COURSE STRUCTUREAND DETAILED SYLLABUS

Effective from the Academic Year 2024-25 onwards

Department of Electronics and Communication Engineering (ECE)

For

M.Tech.(VLSI &ES)

Two Year PG Degree Programme

(MR24 Regulations)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

MALLA REDDY ENGINEERING COLLEGE

(Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH, Hyderabad)
Recognized under section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with „A" Grade (II Cycle) and NBA
Maisammaguda, Dhulapally (Post ViaKompally), Secunderabad - 500 100.
Website: www.mrec.ac.in E-mail: principal@mrec.ac.in

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)
MR24 – ACADEMIC REGULATIONS (CBCS)
for M.Tech. (REGULAR) PG DEGREE PROGRAMME

Applicable for the students of M.Tech. (Regular) programme admitted from the Academic Year ***2024-25*** onwards

The M.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad, Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To be a premier center of professional education and research, offering quality programs in asocio-economic and ethical ambience.

MISSION

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.
- To inculcate innovation and best practices in education, training and research.
- To meet changing socio-economic needs in an ethical ambience.

DEPARTMENT VISION

To produce innovative, globally competent and ethical Electronics and communication Engineers to cater socio-economic needs.

DEPARTMENT MISSION

- To impart quality education in Electronics and Communication Engineering discipline and produce employable graduates
- To improve the thought process of students by exposing them to advanced technologies and make them innovative in their career
- To provide ethical and value-based education by encouraging activities addressing the societal needs.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates acquire insights into mathematics, sciences, computing and fundamentals of electronics and communication engineering including breadth to meet global demand and competitiveness in terms of technological aspects.
PEO2	Graduates excel in best postgraduate schools, reaching advanced degrees in engineeringand related disciplines; will have skills for continued independent, lifelong learning tobecome experts in their profession.
PEO3	Graduates possess best communicative skills and work efficiently on team-based projects in electronics, communication, computational and manufacturing firms with asense of social responsibility.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO I	**(Engineering Knowledge and Analyzing Skills):** Understand the basics of Electronicsand Communications and will be able to apply them in analyzing problems related to Electronics, Communications, Signal processing, VLSI, Embedded systems, etc.
PSO II	**(Problem Solving and System Design Skills):** Solve any problem related to Electronics and Communication Engineering with the help of latest software andspecialized hardware. They will also be able to design a working prototype of thesolution.
PSO III	**(Application of Knowledge in Solving Society/ Environment Problems):** Will beable to apply the knowledge of Electronics and Communication Engineering and design projects for the betterment of people's life (health, security, resource management, etc.) in society and to maintain ecological balance.

PROGRAMME OUTCOMES (POs)

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MALLA REDDY ENGINEERING COLLEGE

COURSE STRUCTURE – M.Tech. VLSI & Embedded Systems Programme

(MR24 Regulations - Effective from Academic Year 2024 - 25 onwards)

I YEAR I SEMESTER

S. No	Category	Course Code	Name of the Course	Contact Hours/ Week			Credits
				L	T	P	
1	PCC	D4101	CMOS Analog IC Design	3	-	-	3
2	PCC	D4102	Embedded System Design	3	-	-	3
3	PCC	D4103	CMOS Mixed Signal Circuit Design	3	-	-	3
4	PEC-I	D4110	Pattern Recognition and Machine Learning	3	-	-	3
		D4111	Advance Digital System Design				
		D4112	Memory Technologies				
5	PEC-II	D4113	Embedded Real Time Operating Systems	3	-	-	3
		D4114	Advanced Computer Architecture				
		D4115	Communication Buses & Interfaces				
6	PCC	D4104	Mixed Signal Design Lab	-	-	4	2
7	PCC	D4105	Embedded System Design Lab	-	-	4	2
8	AC	D0A04	English for Research Paper Writing	2	-	-	-
Total				**17**	**-**	**8**	**19**
Contact Hours: 25							

I YEAR II SEMESTER

S. No	Category	Course Code	Name of the Course	Contact Hours/Week			Credits
				L	T	P	
1	PCC	D4106	CMOS Digital IC Design	3	-	-	3
2	PCC	D4107	Advanced Embedded Processors	3	-	-	3
3	PEC-III	D4116	IoT Architectures and System Design	3	-	-	3
		D4117	Low Power VLSI Design				
		D4118	SOC Design				
4	PEC-IV	D4119	Device Modeling	3	-	-	3
		D4120	Embedded Network Controllers				
		D4121	Physical Design Automation				
5	HSMC	D0H11	Research Methodology and IPR	2	-	-	2
6	PCC	D4108	Digital IC Design Lab	-	-	4	2
7	PCC	C4109	Advanced Embedded Systems Lab	-	-	4	2
8	AC	D0A05	Value Education	2	-	-	-
Total				**16**	**-**	**8**	**18**
Contact Hours: 24							

II YEAR I SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	PEC-V	D4122	Design For Testability	3	-	-	3
		D4123	Sensors and Actuators				
		D4124	Nano Materials and Nano Technology				
2	OEC		Open Elective	3	-	-	3
3	PROJ	D41P1	Technical Seminar	-	-	2	1
4	PROJ	D41P2	Project / Dissertation Phase - I	-	-	16	8
Total				**6**	**-**	**18**	**15**
Contact Hours: 24							

II YEAR II SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	PROJ	D41P3	Project / Dissertation Phase - II	-	-	32	16
Total				**-**	**-**	**32**	**16**
Contact Hours: 32							

- PCC - Professional Core Course
- PEC - Professional Elective Course
- OEC - Open Elective Course
- PROJ - Project

LIST OF OPEN ELECTIVE COURSES

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	OEC	D5128	Business Analytics	3	-	-	3
		D0B20	Advance Optimization Techniques				
		D3228	Industrial Safety				
		D0522	Image and Video Processing				
		D0623	Artificial Intelligence				

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4101	CMOS ANALOG IC DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: CMOS and VLSI Technology.

OBJECTIVE: To learn about MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modelling - Simple MOS Large-Signal Model, Small-Signal Model for the MOS Transistor, to learn about Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power Supply Rejection Ratio of Two-Stage Op Amps, Cascade Op Amps, Measurement Techniques of OP Amp, to know about Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open- Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators

Module - I: MOS DEVICES AND MODELING [9 Periods]

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model forth MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

Module -II: ANALOG CMOS SUB-CIRCUITS [9 Periods]

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascade current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

Module -III: CMOS AMPLIFIERS [8 Periods]

Inverters, Differential Amplifiers, Cascade Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

Module -IV: CMOS OPERATIONAL AMPLIFIERS [9 Periods]

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power Supply Rejection Ratio of Two-Stage Op Amps, Cascade Op Amps, Measurement Techniques of OP Amp.

Module -V: COMPARATORS [9 Periods]

Characterization of Comparator, Two-Stage, Open-Loop Comparators, other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1. Philip E. Allen and Douglas R. Holberg, **CMOS Analog Circuit Design,** Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, **Analysis and Design of Analog Integrated Circuits**, Wiley India, Fifth Edition, 2010.

REFERENCE BOOKS:

1. David A. Johns, Ken Martin, **Analog Integrated Circuit Design,** Wiley Student Edn, 2013.
2. Behzad Razavi, **Design of Analog CMOS Integrated Circuits**, TMH Edition.
3. Baker, Li and Boyce, **CMOS: Circuit Design, Layout and Simulation,** PHI.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Learn about MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Small- Signal Model for the MOS Transistor.
2. Learn about Design of CMOS Op Amps, Compensation of Op Amps, Design of Two- Stage Op Amps, and Power Supply Rejection Ratio of Two-Stage Op Amps, Cascade Op Amps, and Measurement Techniques of OP Amp.
3. Know about Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4102	EMBEDDED SYSTEM DESIGN	L	T	P
Credits: 3		3	-	-

PRE-REQUISITES: Digital Electronics and Microprocessors.

