LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Estd: 1998

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt. T. Kalpana
Course Name & Code   : VLSI DESIGN– 20EC15
L-T-P Structure   : 3-0-0   Credits: 3
Program/Sem/Sec   : B.Tech., ECE., VI-Sem., Section- A   A.Y   : 2025-26

PRE-REQUISITE: EDC and STLD

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on IC Fabrication Technologies, basic electrical properties and scaling of MOS circuits. This course also gives a complete idea on analog IC design and also digital design of combinational and sequential logic circuit. This course also gives the complete information on FPGA design and an introduction to advanced technologies.

COURSE OUTCOMES (CO): At the end of the course, students will be able to

CO1:	Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
CO2:	Design basic building blocks in Analog IC design.
CO3:	Design various CMOS logic circuits for design of Combinational logic circuits.
CO4:	Analyze the behaviour of static and dynamic logic circuits.

COURSE ARTICULATION MATRIX (Correlation between Cos & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	2	-	3	-
CO2	3	2	3	1	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
   1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1   Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell
      And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
T2   Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH, 2007.
T3   Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, 2016.

BOS APPROVED REFERENCE BOOKS:

R1   Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons, reprint 2009.
R2   Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
R3   FinFETs and other multi-gate transistors, Colinge JP, Editor New York, Springer, 2008.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):
UNIT-I :INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	VLSI Design Flow, Introduction to IC technology	1	01.12.2025			
2.	Fabrication process: nMOS.	1	03.12.2025			
3.	Fabrication process: pMOS, CMOS	1	06.12.2025			
4.	Ids versus Vds Relationships	1	08.12.2025			
5.	Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit.	1	10.12.2025			
6.	nMOS Inverter	1	13.12.2025			
7.	Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter,	1	15.12.2025			
8.	Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors.	1	17.12.2025			
9.	Alternative forms of pull-up,The CMOS Inverter-- **Flipped Class**	1	20.12.2025			
10.	Latch-up in CMOS circuits, Bi- CMOS Inverter,	1	22.12.2025			
11.	Comparison between CMOS and BiCMOS technology	1	24.12.2025			
12.	MOS Layers, Stick Diagrams, Design Rules and Layout	1	27.12.2025			

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Layout Diagrams for MOS circuits	1	29.12.2025			
No. of classes required to complete UNIT-I :		13	No. of classes taken:			

UNIT-II :BASIC CIRCUIT CONCEPTS & SCALING OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	Basic circuit concepts: Sheet Resistance	1	31.12.2025			
15.	Sheet Resistance concept applied to MOS transistors and Inverters	1	03.01.2026			
16.	Area Capacitance of Layers, Standard unit of capacitance	1	05.01.2026			
17.	Some area Capacitance Calculations	1	07.01.2026			
18.	The Delay Unit, Inverter Delays	1	10.01.2026			
19.	Driving large capacitive loads	1	12.01.2026			
20.	Propagation Delays, Wiring Capacitances, Choice of layers.	1	17.01.2026			
21.	Scaling models and scaling factors— **Collaborative Learning**	1	19.01.2026			
22.	Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents	1	21.01.2026			
23.	Limits on logic levels and supply voltage due to noise and current density	1	24.01.2026			
No. of classes required to complete UNIT-II		10	No. of classes taken:			

UNIT-III :BASIC BUILDING BLOCKS OF ANALOG IC DESIGN:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learnin	HOD Sign Weekly

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
					g Methods	
24.	Regions of operation of MOSFET	1	02.02.2026			
25.	Modelling of transistor, body bias effect—**Open ended Questions**	1	04.02.2026			
26.	Biasing styles	1	07.02.2026			
27.	Single stage amplifier with resistive load,	1	09.02.2026			
28.	Single stage amplifier with diode connected load	1	11.02.2026			
29.	Common Source amplifier	1	14.02.2026			
30.	Common Drain amplifier	1	16.02.2026			
31.	Common Gate amplifier	1	18.02.2026			
32.	Current sources and sinks.	1	21.02.2026			
No. of classes required to complete UNIT-III		09	No. of classes taken:			

UNIT-IV :CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Static CMOS Design: Complementary CMOS	1	23.02.2026			
34.	Rationed Logic, Pass-Transistor Logic	1	25.02.2026			
35.	Design of Half adder, full adder, multiplexer, decoder—**Experimental Learning**	1	28.02.2026			
36.	Dynamic CMOS Design**:** Dynamic Logic-Basic Principles,	1	02.03.2026			
37.	Speed and Power Dissipation of Dynamic Logic	1	07.03.2026			
38.	Issues in Dynamic Design	1	09.03.2026			
39.	Cascading Dynamic Gates, Design examples of sequential circuits	1	11.03.2026			
40.	Cross coupled NAND and NOR flip-flops,	1	14.03.2026			
41.	D flip-flop, SR JK flip flop, SR Master Slave flip flop.	1	16.03.2026			

No. of classes required to complete UNIT-IV	09	No. of classes taken:	

UNIT-V :FPGA DESIGN&INTRODUCTION TO ADVANCED TECHNOLOGIES:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	FPGA design flow, Basic FPGA architecture	1	18.03.2026			
43.	FPGA Technologies	1	23.03.2026			
44.	Introduction to FPGA Families	1	25.03.2026			
45.	Giga-scale dilemma	1	28.03.2026			
46.	Short channel effects—**Peer Teaching**	1	30.03.2026			
47.	High–k, Metal Gate Technology,	1	01.04.2026			
48.	FinFET, TFET	1	04.04.2026			
No. of classes required to complete UNIT-V:		07	No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
49.	Introduction to gate-all-around FET(GAA FET)	1	04.04.2026			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

