEMS components in communications, space and defense applications.

TEXT BOOKS:

1. Sensor Technology and Devices: Ristic L (ed), Artech House, London, 1994.
2. Semiconductor Sensors: Sze S.M. (ed), John Wiley, New York, 1994.
3. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

REFERENCE BOOKS :

1. Integrated Sensors, Micro actuators and micro-systems (MEMS): K.D. Wise, Special Issue ofproceedings of IEEE, Vol. 86, No.8, August 1998
2. RF MEMS: Theory, Design, and Technology: Gabriel M. Rebeiz, Wiley, 2003.
3. Fundamentals of Microfabrication: Marc Madou, CRC Press, 1997.

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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Domain 2: Signal Processing/ Networks

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
8	Advanced Digital Signal Processing	PGVLS102T/P	Signal Processing/ Networks
9	Biomedical Systems Engineering	PGOPEN501T	
10	Wireless Sensor Network	PGOPEN301T	

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology

PGVLS102T	Advanced Digital Signal Processing

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applications and retrieval ofinformation from signals.
3. To study designing of digital filters and its realization.
4. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
5. To Study Power Spectrum Estimation.
6. To study the application of Wavelet Transforms.

Course Outcome: By the end of the course the students shall be able to:

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regard to sampling andreconstruction.
3. Design and implement digital filter for various applications.
4. Estimation of Power Spectrum
5. Describe the concept of multi rate signal processing and how to apply it for the wavelettransform.
6. Describe the various transforms for analysis of signals and systems.

UNIT I: Multirate Digital Signal Processing: **(9)**

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass SignalsLinear Prediction and Optimum Linear

UNIT II: Filters: **(8)**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linearprediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT III: Power Spectral Estimation: **(9)**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

UNIT IV: Parametric Method of Power Spectrum Estimation: **(10)**

Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation andModel Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

UNIT V: **(8)**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet,Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets

TEXT BOOKS:

1.Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms andApplication, PHI.

2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

REFERENCE BOOKS:

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab",Springer.
3. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, " CRCPress,2005.

Rashtrasant Tukdoji Maharaj Nagpur University, NagpurFaculty of Engineering & Technology

Biomedical Systems Engineering

Subject codes:- PGOPENETX024

Course Objectives: The objective of this course is to provide students with the understanding of
1.An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system
2.Biomedical sensing and measuring devices.
3.Analysis of Biomedical Signals.
4.Application of Artificial Intelligence for Medical Decision Making.

Course Outcome: Upon the completion of this course, students shall be able to:
1. Understand application of electronics in Medical field.
2. Identify various sensing devices and their applications in medical field
3. Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.

UNIT I:
Biomedical signals: origins and dynamic characteristics, Biomedical signal acquisition and processing

UNIT II:
Compression of biomedical signals, Analysis of biomedical signal using advanced techniques (e.g. neural networks,orthogonal transformations including singular value decomposition) and wavelet transformation, higher orderspectra).

UNIT III:
Nonlinear dynamical analysis of biomedical signals, Physiological modelling, identification and simulation. Control of physiological processes and computer controlled drug infusion medical signaling (including CT Scan, MRI and Ultrasound).

UNIT IV:
Medical Informatics, Artificial intelligence methods for medical decision making

UNIT V:
Study of biological sensors: Sensors / receptors in the human body, basic organization of nervous system-neural mechanism and circuit processing. Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste. Sensor models in the time and frequency domains.

TEXT BOOKS:
1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, Tata McGraw Hill.
2. Carr & Brown, “Introduction to Biomedical EquipmentTechnology” Pearson Education, Asia.3. Cromwell, Weibell &Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall, India

REFERENCES BOOKS:
1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.
2. J.Webster, “Bioinstrumentation”, Wiley & Sons.
3. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology

Elective-IV (Open):Wireless Sensor Network

Subject code:- PGOPENETX031

Objectives:

1. To enable the student to understand the role of sensors and the networking of sensed data for different applications.
2. To expose the students to the sensor node essentials and the architectural details, the medium access and routing issues and the energy constrained operational scenario.
3. To enable the student to understand the challenges in synchronization and localization of sensor nodes, topology management for effective and sustained communication, data management and security aspects.

Outcome: By the end of the course, the students shall be able

1. The student would be able to appreciate the need for designing energy efficient sensor nodes and protocols for prolonging network lifetime.
2. The student would be able to demonstrate an understanding of the different implementationchallenges and the solution approaches.

UNIT I: OVERVIEW OF WIRELESS SENSOR NETWORKS (9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- case study, Enabling Technologies for Wireless Sensor Networks.

UNIT II: ARCHITECTURES (8)

Single-Node Architecture, Hardware Components, Energy Consumption of Sensor Nodes ,Operating Systems and Execution Environments, Network Architecture, Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Considerations

UNIT III: MAC AND ROUTING (9)

MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts, S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, Geographic Routing.

UNIT IV: INFRASTRUCTURE ESTABLISHMENT (9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V: DATA MANAGEMENT AND SECURITY (9)

Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TEXT BOOKS:

1. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.
2. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.
3. Mohammad Ilyas and Imad Mahgaob, Handbook Of Sensor Networks: Compact Wireless And WiredSensing Systems, CRC Press, 2005.
4. Wayne Tomasi, Introduction To Data Communication And Networking, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks" John Wiley, 2010
2. Yingshu Li, My T. Thai,Weili Wu, " Wireless Sensor Networks and Applications" Springer 2008 3.Holger Karl

& Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
4. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach",Elsevier, 2007.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks”.