OBJECTIVE: This course introduces the fundamental concepts of Micro Controllers and their architecture. To enable the students to write efficient programs in assembly language programs and to make the students aware of the interfacing techniques so that they can design and develop a microcontroller-based system. It also includes the embedded systems building blocks.

MODULE - I: **8051 Architecture** [**10 Periods]**
Introduction to micro controllers, comparing micro processors and micro controllers 4,8,16 and 32 bit micro controllers, Development systems for Micro controllers, Architecture; Architecture of 8051, pin configuration of 8051 micro controller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts.

MODULE - II: **8051 Instructions** **14 Periods]**
Addressing modes, External Data moves, Code Memory Read-only Data Moves, PUSH and POP OP codes, Data Exchanges, Logical Operations; Byte-Level Logical Operations, Bit Level Logical Operations, Rotate and Swap Operations. Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Jump and Call op codes; The jump and call program range, Jumps, Calls and Subroutines, call and returns, Interrupts and Returns.

MODULE - III: **8051 Interfacing** **[16 Periods]**
8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming.

MODULE - IV: **Introduction to Embedded Systems** [**08 Periods]**
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

MODULE - V: **Typical Embedded System** [**12 Periods]**
Core of the Embedded System: General Purpose and Domain Specific Processors, asics, plds, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

TEXT BOOKS:
1. Kenneth. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 3rd Edition, 2004. (Modules I, II & III)
2. Shibu K.V "Introduction to Embedded Systems", Mc Graw Hill, 1st Edition, 2009. (Modules IV & V) 121

REFERENCE BOOKS:

1. Mazidi M.A, Mazidi JG, & Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", Pearson Education, 2nd edition, 2007.
2. Frank Vahid, Tony Givargis, John Wiley, "Embedded System Design", 2 nd edition, 2001.

OUTCOMES: After completion of the course, students will be able to:

1. Express architecture of Micro Controllers
2. Program a microcontroller system in assembly code and C.
3. Build and test a microcontroller-based system.
4. Understand the concepts of embedded systems.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4103	CMOS MIXED SIGNAL CIRCUIT DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: CMOS Technology and Analog and Digital Communication Concepts.

OBJECTIVE: To Understand the design of circuits in IC form especially both digital and analog designs, to Understand the design of specific circuits like PLL,A/D,D/A and over sampling converters starts with Switched Capacitor circuits, to understanding the circuits by considering so many parameters may arises problems which need to be solve to get optimization

Module - I : SWITCHED CAPACITOR CIRCUITS [8 Periods]

Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

Module – II : PHASED LOCK LOOP (PLL) [9 Periods]

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications

Module - III : DATA CONVERTER FUNDAMENTALS [9 Periods]

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

Module - IV : NYQUIST RATE A/D CONVERTERS [8 Periods]

Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time- interleaved converters.

Module - V : OVERSAMPLING CONVERTERS [7 Periods]

Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibitquantizers, Delta sigma D/A

TEXT BOOKS:

1. Behzad Razavi, **Design of Analog CMOS Integrated Circuits,** TMH Edition, 2002
2.Philip E. Allen and Douglas R. Holberg, **CMOS Analog Circuit Design**, Oxford

University Press, International Second Edition/Indian Edition, 2010.
3. David A. Johns, Ken Martin, **Analog Integrated Circuit Design**, Wiley Student Edition, 2013

REFERENCE BOOKS:

1. Rudy Van De Plassche, **CMOS Integrated Analog-to- Digital and Digital-to-Analog converters,** Kluwer Academic Publishers, 2003
2. Richard Schreier, **Understanding Delta-Sigma Data converters,** Wiley Interscience, 2005.
3. R. Jacob Baker, **CMOS Mixed-Signal Circuit Design,** Wiley Interscience, 2009.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. In a Position that he/she can design mixed signal-based circuits starting from basic constraints to advanced constraints
2. Design circuits like switched capacitor circuits, PLL, A/D and D/A converter
3. Understand the design of over sampling circuits and higher order modulators

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4110	PATTERN RECOGNITION AND MACHINE LEARNING	L	T	P
Credits: 3		3	-	-

PRE-REQUISITES: Statistics and Linear Algebra

OBJECTIVE: The student will be able to understand the mathematical formulation of patterns. To study the various linear models, understand the basic classifiers and be able to distinguish different models.

Module –I **[10 Periods]**

Introduction to Pattern recognition: Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition, Nonparametric Design of Sequential Pattern Classifiers, Analysis of Optimal Performance and a Multiclass Generalization

Module –II **[9 Periods]**

Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

Module –III **[8 Periods]**

Kernel Methods: Constructing Kernels, Radial Basis Function Networks -Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines-Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

Module –IV **[9 Periods]**

Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional

Independence- Three example graphs, D-separation, Markov Random Fields - Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

Module -V **[8 Periods]**

Mixture Models and EM algorithm: K-means Clustering-Image segmentation and compression, Mixtures of Gaussians-Maximum likelihood, EM for Gaussian mixtures, An Alternative View of EM- Gaussian mixtures revisited, Relation to K-means, Mixtures of Bernoulli distributions, EM for Bayesian linear regression, The EM Algorithm in General, Combining Models- Tree-based Models, Conditional Mixture Models- Mixtures of linear regression models, Mixtures of logistic models, Mixtures of experts.

Text Books:

1. Sequential methods in Pattern Recognition and Machine Learning-K.S.Fu, Academic Press, volume no.52.
2. Pattern Recognition and Machine Learning- C. Bishop-Springer,2006.

Reference Books:

1. Pattern Classification- Richard o. Duda, Peter E. hart, David G. Stork, John Wiley& Sons, 2nd Ed., 2001.
2. The elements of Statistical Learning- Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, Springer, 2nd Ed., 2009.

COURSE OUTCOMES:

On completion of this course student will be able to

1. Familiar the basics of pattern classes and functionality.
2. Construct the various linear models.
3. Use the different kernel methods.
4. Design the Markov and Mixed models.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4111	ADVANCE DIGITAL SYSTEM DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI and STLD

OBJECTIVE: To impart knowledge on the theory of Sequential machines and minimization of it. to design digital circuits for various applications. Thorough understanding of VHDL and modeling of digital systems using VHDL

MODULE – I :Minimization And Transformation Of Sequential Machines

[8 Periods]

The Finite State Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines. Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles and Hazards.

MODULE – II : Digital Design [9 Periods]

Digital Design Using ROMs, PALs and PLAs, BCD Adder, 32 – bit adder, State graphs for control circuits, Scoreboard and Controller, A shift and add multiplier, Array multiplier, Keypad Scanner, Binary divider.

MODULE – III: SM Charts [7 Periods]

State machine charts, Derivation of SM Charts, Realization of SM Chart, Implementation of Binary Multiplier, dice game controller.

MODULE – IV: Hardware Description Language [9 Periods]

Review of Verilog HDL, Modelling styles: Behavioural, Dataflow, and Structural Modelling, gate delays, switch-level Modelling, Hierarchal structural modelling, Design environment and constraints logic synthesizers, Language structure synthesis, coding guidelines for clocks and reset.

MODULE – V: Verification [8 Periods]

Functional verification, simulation types, Test Bench design, Dynamic timing analysis, static timing analysis. Design Examples-Adders and Subtractors, Multiplication and Division Algorithms, ALU.

TEXT BOOKS:

1. Charles H. Roth, **Fundamentals of Logic Design, Cengage** Learning,5th Ed.
2. Ming-Bo Lin., **Digital System Designs and Practices Using Verilog HDL and FPGAs,** Wiley, 2008.