Evaluation Task	Marks
Assignment-I (Units-I, II)	**A1=5**
I-Descriptive Examination (Units-I, II)	**M1=15**
I-Quiz Examination (Units-I, II)	**Q1=10**
Assignment-II (Unit-III ,IV & V)	**A2=5**
II- Descriptive Examination (UNIT-III , IV & V)	**M2=15**
II-Quiz Examination (UNIT-III,IV & V)	**Q2=10**

Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE)(Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

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 modelling 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: **Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: **Communication:** Design and develop modern communication technologies for

building the inter disciplinary skills to meet current and future needs of industry.

PSO 2: **VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools

PSO 3: **Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Smt. T. Kalpana	Dr. G. Srinivasulu	Dr. P Lachi Reddy	Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (ECE, EEE, CSE, IT, MECH, CE & ASE) Under Tier-I
L B Reddy Nagar, Mylavaram-521 230, NTR District, Andhra Pradesh.

Department of Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor   : Dr. Y. Amar Babu

Course Name & Code   : Microprocessors & Microcontrollers - 23EC16

L-T-P-Cr Structure   : 3-0-0-3

Program/Sem/Sec   : B.Tech., ECE., VI-Sem., Section- CA.Y   : 2025-26

Course Educational Objective: The objective is the course to provide fundamentals about architecture and functioning of microprocessors, microcontrollers, and ARM processors. It enables to analyze operating modes and interrupt systems, apply assembly language for programming, interfacing and design real-time solutions using various modules with advanced processors. The objective is to prepare students for embedded system design, automation, and IoT-based applications.

Course Outcomes (COs): At the end of the course, students are able to

CO1	Understand the architecture of Microprocessor, Micro controllers and advanced processors, viz., ARM processors its operation
CO2	Applying assembler instructions of processors & controllers to interface with necessary peripherals
CO3	Analyze the various operating modes and interrupt structures of processors and controllers
CO4	Create interfacing with various modules with microprocessors and microcontrollers.

Course Articulation Matrix (Correlation between COs&POs,PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low),   **2-**Moderate(Medium),   **3-**Substantial (High).

TEXT BOOK(S):

T1	Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e 2. The 8051. 3.
T2	Microcontrollers and Embedded Systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2-Edition,2011
T3	The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph Yiu, Newnes Third edition.

REFERENCE BOOK(S):

R1 Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media, 2017. 2.

R2 Cortex-M3 Technical Reference Manual.

PART-B
COURSE DELIVERY PLAN (LESSON PLAN) - Section-B

UNIT-I:Introduction

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	History and classifications of Microprocessor and Microcontroller	1	1-12-2025		TLM2	
2.	Microprocessor Unit versus Microcontroller Unit	1	5-12-2025		TLM2	
3.	Microprocessor Unit versus Microcontroller Unit	1	6-12-2025		TLM2	
4.	8086 Architecture: register organization, internal architecture of 8086	1	8-12-2025		TLM2	
5.	8086 Architecture: register organization, internal architecture of 8086	1	12-12-2025		TLM2	
6.	pin description of 8086	1	13-12-2025		TLM2	
7.	minimum mode and maximum mode of 8086 operation	1	15-12-2025		TLM2	
8.	minimum mode and maximum mode of 8086 operation	1	19-12-2025		TLM2	
9.	Timing Diagrams	1	20-12-2025		TLM2	
10.	Assignment	1	22-12-2025		TLM2	
No. of classes required to complete UNIT-I		10	No. of classes taken			

UNIT-II: 8086 Programming

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	8086 Programming: instruction set	1	26-12-2025		TLM2	
12.	addressing modes	1	27-12-2025		TLM2	
13.	assembler directives	1	2-1-2026		TLM2	
14.	programming with an assembler	1	3-1-2026		TLM2	
15.	writing simple programs	1	5-1-2026		TLM2	
16.	writing simple programs	1	9-1-2026		TLM2	
17.	interrupts and interrupt service routine	1	10-1-2026		TLM2	
18.	interrupt vector table	1	12-1-2026		TLM2	

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
19.	types of interrupts of 8086 system	1	16-1-2026		TLM2	
20.	Assignment	1	17-1-2026		TLM2	
No. of classes required to complete UNIT-II		10	No. of classes taken			

UNIT-III :8086 Interfacing

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Semiconductor memories interfacing (RAM, ROM)	1	19-1-2026		TLM2	
22.	Intel 8255 programmable peripheral interface	1	23-1-2026		TLM2	
23.	Intel 8251 USART architecture and interfacing	1	24-1-2026		TLM2	
24.	Intel 8257 / 8237 DMA controller	1	2-2-2026		TLM2	
25.	stepper motor interfacing	1	6-2-2026		TLM2	
26.	A/D and D/A converters	1	7-2-2026		TLM2	
27.	A/D and D/A converters	1	9-2-2026		TLM2	
28.	Need for 8259 programmable interrupt controllers	1	13-2-2026		TLM2	
29.	ICWs and OCWs	1	14-2-2026		TLM2	
30.	Assignment	1	16-2-2026		TLM2	
No. of classes required to complete UNIT-III		10	No. of classes taken			