Lokmanya Tilak Jankalyan Shikshan Sanstha's
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Domain 3: Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
11	Research Methodology	PGFD205T	Others
12	Project Planning and Management	PGFD302T	

Rastrasant Tukodoji Maharaj Nagpur University, Nagpur (RTMNU)

Foundation Course I : Research Methodology
Course objective

1. Introduction to philosophy of research.
2. Understand process to formulate research questions / idea
3. Understand process of planning of research time, resource
4. Understand different statistical analysis methods
5. Develop thesis and report writing.

Course outcome

1. Knowledge on various kinds of research questions and research designs
2. Formulate research problems (task) and develop a sufficiently coherent research design
3. Assess the appropriateness of different kinds of research designs
4. Knowledge on qualitative, quantitative and mixed methods of research, as well asrelevant ethical and philosophical considerations
5. Develop independent thinking for critically analyzing research reports

Unit 1 Research Foundation

What is Research, Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Importance of research methodology in scientific research

Unit 2 Review of Literature

Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation

Unit 3 Planning of Research

The planning process ,Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurement, Research Design/Plan

Unit 4 Processing of Data and Statistical Analysis of Data

Introduction to Statistical Software, MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, MATLAB and Neural Network based optimization, Optimization of fuzzy systems, Error Analysis, Results and their discussions

Unit 5 Report and Thesis writing

Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out ofthesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

Reference Book:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New AgeInternational Publishers, ISBN:81-224-1522-9
2. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, NewDelhi ISBN:81-307-0128-6
3. Design and Analysis of Experiments by Montogomery D.C. (2001), John Wiley, ISBN: 0471260088
4. MINITAB online manual
5. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M.Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
6. SPSS online manual

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Foundation Course II

PROJECT PLANNING, EVALUATION & MANAGEMENT

Project Management (PM) will provide students with the opportunity to gain a systematic and comprehensive understanding of key concepts and skills essential to project management in international affairs. By examining the project cycle using potential projects, students will learn techniques and tools used in formulating and managing projects and programs for desired impact.
By course end, students will be familiar with aid and development of project works, language and terminology used, different project structures, implementation practices, and strategies to address potential conflicts and obstacles. More importantly, students will have developed skills - strategic design, needs assessment, implementation, proposal and report writing, budgeting, monitoring and evaluation, advocacy, and others - that practitioners need to be effective in a range of professional contexts.

Course Philosophy: This is a course that will utilize learning techniques to provide students with opportunities to practice and process what they learn. This course attempts to cover skills that are relevant and current in international program work.

Learning Objectives: By course end students will be able to, within the above-stated limitations:

1. Conduct a basic needs assessment for a proposed project
2. Develop a project proposal
3. Develop a logical framework
4. Develop measureable indicators
5. Have ability to insert Monitoring and Evaluation into a project
6. Develop a grant proposal
7. Develop a project budget

As part of comprehensive preparation for the subject, by end of semester students will prepare an analytical and operational concept note that demonstrates:

1. Comprehensive understanding of the *context* in which they will work, including socio-political, economic, and cultural aspects.
2. Understanding of the *issue* they will work on, the causes, and its variations across contexts.
3. Strategies that have been used to tackle the problem(s) - the usual ones, and innovative ones. Students can introduce also other possible solutions worth exploring.

Benefits

- Establish measures of success
- Quantify value commensurate with cost
- Optimize use of organizational resources
- Incorporate quality principles
- Put strategic plans into practice
- Ensure fast time-to-market Project Manager
- Reduced cost to deliver solutions
- Lower risk of slipping schedule
- Repeatable successes on projects
- Crisis prevention
- Early problem identification and risk mitigation
- Structured approach to Project Management
- More predictable results
- Improved resource productivity and satisfaction
- Project success that builds business success

Course Contents

Unit 1 : ***Basics of Project Management:*** Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, ProjectManagement Principles

Unit 2 : Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point

Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Organisational Structure and Organisational Issues: Introduction, Concept of Organisational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team

Unit 3: Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks

Unit 4 : ***Project Quality Management and Value Engineering:*** Introduction, Quality, Quality Concepts, Value Engineering

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Purchasing and Contracting for Projects: Introduction, Purchase Cycle, Contract Management, Procurement Process

Unit 5 : ***Project Performance Measurement and Evaluation:*** Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control

Project Close-out, Termination and Follow-up: Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up

Project Management Software: Introduction, Advantages of Using Project Management Software, Common Features Available In Most of the Project Management Software, Project 2000.

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell, 2nd Edition , Sage Publication, 2003
2. Qualitative Inquiry and Research Design: Choosing among Five Approaches, by John W.Creswell, 3rd Edition , Sage publication, 2013.
3. Evaluation: A Systematic Approach, Peter H. Rossi, Mark W. Lipsey, and Howard E. Freeman, 7th edition , Sage publications, 2007.

4. Handbook of Practical Program Evaluation, Joseph S. Wholey, Harry P. Hatry, Kathryn E. Newcomer. 4th edition, Wiley, 2015
5. Program Evaluation and Performance Measurement: An Introduction to Practice, James C. McDavid and Laura R. L. Hawthorn, Sage Publication, 2013.
6. Evaluation, Carol H. Weiss, 2nd Edition, ABE books, 1997.
7. Case Study Research: Design and Methods, Robert K. Yin, 3rd Edition, Sage Publications, 2011