3. J.Bhasker, **Verilog HDL Primer Hardcover,** 2nd Edition, Star Galaxy Publishing ,1999

REFERENCE BOOKS:

1. Michael D. Ciletti, **Advanced Digital Design with the Verilog HDL**", PHI, 2005.
2. Samir Palnitkar, "**Verilog HDL: A Guide to Digital Design and Synthesis**", Pearson Education, 2005.
3. John F Wakerley**, Digital Design Principles and Practice** ,4th Edition, Pearson education, 2006

COURSE OUTCOMES:

1. To expose the students to the fundamentals of sequential system design.
2. To enable the students to formulate and solve problems in Digital Systems design and implementation.
3. To develop Digital Systems design skills.
4. To make the students technically competent in design and implementation using VHDL

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4112	MEMORY TECHNOLOGIES	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Design, Digital Electronics

OBJECTIVE: To know the RAM technologies, architecture and applications, to know the circuit design concepts of Non-volatile memories and understand the Memory package density technologies.

Module - I: **[8 Periods]**
Random Access Memory Technologies: Static Random-Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, Advanced SRAM Architectures, Application Specific SRAMs.

Module -II: **[10 Periods]**
DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs, SRAM and DRAM Memory controllers.

Module - III: **[10 Periods]**
Non-Volatile Memories: Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories.

Module - IV: **[10 Periods]**
Advanced Memory Technologies and High-density Memory Packing Technologies: Ferroelectric Random-Access Memories (FRAMs), Gallium Arsenide (GaAs) FRAMs, Analog Memories, Magneto Resistive Random-Access Memories (MRAMs), Experimental Memory Devices.

Module - V: **[10 Periods]**
Memory Hybrids (2D & 3D), Memory Stacks, Memory Testing and Reliability Issues, Memory Cards, High Density Memory Packaging.

TEXT BOOKS:

1. Ashok K Sharma, "Advanced Semiconductor Memories: Architectures, Designs and Applications", Wiley Interscience
2. Kiyoo Itoh, "VLSI memory chip design", Springer International Ed.

REFERENCE BOOKS:

1.Ashok K Sharma," Semiconductor Memories: Technology, Testing and Reliability, PHI

COURSE OUTCOMES:

1. Select architecture and design semiconductor memory circuits and subsystems.
2. Identify various fault models, modes and mechanisms in semiconductor memories and their

testing procedures.

3. Know, how of the state-of-the-art memory chip design

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4113	EMBEDDED REAL-TIME OPERATING SYSTEMS	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Embedded System Concepts and Linux and UNIX Programming

OBJECTIVE: To learn fundamentals of UNIX operating system. To study implementation aspects of real time concepts. To study example RTOSs and applications.

Module - I: Introduction [8 Periods]

Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec.

Module - II: Real Time Operating Systems [9 Periods]

Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

Module - III: Objects, Services and I/O [7 Periods]

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/OConcepts, I/O Subsystem

Module - IV: Exceptions, Interrupts and Timers [8 Periods]

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

Module - V: Case Studies of RTOS [9 Periods]

RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, Tiny OS and Basic Concepts of Android OS.

TEXT BOOKS:

1. Qing Li, **Real Time Concepts for Embedded Systems**, Elsevier, 2011

REFERENCE BOOKS:

1. Rajkamal, **Embedded Systems- Architecture, Programming and Design,**TMH, 2007,.
2. Richard Stevens, **Advanced UNIX Programming**,
3. Dr. Craig Hollabaugh , **Embedded Linux: Hardware, Software and Interfacing**

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Understand the fundamentals of UNIX operating system.
2. Understand the implementation aspects of real time concepts.
3. Understand the example RTOSs and applications.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4114	ADVANCED COMPUTER ARCHITECTURE	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Computer architecture

OBJECTIVE: To understand the fundamental of computer design, to know the pipelines and parallelism concepts, and know the issues in interconnect networks

Module – I: **[10 Periods]**

Fundamentals of Computer Design: Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, operations in the instruction set.

Module – II: **[9 Periods]**

Pipelines: Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe line for RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.
Memory Hierarchy Design: Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

Module – III: **[9 Periods]**

Instruction Level Parallelism the Hardware Approach: Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.
ILP Software Approach: Basic compiler level techniques, static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues - Hardware verses Software.

Module – IV: **[12 Periods]**

Multi Processors and Thread Level Parallelism: Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.

Module – V: **[9 Periods]**

Inter Connection and Networks: Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.
Intel Architecture: Intel IA- 64 ILP in embedded and mobile markets Fallacies and pit

falls

TEXT BOOKS:

1. John L. Hennessy, David A. Patterson, "Computer Architecture: A Quantitative Approach", 3rd Edition, Elsevier.

REFERENCE BOOKS:

1. John P. Shen and Miikko H. Lipasti, "Modern Processor Design: Fundamentals of Super Scalar Processors", 2002, Beta Edition, McGraw-Hill
2. Kai Hwang, Faye A.Brigs., "Computer Architecture and Parallel Processing", Mc Graw Hill.
3. DezsoSima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architecture - A Design Space Approach", Pearson Education.

COURSE OUTCOMES:

1. Familiarize the instruction set, memory addressing of Computer
2. Handle the issues in pipelining and parallelism
3. Familiarize the practical issues in inter network

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D4115	COMMUNICATION BUSES AND INTERFACES	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Computer architecture

OBJECTIVE: To know how to select the suitable Buses for different applications, to know the architecture of CAN and applications, to understand the use of PCIe, USB etc., to know the serial communication protocol

Module - I: **[8 Periods]**

Serial Busses - Physical interface, Data and Control signals, features, limitations and applications of RS232, RS485, I2C, SPI

Module –II: **[9 Periods]**

CAN - Architecture, Data transmission, Layers, Frame formats, applications

Module - III: **[8 Periods]**

PCIe - Revisions, Configuration space, Hardware protocols, applications

Module - IV: **[9 Periods]**

USB - Transfer types, enumeration, Descriptor types and contents, Device driver

Module - V: **[10 Periods]**

Data Streaming Serial Communication Protocol - Serial Front Panel Data Port (SFPDP) using fiber optic and copper cable

TEXT BOOKS:

1. Jan Axelson, “Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems”, Lakeview Research, 2nd Edition
2. Jan Axelson, “USB Complete”, Penram Publications
3. Mike Jackson, Ravi Budruk, “PCI Express Technology”, Mindshare Press
4. Wilfried Voss, “A Comprehensible Guide to Controller Area Network”, Copperhill Media Corporation, 2nd Edition, 2005.
5. Serial Front Panel Draft Standard VITA 17.1 –200x
6. Technical references onwww.can-cia.org, http://www.pcisig.com/www.pcisig.com, http://www.usb.org/www.usb.org

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Select a particular serial bus suitable for a particular application.
2. Develop APIs for configuration, reading and writing data onto serial bus.
3. Design and develop peripherals that can be interfaced to desired serial bus.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: D4104	MIXED SIGNAL DESIGN LAB	L	T	P
Credits: 2		-	-	4

NOTE: Following Experiments must be done using **Cadence / Mentor Graphics / Synopsys** Back End Tools and all types of Analysis must be carried out (Transient, AC Analysis, DC Analysis, Post Lay out & Pre Layout Simulations etc.)

List of experiments:

1. Current Source/Current Mirror Circuits
2. Common Source Amplifier
3. Class AB Amplifier
4. Feed Back Amplifier.
5. Differential Amplifier.
6. Trans conductance Operational Amplifier.
7. CMOS as a Comparator.
8. Analog Multiplier.
9. Switched Capacitor Integrator.
10. Sample and Hold Circuit.
11. Digital to Analog Converters (R-2R Ladder/Cyclic).
12. Phase Locked Loop.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: D4105	EMBEDDED SYSTEM DESIGN LAB	L	T	P
Credits: 2		-	-	4

Note: The following programs are to be implement on 89C51 Development board using Embedded C Language on Keil IDE and Flash magic.