UNIT-IV: Intel 8051 Microcontroller and Interfacing

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Intel 8051 MICROCONTROLLER and Interfacing: Architecture, Interfacing to	1	20-2-2026		TLM2	
32.	Input/output ports, internal /external memory, counters/timers	1	21-2-2026		TLM2	
33.	serial data input/output, interrupts.	1	23-2-2026		TLM2	
34.	Assembly language programming: Instructions, addressing modes, simple programs.	1	27-2-2026		TLM2	
35.	8051: Semiconductor memories interfacing with 8051 (RAM, ROM),	1	28-2-2026		TLM2	
36.	A/D and D/A Convertors	1	2-3-2026		TLM2	
37.	Stepper motor interface	1	6-3-2026		TLM2	
38.	LCD Interfacing	1	7-3-2026		TLM2	
39.	Traffic light control	1	9-3-2026		TLM2	

40.	Assignment	1	13-3-2026		TLM2	
No. of classes required to complete UNIT-IV		10	No. of classes taken			

UNIT-V: ARM Architectures and Processors

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41.	ARM Architectures and Processors: Introduction to CISC and RISC architecture	1	14-3-2026		TLM2	
42.	ARM Architecture, ARM design philosophy	1	16-3-2026		TLM2	
43.	ARM Processors Families, Registers, Program status register	1	20-3-2026		TLM2	
44.	Instruction pipeline, Interrupts and Interrupt vector table of ARM	1	21-3-2026		TLM2	
45.	Addressing modes, ARM Programming: Instruction set - Data processing instructions	1	23-3-2026		TLM2	
46.	Branch, Load-Store instructions	1	27-3-2026		TLM2	
47.	multiple register Load and Store instructions	1	28-3-2026		TLM2	
48.	PSR instructions and Conditional instructions ,programs on arithmetic, logical and bitwise operations	1	30-4-2026		TLM2	
49.	programs using branch instructions, Writing loops with counters	1	3-4-2026		TLM2	
50.	Assignment	1	4-4-2026		TLM2	
No. of classes required to complete UNIT-V		**10**	No. of classes taken			

Contents beyond the Syllabus

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51.	ARM based Embedded system Design	1	4-4-2026		TLM2	
52.	ARM based Embedded system Design	1	4-4-2026		TLM2	

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	**A1=5**
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	**M1=15**

I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	**Q1=10**
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	**A2=5**
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	**M2=15**
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	**Q2=10**
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	**30**
Semester End Examination (SEE)(Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	**70**
Total Marks = CIE + SEE	**100**

PART-D

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.

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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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: **Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

PSO 2: **VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools.

PSO 3: **Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. Y. Amar Babu	Dr. Y. Amar Babu	Dr. P Lachi Reddy	Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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ISO 21001:2018, 50001:2018,14001:2015 Certified Institution
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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics & Communication Engineering

COURSE HANDOUT

Date:01-12-2025

PART-A

Name of Course Instructor : Mr. M. Sivasankara Rao
Course Name & Code : Digital Signal Processing**-**23EC17
L-T-P Structure : 3-0-0   Credits : 3
Program/Sem/Sec : B.Tech, ECE,VI-Sem-A-Section A.Y : 2025-26
PRE-REQUISITE **:** Signals & Systems.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course introduces discrete time signals and systems and operations performed on them. It introduces Discrete time Fourier Transform; Discrete Fourier transform meant for spectral analysis of discrete time signals and systems. It also introduces Fast Fourier Transform which is an efficient way of implementing DFT. The course also provides the basic knowledge about the design of both IIR and FIR filters. It also provides a overview about the architectures of Digital signal Processors.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand the concepts of discrete time signals and systems in time domain (L2- Understand)
CO 2	Examine the frequency domain representation of discrete time signals (L3-Apply)
CO 3	Design and realization of IIR Filters and FIR Filters (L3-Apply)
CO 4	Interpret the architectures of digital signal processors

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2	-	-	3
CO4	2	1	1	1	-	-	-	-	-	-	-	3	-	-	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
  1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

 T1 John G. Proakis, Dimitris G. Manolakis "Digital Signal Processing, Principles, Algorithms & Applications", Pearson education, 4 th edition, 2008

 T2 Deep Learning for Computer Architects, Brandon Reagen, Robert Adolf, Gu-Yeon Wei, David Brooks

REFERENCE BOOKS:

 R1 Alan V Openheim, Ronald W. Schafer, "Digital Signal Processing", PHI learning, 1 st edition, 2010

 R2 A. Nagoor Kani, "Digital Signal Processing", RBA Publications, 1st edition, 2005.

 R3 P. Ramesh Babu, "Digital Signal Processing", Scitech Publications, 4 th edition, 2012 Pvt Ltd.

 R4 Anand kumar, "Digital Signal Processing", PHI Learning, 2 nd edition, 2016

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Discrete Time Signals & Discrete Time Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Objectives and Outcomes	**1**	01-12-2025		TLM1	
1.	Discrete Time Signals	1	04-12-2025		TLM1	
2.	Classification of Discrete Time Systems: Linear and Nonlinear, Shift Invariant and Variant	1	06-12-2025		TLM1	
3.	Causal and Non Causal, Stable and Unstable, static and dynamic, IIR and FIR systems	1	08-12-2025		TLM1	
4.	Analysis of Discrete Time Linear Time Invariant Systems	1	11-12-2025		TLM1	
5.	Discrete Time Systems Described by Difference Equations	1	13-12-2025		TLM1	
6.	Implementation of Discrete Time Systems	1	15-12-2025		TLM1	
7.	Convolution and Correlation of DT Signals. -**Simulation-Driven Learning**	1	18-12-2025		TLM4	
8.	DTFT of a Sequence, Frequency Response Properties of DTFT	1	20-12-2025		TLM1	
9.	Linear, Periodicity, Time Shifting, Frequency Shifting,	1	22-12-2025		TLM1	
10.	Time Reversal, Conjugate and Parseval's Theorem	1	27-12-2025		TLM1	
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: Discrete Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	DFT of a sequence, Relation between DTFT and DFT.	1	29-12-2025		TLM1	
2.	Properties of Twiddle factor, Properties of DFT- Linearity, Periodicity, Time Shifting, Frequency Shifting, Time Reversal,	1	03-01-2026		TLM1	
3.	Differentiation in frequency domain, Conjugate, Parseval's Theorem,	1	05-01-2026		TLM1	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
4.	Circular Convolution	1	08-01-2026		TLM1	
5.	Linear Convolution through DFT and IDFT	1	10-01-2026		TLM1	
6.	Fast Fourier Transform: Need for FFT-**Flipped Classroom for Derivations**	1	19-01-2026		TLM4	
7.	Radix-2 DIT&DIF FFT	1	22-01-2026		TLM1	
8.	Comparison between DIT – DIF and IFFT	1	24-01-2026		TLM1	
No. of classes required to complete UNIT-II: 8				No. of classes taken:		

UNIT-III: Realization of Discrete Time Systems & IIR Filters

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Structures for FIR and IIR Systems	1	02-02-2026		TLM1	
2.	Direct Form Structure	1	05-02-2026		TLM1	
3.	Cascade Form Structures, Parallel Form Structures.	1	07-02-2026		TLM1	
4.	Design of IIR digital filters - Impulse Invariant Transformation	1	09-02-2026		TLM1	
5.	Design of IIR digital filters - Bilinear Transformation	1	12-02-2026		TLM1	
6.	Design of Low Pass Butterworth Filter	1	16-02-2026		TLM1	
7.	Design of Low Pass Chebyshev Filter	1	19-02-2026		TLM1	
8.	Analog Frequency Transformations	1	21-02-2026		TLM1	
No. of classes required to complete UNIT-III: 8				No. of classes taken:		

UNIT-IV :FIR Filters

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Symmetric FIR Filters	1	23-02-2026		TLM1	
2.	Ant symmetric FIR Filters	1	26-02-2026		TLM1	
3.	Design of Linear Phase FIR Filters	1	02-03-2026		TLM1	
4.	Rectangular Window, Triangular, Hanning	1	05-03-2026		TLM1	
5.	Hamming Window and Kaiser Window	1	07-03-2026		TLM1	
6.	Comparison of various Window Functions- **Lab-in-Class Approach**	1	09-03-2026		TLM4	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
7.	Design of Linear Phase FIR Filters by the Frequency Sampling Method	1	12-03-2026		TLM1	
8.	Comparison between FIR and IIR Filters.	1	14-03-2026		TLM1	
No. of classes required to complete UNIT-IV: 8				No. of classes taken:		

UNIT-V : Introduction to programmable DSPs Architecture of TMS320C54XX

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Multiplier and Multiplier Accumulator	1	16-03-2026		TLM2	
2.	Modified bus structures and memory access schemes in P-DSPs	1	23-03-2026		TLM2	
3.	Multiple Access Memory, Multi ported memory,	1	26-03-2026		TLM2	
4.	VLIW architecture,	1	28-03-2026		TLM2	
5.	Pipelining, Special addressing modes	1	30-03-2026		TLM2	
6.	On-Chip Peripherals, Bus Structure, Central ALU	1	18-03-2026		TLM2	
7.	Auxiliary Register ALU, Index Register, Auxiliary Register,	1	02-04-2026		TLM2	
8.	Compare Register& Block Move Address Register, Block Repeat Registers, Parallel Logic Unit -**Real-Time DSP Demonstrations (Hardware-Based)**	1	04-04-2026		TLM4	
No. of classes required to complete UNIT-V: 8				No. of classes taken:		

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Signal Processing Applications & Introduction to DIP		04-04-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

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 modelling 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	**Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.M.Sivasankara Rao	Mr.M.Sivasankara Rao	Dr.G.L.N. Murthy	Dr.G. Srinivasulu

COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–A
Academic Year	: 2025-26
Course Name & Code	: Satellite Communication– 23EC19
L-T-P-Cr	: 3-0-0-3
Course Instructure	: Mrs. M V L Bhavani

Course Objective:

This course provides the technical knowledge of orbital dynamics, launching of satellite in to the orbit, various subsystems used in space segment, uplink and downlink aspects of satellite. This course will also give an idea about different multiple access techniques, design requirements for the selection of earth station and various real time applications.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Understand the basic principles, orbital mechanics, launch vehicles, and subsystems involved in satellite communication systems. (Understand – L2)
CO 2	Apply satellite link design principles including link budget equations, C/N and G/T ratios, to evaluate overall system performance. (Apply – L3)
CO 3	Summarize the concepts of multiple access techniques (FDMA, TDMA, CDMA) and analyze the components and architecture of earth stations. (Understand – L2)
CO 4	Describe the structure, operation, and applications of GNSS systems including GPS and IRNSS, and analyze their role in satellite-based navigation (Understand – L2)

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO 3	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 4	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: **'-'**

Textbooks (T) and References (R):

T1: Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications",WSE, Wiley Publications, 3RD Edition, 2020.