List of experiments:

1. Program to toggle all the bits of Port P1 continuously with 250 mS delay.
2. Program to toggle only the bit P1.5 continuously with some delay. Use Timer 0, mode 1 to create delay.
3. Program to interface a switch and a buzzer to two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
4. Program to interface LCD data pins to port P1 and display a message on it.
5. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD.
6. Program to interface seven segment display unit.
7. Program to transmit a message from Microcontroller to PC serially using RS232.
8. Program to receive a message from PC serially using RS232.
9. Program to get analog input from Temperature sensor and display the temperature value on PC Monitor.
10. Program to interface Stepper Motor to rotate the motor in clockwise and anticlockwise directions
11. Program to interfacing RFID.
12. Implementation of Traffic light controller.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: D0A04	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P
Credits: Nil		2	-	-

Prerequisites: Nil

Course Objectives: The objective of the course is to provide the knowledge on structuring paragraphs, paraphrasing and preparation of research documents related to abstract, literature review, methods and results.

Module I **[6 Periods]**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Module II **[7 Periods]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and criticising, paraphrasing and plagiarism, sections of a paper, abstracts. Introduction.

Module III **[6 Periods]**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Module IV **[6 Periods]**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V **[7 Periods]**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R, **Writing for Science**, Yale University Press, 2006
2. Day R, **How to Write and Publish a Scientific Paper**, Cambridge University Press, 2006
3. Highman N, **Handbook of Writing for the Mathematical Sciences**, SIAM. Highman's book, 1998.
4. Adrian Wallwork, **English for Writing Research Papers**, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes:

At the end of the course, students will be able to

1. **Structure** the sentences and paragraphs.
2. **Elaborate** the various sections of research papers.

3. **Explore** the check list in research documents.
4. **Apply** the key skills to coin the title, abstract, introduction and literature review.
5. **Inspect** the skills required for preparing experimental results and discussions.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4106	CMOS DIGITAL IC DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Technology and IC Design

OBJECTIVE: To teach fundamentals of CMOS Digital integrated circuit design such as importance of Pseudo logic, Combinational MOS logic circuits, Sequential MOS logic circuits, To teach the fundamentals of Dynamic logic circuits and basic semiconductor memories which are the basics for the design of high performance digital integrated circuits.

Module - I **[10 Periods]**

MOS DESIGN: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

Module - II **[8 Periods]**

COMBINATIONAL MOS LOGIC CIRCUITS:MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

Module - III **[7 Periods]**

SEQUENTIAL MOS LOGIC CIRCUITS: Behavior of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flipflop.

Module - IV **[10 Periods]**

DYNAMIC LOGIC CIRCUITS: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

Module - V **[8 Periods]**

SEMICONDUCTOR MEMORIES: Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.

TEXT BOOKS

1. Ken Martin**, Digital Integrated Circuit Design**, Oxford University Press, 2011.
2. Sung-Mo Kang, Yusuf Leblebici, **CMOS Digital Integrated Circuits Analysis and Design,** TMH, 3rd Ed., 2011.

REFERENCE BOOKS

1. Ming-BO Lin, **Introduction to VLSI Systems: A Logic, Circuit and System Perspective**, CRC Press, 2011

2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, **Digital Integrated Circuits – A Design Perspective,** 2nd Ed,PHI.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Able to understand the realization of different logic circuit designs for logic expressions and the importance of the circuit designs, the drawback of the designs both in combinational as well as sequential.
2. Able to know different types of memories, performance evaluation of each memory modules they can be able to think how to improve performance by taking different structures

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4107	ADVANCED EMBEDDED PROCESSORS	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Microcontrollers and Embedded Systems

OBJECTIVE: To know about ARM Processors Registers, Instruction pipeline, Interrupts and Architecture, to learn about Instructions, Addressing modes and conditional instructions, to learn about Cache architecture, Polices, Flushing, MMU, page tables, translational, and access permissions.

Module- I: ARM ARCHITECTURE [10 Periods]

ARM Register set ,Modes , Interrupt vector Table , ARM Assembly programming using the Keil RVDK tool ,ARM Instruction set ,Conditional Execution ,Arithmetic instructions, Logical Instructions, Branch instructions, Load and Store instructions, Multiple load//store instructions, Realization of stacks..

Module - II: PERIPHERAL PROGRAMMING [9 Periods]

Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

Module - III: ARM9 MICROCONTROLLER ARCHITECTURE [10 Periods]

AT91RM9200 Architecture: Block Diagram, Features, Memory Mapping
Memory Controller (MC): Memory Controller Block Diagram, Address Decoder, External Memory Areas, Internal Memory Mapping
External Bus Interface (EBI): Organization of the External Bus Interface, EBI Connections to Memory Devices
External Memory Interface: Write Access, Read Access, Wait State Management

Module - IV: AT91RM9200 PERIPHERALS [9 Periods]

Interrupt Controller: Normal Interrupt, Fast Interrupt, AIC
System Timer (ST): Period Interval Timer (PIT), Watchdog Timer (WDT), Real-time Timer (RTT), Real Time Clock (RTC) Parallel Input/output Controller (PIO)

Module - V: CORTEX-M3/M4 MICROCONTROLLER [7 Periods]

STM32L15xxx ARM Cortex M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control.
STM32L15xxx Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART.

TEXT BOOKS:

1. Andrew N.Sloss, Dominic Symes, Chris Wright, **ARM Systems Developer's Guides- Designing & Optimizing System Software**, Elsevier, 2008.
2. Lyla B.Das: "Embedded Systems -An Integrated Approach", Pearson Education , India, 2012.
3. Joseph Yiu, **The Definitive Guide to the ARM Cortex-M3**, Second Edition, Elsevier Inc. 2010.

REFERENCE BOOKS:

1. Jonathan W. Valvano – Brookes/ Cole, **Embedded Microcomputer Systems, Real Time Interfacing**, Thomas Learning, 1999.
2. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual
3. David Seal, **ARM Architecture Reference Manual**, 2001 Addison Wesley England; Morgan Kaufmann Publishers.
4. Andrew N Sloss, Dominic Symes, Chris Wright, **ARM System Developer's Guide - Designing and Optimizing System Software**, 2006, Elsevier

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. To understand architecture and features of typical Microcontroller.
2. To understand architecture, features and need of ARM7& ARM CORTEX processors in embedded system.
3. To learn peripheral programming with ARM7& ARM CORTEX processors.
4. To understand architecture, features and external interfaces of ARM 9 Microcontrollers

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4116	IOT ARCHITECTURES AND SYSTEM DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: IoT, Embedded Systems**.**

OBJECTIVE: To Know the definition and basic concepts of IoT, learn the interfacing the IoT and M2M, to understand the Architecture of IoT

MODULE-I: [12 Periods]

IoT introduction: Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

MODULE -II: [12 Periods]

IoT and M2M: M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT.M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

MODULE-III: [12 Periods]

IoT Hands-on: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

MODULE-IV: [12 Periods]

IoT Architecture: IoT Architecture components, Comparing IoT architectures, A simplified IoT architecture, The core IoT functional stack, IoT data management and compute stack

MODULE-V: [12 Periods]

IoT System design: Challenges associated with IoT, Emerging pillors of IoT, Agricultural IoT, Vehicular IoT, Healthcare IoT, Smart cities, Transportation and logistics.

TEXT BOOKS:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy “Introduction to IOT”, Cambridge University Press.
2. David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry “IoT Fundamentals Networking technologies, protocols, and use cases for IoT”, Cisco Press

REFERENCE BOOKS:

1. Cuno pfister, “Getting started with the internet of things”, O Reilly Media, 2011
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications.
3. “Internet of Things concepts and applications”, Wiley
4. Arshdeep Bahga,Vijay Madisetti “Internet of Things A Hands on approach”, Universities Press

5.
6. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan, “Internet of things” John Wiley and Sons.
7. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Integrate the sensors and actuator depending on the applications
2. Interface the IoT and M2M with value chains
3. Write Python programming for Arduino, Raspberry Pi devices
4. Design IoT based systems such as Agricultural IoT, Vehicular IoT etc.,

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4117	LOW POWER VLSI DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Technology and Design

OBJECTIVE: To Identify suitable techniques to reduce the power dissipation.
To learn design of adders, multipliers and memory circuits with low power dissipation

Module - I **[10 Periods]**

FUNDAMENTALS: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

Module - II **[10 Periods]**

LOW-POWER DESIGN APPROACHES:
Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches.
Switched Capacitance Minimization Approaches:
System Level Measures, Circuit Level Measures, Mask level Measures.