T2: Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, "Satellite Communications Engineering", Pearson Publications, 2nd Edition, 2003.

R1: M. Richharia, "Satellite Communications: Design Principles", BS Publications, 2nd Edition, 2003.

R2: D.C Agarwal, "Satellite Communication", Khanna Publications, 5th Ed.

R3: K.N. Raja Rao, "Fundamentals of Satellite Communications" PHI, 2004

R4: Dennis Roddy, "Satellite Communications", McGraw Hill, 2nd Edition, 1996.

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Introduction, Orbital Mechanics and Launchers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Origin of Satellite Communications	1	01-12-2025			
2.	Historical Back-ground	1	02-12-2025			
3.	Basic Concepts of Satellite Communications	1	05-12-2025			
4.	Frequency allocations for Satellite Services	1	08-12-2025			
5.	Applications of Satellite Communications	1	09-12-2025			
6.	Future Trends of Satellite Communications	1	12-12-2025			
7.	Orbital Mechanics	1	15-12-2025			
8.	Look Angle determination	1	16-12-2025			
9.	Orbital perturbations, Orbit determination	1	19-12-2025			
10.	**Launches and launch vehicles; Activity : flipped class.**	1	22-12-2025			
11.	Orbital effects in communication systems performance	1	23-12-2025			
12.	Revision	1	26-12-2025			
No. of classes required to complete UNIT-I: 12			**No. of classes taken:**			

UNIT-II: Satellite Subsystems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Attitude and orbit control system	1	29-12-2025			
2.	Telemetry	1	30-12-2025			
3.	Tracking	1	02-12-2025			
4.	Command and monitoring system	1	05-01-2026			
5.	Power systems	1	06-01-2026			
6.	Communication subsystems	1	09-01-2026			
7.	**Satellite antennas; Activity : Case study.**	1	12-01-2026			
8.	Equipment reliability	1	16-01-2026			
9.	Space qualification	1	19-01-2026			
10.	Revision	1	20-01-2026			
11.	Revision	1	23-01-2026			
No. of classes required to complete UNIT-II: 11			**No. of classes taken:**			

UNIT-III: Satellite Link Design

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Basic transmission theory, link equation	1	02-02-2026			
2.	C/N ratio, system noise temperature and G/T ratio	1	03-02-2026			
3.	Design of down links	1	06-02-2026			
4.	Uplink design	1	09-02-2026			
5.	**Design of satellite links for specified C/N; Activity : Problem Based Learning.**	1	10-02-2026			
6.	System design example	1	13-02-2026			

No. of classes required to complete UNIT-III: 06		No. of classes taken:	

UNIT-IV: Multiple Access, Earth Station Technology

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Frequency division multiple access (FDMA): Intermodulation, Calculation of C/N	1	16-02-2026			
2.	Time division Multiple Access (TDMA); Frame structure, Examples	1	20-02-2026			
3.	Code Division Multiple access (CDMA): Spread spectrum transmission and reception	1	23-02-2026			
4.	Introduction, basic architecture of earth station technology	1	24-02-2026			
5.	Transmitters, Receivers, Antennas	1	27-02-2026			
6.	**Tracking systems, Terrestrial interface; Activity : Debate.**	1	02-03-2026			
7.	Primary power test methods	1	06-03-2026			
No. of classes required to complete UNIT-IV: 07			No. of classes taken:			

UNIT-V: Low Earth Orbit and Geo-Stationary Satellite Systems, Global Navigation Satellite System (GNSS)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	LSO and GSO Orbit consideration, coverage and frequency considerations	1	09-03-2026			
2.	Delay & Throughput considerations	1	10-03-2026			
3.	System considerations, Operational NGSO Constellation designs.	1	13-03-2026			
4.	**GNSS Introduction, various GNSS: GPS, GLONASS, GALILEO; Activity : Quiz.**	1	16-03-2026			
5.	BeiDou, QZSS, IRNSS. GPS-location principle, GPS navigation message	1	17-03-2026			
6.	GPS receiver operation, differential GPS; IRNSS-introduction	1	23-03-2026			
7.	IRNSS satellites, IRNSS constellation	1	24-03-2026			
8.	IRNSS configuration, IRNSS services	1	27-03-2026			
9.	Navigation data, applications of IRNSS , Multi GNSS	1	30-03-2026			
No. of classes required to complete UNIT-V: 09			No. of classes taken			

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study on latest Indian Satellite Launching and Services	1	31-03-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	TLM 6	Assignment or Quiz
TLM 2	PPT	TLM 7	Seminar or GD
TLM 3	Tutorial	TLM 8	Lab

TLM 4	Problem Solving	TLM 9	Case Study
TLM 5	Programming	TLM 10	Others

PART-C:

Evaluation Process (R23)

Evaluation Task	Marks
Assignment-I (Unit-I & Unit-II)	A1=5
I-Descriptive Examination (Units-I & Unit-II)	M1=15
I-Quiz Examination (Unit-I & Unit-II)	Q1=10
Assignment-II (Unit-III, Unit-IV & Unit-V)	A2=5
II- Descriptive Examination (Unit-III, Unit-IV & Unit-V)	M2=15
II-Quiz Examination (Unit-III, Unit-IV & Unit-V)	Q2=10
Cumulative Internal Examination (CIE) $=80\%$ of Max((M1+Q1+A1) , (M2+Q2+A2)) +20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D:

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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 modelling 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:	**Ethic**s: 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   Course Coordinator   Module Coordinator   HOD

Mrs. M V L Bhavani   Dr. M. Venkata Sudhakar   Dr. M. Venkata Sudhakar   Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific & Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Name of Course Instructor   : Mr T. Anil Raju

Course Name & Code   : Embedded System

L-T-P Structure   : 3-0-0   Credits : 3

Program/Sem/Sec   : B.Tech., ECE., VI-Sem., Section- A   A.Y   : 2025-26

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO1	Understand the basics of embedded system, classification, memories, different communication interfaces and embedded firmware and its role in embedded system.
CO2	Demonstrate all communication devices in embedded system, and peripheral devices.
CO3	Distinguish concepts of C versus embedded C and compiler versus cross-compiler.
CO4	Choose an operating system, and learn how to choose an RTOS

COURSE ARTICULATION MATRIX (Correlation between COs &POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low),   **2-**Moderate(Medium),   **3-**Substantial (High).

TEXT BOOKS:

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications,2005
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications.

REFERENCE BOOKS:
1. Embedding system building blocks By Labrosse, CMP publishers.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section A

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded System, History, Classification,	1	01.12.2025			
2.	Application areas & Purpose	1	03.12.2025			
3.	Typical and Core embedded system	1	04.12.2025			
4.	Memory, Sensors and Actuators	1	08.12.2025			
5.	Communication Interface	1	10.12.2025			
6.	Embedded firmware	1	11.12.2025			
7.	**PCB and passive components Activity : Flipped class.**	1	15.12.2025			
8.	Characteristics, Quality attributes	1	17.12.2025			
9.	Application-specific and Domain-Specific	1	18.12.2025			
10.	Main processing elements	1	22.12.2025			
11.	Hardware and software partitions.	1	24.12.2025			
No. of classes required to complete UNIT-I		**11**	No. of classes taken			

UNIT-II: Embedded Hardware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analog and digital electronic components	1	29.12.2025			
2.	I/O types and examples	1	31.12.2025			
3.	Serial communication devices	1	05.01.2026			
4.	Parallel device ports	1	07.01.2026			
5.	**Timer and counting devices Activity : Case study**	1	08.01.2026			
6.	Watch dog timer, Real-time clock	1	19.01.2026			
7.	Timer and counting devices	1	21.01.2026			
8.	Watch dog timer	1	22.01.2026			
No. of classes required to complete UNIT-I		**08**	No. of classes taken			

UNIT-III: Embedded Firmware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded Firmware design	1	02.02.2026			
2.	Embedded Firmware development languages,ISR concept.	1	04.02.2026			
3.	**Interrupt sources Activity : Quiz**	1	05.02.2026			
4.	Interrupt servicing mechanism, Multiple interrupts	1	09.02.2026			
5.	DMA, Device driver programming	1	11.02.2026			
6.	Concepts of C versus Embedded C	1	12.02.2026			
7.	Compiler versus Cross-compiler	1	16.02.2026			
No. of classes required to complete UNIT-III:**07**				No. of classes taken		

UNIT-IV: Real Time Operating System & Hardware Software Co-Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System Basics and Types	1	18.02.2026			
2.	Tasks, Process and Threads	1	19.02.2026			
3.	Multiprocessing and Multitasking	1	23.02.2026			
4.	Threads, Processes and Scheduling, Task Scheduling , Communication	1	25.02.2026			
5.	**Synchronisation, Device Drivers, RTOS.** **Activity : Problem Based Learning**	1	26.02.2026			
6.	Fundamental Issues in Hardware Software Co-Design	1	02.03.2026			
7.	Computational models in embedded design	1	04.03.2026			
8.	Integration of Hardware and Firmware, ICE.	1	05.03.2026			
No. of classes required to complete UNIT-IV:**08**				No. of classes taken		

UNIT-V: Embedded System Development, Implementation and Testing

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	The integrated development environment	1	09.03.2026			
2.	Types of files generated on cross-compilation, Dissembler/De-compiler, Simulators	1	11.03.2026			
3.	Emulators and Debugging, Target hardware debugging	1	12.03.2026			
4.	Boundary Scan, Embedded Software development process and tools	1	16.03.2026			
5.	**The main software utility tool, CAD and the hardware**	1	18.03.2026			
6.	Translation tools-Pre-processors	1	19.03.2026			
7.	Interpreters, Compilers and Linkers, Debugging tools	1	23.03.2026			
8.	Quality assurance and testing of the design	1	25.03.2026			
9.	Testing on host-machine	1	26.03.2026			
10.	Simulators, Laboratory Tools	1	30.03.2026			
11.	Test and evolution of an embedded systems	1	01.04.2026			
No. of classes required to complete UNIT-V	**08**		No. of classes taken			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study-typical embedded system design flow	1	02.04.2026			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	01.12.2025	24.01.2026	8 W
I Mid Examinations	31.01.2026	31.01.2026	1 W
II Phase of Instructions	02.02.2026	04.04.2026	9 W
II Mid Examinations	06.04.2026	11.04.2026	1 W
Preparation and Practical's	13.04.2026	18.04.2026	1 W
Semester End Examinations	20.04.2026	02.05.2026	2 W
Internship	04.05.2026	27.06.2026	8 W

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

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 modelling 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:	**Ethic**s: 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

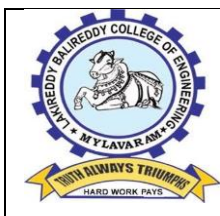|		diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, 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.	