Module - III **[9 Periods]**

LOW-VOLTAGE LOW-POWER ADDERS: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques–Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

Module - IV **[8 Periods]**

LOW-VOLTAGE LOW-POWER MULTIPLIERS: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

Module – V **[8 Periods]**

LOW-VOLTAGE LOW-POWER MEMORIES: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1. Sung-Mo Kang, Yusuf Leblebici, **CMOS Digital Integrated Circuits – Analysis and Design**, TMH, 2011.
2. Kiat-Seng Yeo, Kaushik Roy, **Low-Voltage, Low-Power VLSI Subsystems** –TMH Professional Engineering.

REFERENCE BOOKS:

1. Ming-BO Lin, **Introduction to VLSI Systems: A Logic, Circuit and System Perspective**, CRC Press, 2011
2. **Low Power CMOS Design**, Anantha Chandrakasan, IEEE Press/Wiley International, 1998.
3. Kaushik Roy, Sharat C. Prasad, **Low Power CMOS VLSI Circuit Design – John Wiley & Sons**, 2000.
4. Gary K. Yeap, **Practical Low Power Digital VLSI Design**, Kluwer Academic Press, 2002.
5. A. Bellamour, M. I. Elamasri, **Low Power CMOS VLSI Circuit Design**, Kluwer Academic Press, 1995.
6. Siva G. Narendran, Anatha Chandrakasan, **Leakage in Nanometer CMOS Technologies, Springer**, 2005.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Clearly identify the sources of power consumption, analyze and estimate leakage power components in a given VLSI circuit.
2. Choose different types of SRAMs/DRAMs for low power applications.
3. Design low power arithmetic circuits and systems.
4. Decide at which level of abstraction it is advantageous to implement low power techniques in a VLSI system design.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4118	SOC DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Design

OBJECTIVE: To learn ASIC design concepts and strategies, to know the NISC applications and advantages, to familiar with simulation and synthesis process

Module - I: **[10 Periods]**

ASIC: Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP)concepts.

Module –II: **[9 Periods]**

NISC: NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction- set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

Module – III : **[8 Periods]**

Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

Module -IV: **[8 Periods]**

Low power SoC design / Digital system Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

Module – V: **[9 Periods]**

Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report, analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs

TEXT BOOKS:

1. Hubert Kaeslin, “Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication”, Cambridge University Press, 2008.
2. B. Al Hashimi, “System on chip-Next generation electronics”, The IET, 2006

REFERENCE BOOKS:

1. Rochit Rajsuman, “System-on- a-chip: Design and test”, Advantest America R & D Center, 2000

2. P Mishra and N Dutt, “Processor Description Languages”, Morgan Kaufmann, 2008
3. Michael J. Flynn and Wayne Luk, “Computer System Design: System-on-Chip”. Wiley, 2011

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Identify and formulate a given problem in the framework of SoC based design approaches
2. Design SoC based system for engineering applications
3. Realize impact of SoC on electronic design philosophy and Macro-electronics thereby incline towards entrepreneurship & skill development.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4119	DEVICE MODELLING	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Electronic devices

OBJECTIVE: To obtain the functional relationship among the terminal electrical variables of the device that is to be modeled, to know the physical properties of materials and devices, to know the MOS transistor low frequency model, to understand the characteristics of the FinFETs and its applications

Module –I: [10 Periods]
MOS Capacitor: Energy band diagram of Metal-Oxide-Semiconductor contacts, Mode of Operations: Accumulation, Depletion, Mid gap, and Inversion, 1D Electrostatics of MOS, Depletion Approximation, Accurate Solution of Poisson's Equation.

Module –II: [8 Periods]
MOS Capacitor Characteristics and Non idealities: CV characteristics of MOS, LFCV and HFCV, Non- idealities in MOS, oxide fixed charges, interfacial charges.

Module –III: [8 Periods]
The MOS transistor: Small signal modeling for low frequency and High frequency, Pao-Sah and Brews models; Short channel effects in MOS transistors.

Module –IV: [10 Periods]
The bipolar transistor: Eber's-Moll model; charge control model; small-signal models for low and high frequency and switching characteristics.

Module –V: [9 Periods]
FinFETs: I-V characteristics, device capacitances, parasitic effects of extension regions, performance of simple combinational gates and amplifiers, novel circuits using FinFETs and GAA devices.

TEXT BOOKS:

1. S. M. Sze, "Physics of Semiconductor Devices", 2nd Ed., Wiley Eastern, 1981.
2. Y. P. Tsividis, "Operation and Modelling of the MOS Transistor", McGraw-Hill, 1987.
3. E. Takeda, "Hot-carrier Effects in MOS Transistors", Academic Press, 1995.
4. P. Colinge, "FinFETs and Other Multi-Gate Transistors", Springer. 2009.

COURSE OUTCOMES:
After completion of the course, students will be able to:

1. Develop a functional relationship among the terminal electrical variables of the device that is to be modeled.
2. Describe the behavior of all components successfully

3. Perform the simulation and analyze the VLSI circuits
4. Use the FinFET for various applications

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D4120	EMBEDDED NETWORK CONTROLLERS	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Microcontrollers and Computer Networks

OBJECTIVE: To understand the significance of embedded networks in real time applications and to use it for specific applications, to Know different types of communication protocols like serial and parallel communication protocols, to know different types of communication protocols which have embedded end modules, to understand wired and wireless communication protocols, its formats ,to understand and gain knowledge on wireless sensors and its application in wireless embedded networks

Module - I: Embedded Communication Protocols [8 Periods]

Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols –Firewire.

Module - II: USB and CAN Bus [10 Periods]

USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing –PIC microcontroller CAN Interface –A simple application with CAN.

Module - III: Ethernet Basics [9 Periods]

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers –Using the internet in local and internet communications – Inside the Internet protocol.

Module - IV: Embedded Ethernet [8 Periods]

Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

Module - V: Wireless Embedded Networking [8 Periods]

Wireless sensor networks – Introduction – Applications – Network Topology – Localization
–Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing –Data Centric routing.

TEXT BOOKS:

1. Frank Vahid, Tony Givargis, Embedded Systems Design: A Unified Hardware/Software Introduction, John & Wiley Publications, 2002
2. Jan Axelson, Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port, Penram Publications, 1996.

REFERENCE BOOKS:

1. Dogan Ibrahim, Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series, Elsevier 2008.
2. Jan Axelson, Embedded Ethernet and Internet Complete, Penram publications, 2003.
3. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge press 2005.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Understand the basic working modes of networks and its formatted data frames, its control
2. Understand the significance of embedded networks in real time applications and to use it for specific applications.
3. Know different types of communication protocols like serial and parallel communication protocols
4. Know different types of communication protocols which have embedded end modules
5. Understand wired and wireless communication protocols, its formats
6. Understand and gain knowledge on wireless sensors and its application in wireless embedded networks

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			M.Tech II Sem
Code: D4121	PHYSICAL DESIGN AUTOMATION	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Design

OBJECTIVE: To understand the concepts of Physical Design Process (partitioning, Floor planning etc.,). To know the concepts of design optimization algorithms and their application, to understand the clock and power design concepts

Module – I: **[08 Periods]**
Introduction to VLSI Physical Design Automation: Design Representation, VLSI Design Styles, and VLSI Physical Design automation.

Module – II: **[12 Periods]**
Partitioning, Floor planning, Pin Assignment, Standard cell, Performance issues in circuit layout, delay models, Layout styles.

Module – III: **[10 Periods]**
Placement: Problem formulation, classification, Simulation based placement algorithms, Partitioning based placement algorithms, Time driven and performance driven placement.

Module – IV: **[12 Periods]**
Global routing: Problem formulation, classification of global routing, Maze routing algorithms, Line- Probe algorithms, and shortest path based algorithms, Steiner Tree based algorithms, Integer programming based approach, Performance driven routing.
Detailed Routing: Problem formulation, classification, Single layer, two layer, three layer and Multi-Layer channel routing, Algorithms, Switch box routing.

Module – V: **[08 Periods]**
Over the Cell Routing - Single layer and two-layer routing: Over the cell routing, Two Layer, Three Layer and Multi-Layer OTC Routing.
Via Minimization: Constraint and Unconstrained via minimization.
Clock and Power Routing: Clocking schemes, design considerations for the clock, Problem formulation, Clock routing algorithms, Skew and Delay reduction by Pin Assignment, Multiple clock routing, Power and Ground Routing

TEXT BOOKS:

1. Algorithms for VLSI Physical Design Automation – Naveed Sherwani, 3rd Ed., 2005,
2. Algorithms for VLSI Design Automation, S.H.Gerez, 1999, WILEY Student Edition, John wiley& Sons (Asia) Pvt. Ltd.

REFERENCE BOOKS:

1. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson,

1993, Wiley.
2. Modern VLSI Design: Systems on silicon – Wayne Wolf, 2nd ed., 1998, Pearson Education Asia

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Implement automation process for VLSI System design.
2. Familiarize to use various physical design CAD tools.
3. Develop and enhance the existing algorithms and computational techniques for physical design process of VLSI systems.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: D0H11	RESEARCH METHODOLOGY AND IPR	L	T	P
Credits: 2		2	-	-

PREREQUISITES: Nil

Course Objectives: The objective of the course is to make students familiar with the basics of research methodology and various types of Intellectual Properties, IPR legislations and policies.

Module I: Research Problem **[6 Periods]**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Module II: Technical Writing and Research Proposal **[7 Periods]**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Module III: Intellectual Property Rights **[6 Periods]**

A: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. **B:** International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Module IV: Patent Rights **[6 Periods]**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Module V: Case Studies **[7 Periods]**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Prabhuddha Ganguli, **Intellectual Property Rights**, Tata Mc-Graw – Hill, New Delhi
2. M. Ashok Kumar and Mohd. Iqbal Ali, **Intellectual Property Right,** Serials Pub.
3. Carlos M.Correa, **Intellectual property rights**, The WTO and Developing countries"-Zed books
4. Wadehra, B.L, **Law relating to patents, trademarks**, copyright designs. & 2 ed. Universal Law Publishing 2000.
5. C.R.Kothari, **Research Methodology**, New Age International Publishers, Fourth edition, 2018.

6. Donald Cooper & Pamela Schindler, **Business Research Methods**, TMGH, 9th edition.
7. Alan Bryman & Emma Bell, **Business Research Methods**, Oxford University Press.

Course Outcomes:

After completion of the course, students will be able to:

1. Comprehend the concepts of research methodology and its concepts.
2. Realize the concepts of literature review and developing a research proposal.
3. Understand the basic concepts of Intellectual property rights.
4. Understand the types of patents and their procedures.
5. Recognize the recent developments in IPR administration.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: D4108	DIGITAL IC DESIGN LAB	L	T	P
Credits: 2		-	-	4

Note: Programming can be done using any complier. Down load the programs on XILINX FPGA/CPLD boards.

List of Experiments:

1. HDL code to realize all the logic gates
2. Design and Simulation of half adder, full adder, parallel adder and Serial Binary Adder.
3. Design of decoders and encoders.
4. Design of Multiplexer/ De multiplexer, comparator
5. Design of flip flops: SR, D, JK, T
6. Design of 4-bit binary, BCD counters.
7. Design of a N- bit universal shift register.
8. Design of Sequence Detector (Finite State Machine- Mealy and Moore Machines).
9. Design of ALU to Perform – ADD, SUB, AND-OR, 1's and 2's Compliment, Multiplication, and Division.

Note: Layout, Physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis of the following using Cadence / Mentor Graphics / Synopsys tools:

10. CMOS Inverter.
11. CMOS NOR/ NAND Gates.
12. CMOS 1-bit Full Adder.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: D4109	ADVANCED EMBEDDED SYSTEMS LAB	L	T	P
Credits: 2		-	-	4

Note: The following programs are to be implement on ARM based Processors using Keil IDE and Flash magic.

List of experiments:

1. Introduction to ARM Development Board & Software
2. Simple Assembly Program for
   a. Addition | Subtraction | Multiplication | Division
3. Simple Assembly Program for
   a. Operating Modes, System Calls and Interrupts
   b. Loops, Branches
4. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) port pins.
5. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.
6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment
7. Program to demonstrates a simple interrupt handler and setting up a timer
8. Program demonstrates setting up interrupt handlers. Press button to generate an interrupt and trace the program flow with debug terminal.
9. Program to Interface 8 Bit LED and Switch Interface
10. Program to implement Buzzer Interface on IDE environment
11. Program to Displaying a message in a 2-line x 16 Characters LCD display and verify the result in debug terminal.
12. Demonstration of Serial communication. Transmission from Kit and reception from PC using Serial Port on IDE environment use debug terminal to trace the program

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: D0A05	VALUE EDUCATION	L	T	P
Credits: Nil		2	-	-

Prerequisites: Nil

Course Objectives: The course deals about value of education and self-development, Imbibe good values in students and know about the importance of character.

Module I **[6 Periods]**

Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Module II **[7 Periods]**

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism. Love for nature, Discipline.

Module III **[6 Periods]**

A:Personality and Behavior Development - Soul and Scientific attitude,
Positive Thinking. Integrity and discipline, Punctuality,
B: Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour.

Module IV **[7 Periods]**

Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Module V **[6 Periods]**

Character and Competence -Holy books vs Blind faith, Self-management and Good health Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

References:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course Outcomes:

After completion of the course, students should be able to:

1. **Understand** self-development and moral values
2. **Explore** the importance of character and cultivation of values
3. **Apply** the personality development methods
4. **Analyze** the association and cooperation principles
5. **Elaborate** the principles of religions and good health science.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D4122	DESIGN FOR TESTABILITY	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI Design.

OBJECTIVE: To acquire the knowledge of fundamental concepts of testing

To provide broad understanding the fault simulation, to illustrate the framework of Built-in-self test and Boundary scan methods.

UNIT -I: **[8 Periods]**

Introduction to Testing: Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

UNIT -II: **[10 Periods]**

Logic and Fault Simulation: Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation, ATPG.

UNIT -III: **[9 Periods]**

Testability Measures: SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

UNIT -IV: **[8 Periods]**

Built-In Self-Test: The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-Per- Scan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

UNIT -V: **[10periods]**

Boundary Scan Standard: Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BDSL Description Components, Pin Descriptions.

TEXT BOOKS:

1. M.L. Bushnell, V. D. Agrawal, "Essential of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits", Kluwer Academic Publishers.

REFERENCE BOOKS:

1. M. Abramovici, M. A. Breuer and A.D Friedman, Digital Systems and Testable Design", Jaico Publishing House.
2. P. K. Lala, "Digital Circuits Testing and Testability", Academic Press.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Acquire verification knowledge and test evaluation
2. Design for testability rules and techniques.
3. Utilize the scan architectures for different digital circuits.
4. Acquire the knowledge of design of built-in-self test.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D4123	SENSORS AND ACTUATORS	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Embedded Systems Sensors and Sensor, Actuators Types.