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   **Course Coordinator**   **Module Coordinator**   **HOD**
Mr. T Anil Raju   Mr. T Anil Raju   Dr. P Lachi Reddy   Dr. G Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
L.B. REDDY NAGAR, MYLAVARAM – 521230. A.P. INDIA
Affiliated to JNTUK Kakinada & Approved by AICTE, New Delhi
Accredited By NAAC, Accredited By NBA Tier-I
An ISO 21001:2018,14001:2015,50001:2018 Certified Institution
http://www.lbrce.ac.in, Phone: 08659 – 222933, Fax: 08659 – 222931 Extn:109

DEPARTMENT OF INFORMATION TECHNOLOY

COURSE HANDOUT
PART-A

Name of Course Instructor	: **Dr.K.VenuGopal**		
Course Name & Code	: **INTRODUCTION TO PROGRAMMING IN JAVA (23IT82)**		
Regulation	**:** R23		
L-T-P Structure	: 3-0-0	**Credits**	: 3
Program/Sem/Sec	: B.Tech., IT., VI-Sem. A Secion,	**A.Y**	: 2025-26

PRE-REQUISITE: Programming for Problem Solving Using C

COURSE EDUCATIONAL OBJECTIVES (CEOs): Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Technique in software development through JAVA.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand Object Oriented Programming Concepts through constructs of JAVA.(Understand - L2)
CO 2	Apply the concepts of Inheritance and Polymorphism on real-world applications. (Apply –L3)
CO 3	Apply reusability using interface and packages. (Apply- L3)
CO 4	Construct robust applications using exception handling & multithreading (Apply- L3).
CO 5	Understand and Implement Event Handling & Swings. (Understand - L2)

UNIT – I: Introduction to OOP & JAVA:
Java Basics: Java Buzzwords/Features OOP Concepts, Java History, Advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs. Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi- dimensional), String, StringBuffer, StringTokenizer Classes.

UNIT – II: Extending Classes/ Reusability:
Inheritance: Introduction, Derived Classes, Advantages and Types of Inheritance, Implementation, Inheritance and Member Accessibility. Overriding, super keyword, Abstract Classes and Methods, final keyword, Final Classes and Final Methods, Dynamic Binding, Polymorphism

UNIT – III: Interfaces & Packages:
Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces.
Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default and private). Wrapper Classes (Integer, Float, Double)

UNIT – IV: Exception Handling & Multithreading:
Exception Handling: Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception, assertions.
Multithreading: Thread life cycle, creating threads, synchronizing and intercommunication of threads.

UNIT – V: Event Handling & Swings:
Event Handling- Introduction, limitations of AWT, The Delegation event model- Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events. s
Exploring Swing Controls- JLabel and Image Icon, JText Field, JButton, JCheck Box, JRadio Button, JList, JCombo Box

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CO1	1.6.1 1.7.1 2/5 40% 3	2.5.2 2.6.2 2/14 14% 1	3.5.1 1/14 7% -	-	-	-	-	-	-	-	-	12.6.1 1/6 17% 1	-	2.1 1/3 33% 3	-
CO2	1.6.1 1.7.1 2/5 40% 3	2.6.2 2.7.1 2/14 14% 1	3.6.2, 3.8.3 2/14 14% 1	-	-	-	-	-	-	-	-	-	-	2.1, 2.2 2/3 67% 3	-
CO3	1.6.1 1.7.1 2/5 40% 3	2.6.2 2.7.1 2/14 14% 1	3.6.2, 3.7.1 2/14 14% 1	-	5.4.1 1/6 17% 1	-	-	-	-	-	-	-	-	2.2 1/3 33% 3	-
CO4	1.6.1 1.7.1 2/5 40% 3	2.6.3 2.6.4 2/14 14% 1	3.6.2, 3.8.3 2/14 14% 1	4.4.2, 4.6.1 2/8 25% 2	-	-	-	-	-	-	-	-	-	2.3 1/3 33% 3	-
CO5	1.7.1 1/5 20% 2	-	3.8.2 1/14 7%-	-	5.4.1 5.5.2 2/6 33% 3	-	-	-	9.5.1 1/7 14% 1	10.4.1 1/7 14% 1	-	12.6.1 1/6 17% 1	-	2.1 1/3 33% 3	3.1 ' 3.3 2/3 67 % 3

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	3	-
CO2	3	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	1	1	2	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	3	-	-	-	1	1	-	1	-	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:
1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education