OBJECTIVE: To learn about sensor Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), and Characterization, to know about different sensors like Thermal sensors, Magnetic sensors, to know about Smart Sensors, Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface and the Automation

Module -I: Sensors/ Transducers [8 Periods]

Principles–Classification–Parameters–Characteristics–
EnvironmentalParameters (EP) – Characterization.

Mechanical and electromechanical sensors: Introduction – Resistive Potentiometer – Strain Gauge – Resistance Strain Gauge – Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor –Types-Capacitive Sensors: – Electrostatic Transducer– Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors

Module -II: Thermal Sensors [10 Periods]

Introduction – Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors– Acoustic Temperature Sensor – Dielectric Constant and Refractive Index thermo sensors – Helium Low Temperature Thermometer – Nuclear Thermometer – Magnetic Thermometer – Resistance Change Type Thermometric Sensors –Thermo emf Sensors– Junction Semiconductor Types– Thermal Radiation Sensors –Quartz Crystal Thermoelectric Sensors – NQR Thermometry – Spectroscopic Thermometry – Noise Thermometry – Heat Flux Sensors

Magnetic sensors: Introduction – Sensors and the Principles Behind – Magneto-resistive Sensors –Anisotropic Magneto resistive Sensing – Semiconductor Magneto resistors– Hall Effect and Sensors –Inductance and Eddy Current Sensors– Angular/Rotary Movement Transducers – Synchros – Synchro-resolvers - Eddy Current Sensors – Electromagnetic Flow meter – Switching Magnetic Sensors SQUID Sensors

Module -III: Radiation and Electro Analytical Sensors [9 Periods]

Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors.

Electro analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gas Media .

Module -IV: Smart Sensors and Applications [9 Periods]

Introduction – Primary Sensors – Excitation – Amplification – Filters –

Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation.

Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring

Module -V: Actuators **[10 Periods]**

Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic and hydraulic systems - Directional Control valves – Pressure control valves – Cylinders - Servo and proportional control valves – Process control valves – Rotary actuators Mechanical Actuation Systems- Types of motion – Kinematic chains – Cams – Gears – Ratchet and pawl – Belt and chain drives – Bearings – Mechanical aspects of motor selection Electrical Actuation Systems-Electrical systems -Mechanical switches – Solid-state switches
Solenoids – D.C. Motors – A.C. motors – Stepper motors

TEXT BOOKS:
1. D. Patranabis, **Sensors and Transducers,** PHI Learning Private Limited.
2. W. Bolton, **Mechatronics,** Pearson Education Limited.

REFERENCE BOOKS:
1. D. Patranabis**, Sensors and Actuators,** PHI, 2nd Ed, 2013.

COURSE OUTCOMES:
After completion of the course, students will be able to:

1. Learn about sensor Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), and Characterization.
2. Know about different sensors like Thermal sensors, Magnetic sensors.
3. Know about Smart Sensors, Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface and the Automation

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D4124	NANO MATERIALS AND NANO TECHNOLOGY	L	T	P
Credits: 3		3	-	-

Pre-requisites: Embedded network controllers.

OBJECTIVE: To know the characteristics of nano materials and their utility, to understand the basic science behind the design and fabrication of nano scale systems, to know the basic principle of working of MEMS and its applications

Module – I: **[9 Periods]**

Introduction of nano materials and nanotechnologies, Features of nanostructures, Applications of nano materials and technologies, Nano dimensional Materials 0D, 1D, 2D structures , Size Effects, Fraction of Surface Atoms, Specific Surface Energy and Surface Stress, Effect on the Lattice Parameter, Phonon Density of States, the General Methods available for the Synthesis of Nanostructures, precipitative, reactive, hydrothermal/solvo thermal methods, suitability of such methods for scaling , potential Uses.

Module – II: **[12Periods]**

Fundamentals of nanomaterials, Classification, Zero-dimensional nanomaterials, One-dimensional, nanomaterials, Two-dimensional nanomaterials, Three dimensional nanomaterials, Low-Dimensional Nanomaterials and its Applications, Synthesis, Properties, and Applications of Low-Dimensional Carbon-Related Nanomaterials.

Module – III: **[9 Periods]**

Micro- and Nanolithography Techniques, Emerging Applications, Introduction to Micro electro mechanical Systems (MEMS), Advantages and Challenges of MEMS, Fabrication Technologies, Surface Micromachining, Bulk Micromachining, Molding, Introduction to Nano Phonics.

Module – IV: **[9 Periods]**

CNTs: Introduction, Synthesis of CNTs - Arc-discharge, Laser-ablation, Catalytic growth, Growth mechanisms of CNT's, Multi-walled nanotubes, Single-walled nanotubes, Optical properties of CNT's, Electrical transport in perfect nanotubes, Applications as case studies, Synthesis and Applications of CNT's.

Module – V: **[9 Periods]**

Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

Text Books :

1. I Gusev and A A Rempel, "Nanocrystalline Materials", Cambridge International Science Publishing, 1 st Indian edition by Viva Books Pvt. Ltd. 2008.
2. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath, James Murday, "Nanoscience and Nanotechnology", Tata McGraw Hill Education 2012.

REFERENCE BOOKS:

1. Kenneth J. Klabunde and Ryan M. Richards, “Nanoscale Materials in Chemistry”, 2 edition, John Wiley and Sons, 2009.
2. Bharat Bhushan, “Springer Handbook of Nanotechnology”, Springer, 3rd edition, 2010.

3. Kamal K. Kar, “Carbon Nanotubes: Synthesis, Characterization and Applications”, Research Publishing Services; 1 st edition, 2011, ISBN-13: 978-9810863975.

COURSE OUTCOMES:

At the end of the course the student will be able to:

1. Formulate new engineering solutions for current problems and competing technologies for future applications.
2. Made inter disciplinary projects applicable to wide areas by clearing and fixing the boundaries in system development.
3. Gather detailed knowledge of the operation of fabrication and characterization devices to achieve precisely designed systems

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D5128	BUSINESS ANALYTICS	L	T	P
Credits: 3	(Open Elective)	3	-	-

Prerequisites: Nil

Course Objectives:

This course provides the students to learn and understand the role of business analytics within an organization, Analyze data using statistical and data mining techniques Also to gain an understanding of how managers use business analytics to formulate and solve, business problems.

Module I: **Business analytics and Statistical Tools** **[9 Periods]**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business, Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

Module II: **Trendiness and Regression Analysis** **[9 Periods]**

Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Module III: **Organization Structures and Analytic** **[10 Periods]**

A: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes.

B: Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Module IV: **Forecasting Techniques** **[10 Periods]** Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module V: **Decision Analysis** **[10 Periods]**

Formulating Decision Problems, Decision Strategies with the without outcome Probabilities, Decision Trees, Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "**Business analytics Principles, Concepts, and Applications**"**,** Pearson FT Press.
2. James Evans, "**Business Analytics**"**,** Persons Education.

REFERENCES

1. James Cadle, Donald Yeates, James Cadle, Malcolm Eva, Keith Hindle, Debra Paul, Craig Rollason, Paul Turner, Donald Yeates Debra Paul, "**Business Analysis**"**,** BCS, The Chartered Institute for IT; Revised edition, 2014.
2. Erik Larson and, Clifford Gray**, "Project Management: The Managerial Process**", McGraw Hill Education; Sixth Edition, 2017.

Course Outcomes:

At the end of the course, students will be able to:

1. **Understand** the knowledge and need for data analytics.
2. **Demonstrate** the ability of think critically in making decisions based on data and deep analytics.
3. **Explore** the technical skills in predicative and prescriptive modeling to support business decision-making.
4. **Acquire** the ability to translate data into clear, actionable insights.
5. **Analyze** the problems and use various decision strategies.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: D0B20	ADVANCE OPTIMIZATION TECHNIQUES (Open Elective)	L	T	P
Credits: 3		3	-	-

Pre-requisite: Nil

Course Objectives:

To understand extremely important topics under the broad umbrella of optimization, this is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

Module I: Linear Programming [10 Periods]

Introduction and formulation of models; convexity; graphical &simplex method; Big-M Method, Two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, sensitivity analysis for cost and requirement vector; Revised simplex method; Transportation and Assignment problems.

Module II: Integer Linear Programming [10 Periods]

Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

Module III: Dynamic Programming, CPM & PERT [9 Periods]

A: Belman's Principle of optimality; recursive relations; Solution of L.P. Problem; simple examples.

B: CPM & PERT

Module IV: Non-Linear Programming [9 Periods]

Classical optimization methods; equality and inequality constraints; Lagrange multipliers; Kuhn-tucker conditions; quadratic forms; quadratic programming and Beale's methods.

Module V: Search Methods [10 Period]

One dimensional optimization; Fibonacci search; multi dimensional search methods; uni-variate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

TEXT BOOKS

1. J.K. Sharma, "**Operations Resarach Theory & Applications**", 4th Edition, Mc.Millan Publications
2. S.S.Rao, "**Engineering Optimization theory and Practice**", 4th Edition, J Wiley & Sons, Newjersey

REFERENCES

1. K.V.Mital , **"Optimization methods in operations research and system analysis**", 3rd Edition, Newage International (P) Ltd., publishers.
2. H.A Taha "**Operations Research: An Introduction**" Prentice Hall Edition, 2016

reprint
3. Raul Poler et.al “Operations Research Problems Statement and solutions” Springer, 2014.

Course Outcomes

After completion of the course, students will be able to:

1. Find feasible solution to LPP by various methods.
2. Minimize the cost and time by using Travelling salesmen Problem.
3. Understand various methods Dynamic programming.
4. Understand the various concepts on Non-Linear programming.
5. Understand the various concepts of Search methods.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: D3228	INDUSTRIAL SAFETY (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Industrial Management

Course objectives: The objective of this course is to understand and maintain health and safety from various hazards and understand the different types of maintenance in industry.

Module-I: Industrial safety **10 Periods**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module -II: Fundamentals of maintenance engineering: **9 Periods**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module -III: Wear and Corrosion and their prevention: **9 Periods**

A: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, Screw down grease cup, Pressure grease gun,. Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication and Ring lubrication.
B: Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV: Fault tracing: **10 Periods**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module -V: Periodic and preventive maintenance: **10 Periods**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

References:

1. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

E-Resources

1. https://www.safeopedia.com/definition/1052/industrial-safety
2. https://en.wikipedia.org/wiki/Industrial_safety_system

Course Outcomes

After completion of the course, students will be able to:

1. Understand the basic concepts of industrial safety needs
2. Understand and identify various hazards in industry
3. Understand and avoid wear and tear during manufacturing process
4. Identify suitable fault-finding activities
5. Use periodic and preventive maintenance in industry

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: D0522	IMAGE AND VIDEO PROCESSING (Open Elective)	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Signal Processing.

OBJECTIVE: To Study fundamental concepts of Image Processing and various Image Transforms. Learn Image Enhancement Techniques in Spatial domain, Image Segmentation methods. To Familiarize with fundamentals of Image compression, Lossy & Lossless Compression methods. Define concepts of Video Processing, Image Formation models, and processing of Video signals. Understand general methodologies of 2 D Motion Estimation and Video coding methods.

UNIT -I: FUNDAMENTALS OF IMAGE PROCESSING [8 Periods]

Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels.

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, smoothing spatial filters, Sharpening spatial filters

UNIT -II:IMAGE SEGMENTATION [10 Periods]

Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region Based segmentation, Hough Transform, Boundary detection, chain coding.

Image Restoration: A Model of the Image Degradation/Restoration Process, inverse filtering, wiener filtering, Constrained Least Squares Filtering, geometric transformation.

Color Image Processing: color models, pseudo coloring, Color Segmentation, ColorImage Compression.

UNIT -III: IMAGE COMPRESSION [9 Periods]

Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards.

UNIT -IV: BASIC CONCEPTS OF VIDEO PROCESSING [8 Periods]

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT -V: 2-D MOTION ESTIMATION [10 Periods]

Optical flow, General Methodologies, Pixel Based Motion Estimation, BlockMatching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding,

Application of motion estimation in Video coding, constant dependent video coding and joint shape and texture coding .MPEG and H.26X standards.

TEXT BOOKS:

1. Gonzaleze and Woods, **Digital Image Processing**, 3rd edition, Pearson.
2. Yao Wang, Joem Ostermann, Ya–quin Zhang, **Video processing and communication**, 1st Edition, PH Int
3. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, **Digital Image Processing**, TMH, 2009.

COURSE OUTCOMES:

After completion of the course, students will be able to:

1. Understand, analyze and develop new image processing problems and algorithms.
2. Help in designing the hardware architecture for image processing algorithms

Develop the skill to further explore the advanced topics of digital imageprocessing

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: D0623	ARTIFICIAL INTELLIGENCE (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Discrete Mathematics

Course objectives: This course enable the students to understand the basic fundamentals of Artificial Intelligence, determine various problem solving strategies, understand the logic concepts, different approaches to represent the knowledge, develop the expert systems in various phases and its applications, apply the fuzzy logic in various problem solving techniques

Module-I: Introduction **10 Periods**

Introduction to Artificial Intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.

Module -II: Problem Solving **9 Periods**

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction.
Problem reduction and game playing: Introduction, problem reduction, game playing, alphabeta pruning, two-player perfect information games.

Module -III: Logic Concepts and Knowledge Representation **10 Periods**

A: Logic Concepts - Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.
B: Knowledge Representation - Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.

Module-IV: Expert System and Applications **10 Periods**

Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems, blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

Module -V: Uncertainty Measure **9 Periods**

Probability theory: Introduction, Bayesian belief networks, certainty factor theory, dempster-shafer theory.

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Text Books:

1. Saroj Kaushik, "**Artificial Intelligence**", CENGAGE Learning,
2. Stuart Russel, Peter Norvig, "**Artificial intelligence, A modern Approach**", 2nd ed, PEA
1. Rich, Kevin Knight, Shiv Shankar B Nair, "**Artificial Intelligence**", 3rd Ed, TMH
2. Patterson, **Introduction to Artificial Intelligence,** PHI

References:

1. George F Lugar, "**Artificial intelligence, structures and Strategies for Complex problem solving",** 5th edition, PEA
1. Ertel, Wolf Gang, "**Introduction to Artificial Intelligence",** Springer
2. Blay Whit BY, "**Artificial Intelligence**", Rosen Publishing.

E-Resources

1. https://i4iam.files.wordpress.com/2013/08/artificial-intelligence-by-rich-andknight.pdf
2. https://books.google.co.in/books?id=pVR9W5LEZUwC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. https://www.journals.elsevier.com/artificial-intelligence/
4. http://www.ceser.in/ceserp/index.php/ijai
5. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY7_M07uyea_7zp_zRG3BvdUVy2TIab45fvPeNJfynQsAbmBEgDSUqzidwcse6xwotJA
6. http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVlXBW-YWRBg_vrHK12lgOzTVbb5oZ6eQOBjCWDfRvquHJLEOFENjI5AmOqRc9Ar3eJF4CGFrw

Course Outcomes

After completion of the course, students will be able to:

1. Describe the key components of the Artificial Intelligence field.
2. Identify various problem solving strategies.
3. Construct the solution for the problem using various logic and knowledge representation techniques.
4. Interpret the knowledge in various domains using expert systems.
5. Discover the solutions by using the probability theory and fuzzy logic.

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D41P1	TECHNICAL SEMINAR	L	T	P
Credits: 1		-	-	2

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: D41P2	PROJECT / DISSERTATION PHASE - I	L	T	P
Credits: 8		-	-	16

2024-25 Onwards (MR-24)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech IV Sem		
Code: D41P3	PROJECT / DISSERTATION PHASE - II	L	T	P
Credits: 16		-	-	32