REFERENCE BOOKS:
1. The Java™ Programming Language: Ken Arnold, James Gosling, Pearson.
2. Introduction to Java Programming 7/e, Brief version, Y. Daniel Liang, Pearson
3. Java for Programmers, P.J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to OOP & JAVA:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Java Buzzwords / Features	1	1-12-2025		TLM1	
2.	Object Oriented Programming (**OOP**) concepts	1	2-12-2025		TLM1	
3.	Java History, Advantages, Datatypes, Operators, Expressions	1	5-12-2025		TLM1	
4.	Control Statements	1	6-12-2025		TLM1	
5.	Methods and recursion , Sample programs	1	8-12-2025		TLM1	
6.	Java Objects and References	1	9-12-2025		TLM1	
7.	Constructors, this keyword	2	15-12-2025 16-12-2025		TLM1 TLM6	
8.	Arrays (single and multi-dimensional),	1	19-12-2025		TLM1 TLM6	
9.	String, StringBuffer, StringTokenizer Classes	2	20-12-2025 23-12-2025		TLM1	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: Extending Classes/ Reusability:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	**Inheritance :** Introduction , Derived Classes, Advantages and Types of Inheritance	1	27-12-2025		TLM1	
11.	Implementation of Inheritance	2	29-12-2025 30-12-2025		TLM1	
12.	Inheritance and Member Accessibility	1	02-01-2025		TLM1	
13.	Overriding, super keyword	1	03-01-2025		TLM1 TLM6	
14.	abstract classes and methods	2	05-01-2025 09-01-2025		TLM1 TLM6	
15.	final keyword, final methods and final classes	1	19-01-2025		TLM1	
16.	Dynamic Binding, Polymorphism	2	20-01-2025 24-01-2025		TLM1 TLM6	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: Interfaces & Packages:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	**Interfaces:** Differences between classes and interfaces	1	2-02-2025		TLM1	
18.	defining an interface	1	02-02-2025		TLM1	
19.	implementing interface	1	03-02-2025		TLM6	
20.	variables in interface, extending interfaces	1	06-02-2025		TLM1	
21.	**Packages:** Defining, Creating	1	07-02-2025		TLM1	
22.	Accessing a Package	1	10-02-2025		TLM1	
23.	importing packages,	1	13-02-2025		TLM1, TLM6	
24.	access controls (public, protected, default and private).	1	16-02-2025		TLM1	
25.	Wrapper Classes (Like Integer, Float, Double).	1	17-02-2025		TLM1	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

UNIT-IV : Exception Handling & Multithreading:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	**Exception Handling:** Concepts of exception handling	1	20-02-2025		TLM1	
27.	usage of try, catch, multiple catch clause	1	21-02-2025		TLM1, TLM6	
28.	Nested try, throw,	1	23-02-2025		TLM1	
29.	Throws, Finally	1	24-02-2025		TLM1	
30.	creating own exception	2	27-02-2025 28-02-2025		TLM1	
31.	Multithreading: Thread life cycle	1	02-03-2025		TLM1	
32.	creating threads (by extending thread class)	1	03-03-2025		TLM1, TLM6	
33.	creating threads (implementing Runnable Interface)	1	06-03-2025		TLM1, TLM6	
34.	Example programs on threads	1	07-03-2025		TLM1	
35.	Synchronization : method, Synchronization block	2	09-03-2025 10-03-2025		TLM1, TLM6	
36.	Inter thread Communication	2	13-03-2025 16-03-2025		TLM1, TLM6	
No. of classes required to complete UNIT-IV: 14				No. of classes taken:		

UNIT-V : Event Handling &Swings:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Event Handling – Introduction, Limitations of AWT	1	20-03-2025		TLM1	
38.	Delegation Event Model – Events, Event Sources, Event Listeners	2	21-03-2025 24-03-2025		TLM1	
39.	Event Classes, Handling Mouse & Keyboard Events	2	27-03-2025 28-03-2025		TLM1	
40.	Swing Controls – JLabel, ImageIcon, JTextField	2	1-04-2025		TLM1	
41.	Swing Buttons – JButton, JCheckBox, JRadioButton	2	30-03-2025 31-03-2025		TLM1 TLM5	
42.	JList & JComboBox	2	03-04-2025 04-03-2025		TLM1	
No. of classes required to complete UNIT-V: 11				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Problem Solving
TLM2	PPT	**TLM5**	Programming
TLM3	Tutorial	**TLM6**	Assignment or Quiz
TLM7	Seminars or GD	**TLM8**	Lab Demo
TLM9	Case Study		

PART-C

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 modelling 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	**Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and Interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs.
PSO 3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr.K.Venu Gopal	Mr.B.Sarath Chandra	Dr. Phaneendra K	Dr. D. Ratna Kishore
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–A
Academic Year	: 2025-26
Course Name & Code	: VLSI DESIGN LAB– 20EC59
L-T-P-Cr	: 0-0-3-1.5
Course Instructure	: Smt. T. Kalpana, Dr. K. Rani Rudrama, Mr. K. Sreedhar Reddy

Course Objectives:

The objective of this laboratory course is to enable students to design, simulate, and implement CMOS-based digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools. Students are expected to develop a comprehensive understanding of schematic capture, layout design, and verification methodologies as per current CMOS technology standards.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Implement combinational and sequential circuits in Verilog. (Apply – L3)
CO 2	Design the Combinational and Sequential logic using NMOS and CMOS Technology. (Apply – L3)
CO 3	Analyze combinational and sequential circuits using Static CMOS logic from schematic to layout. (Analyze –L4)
CO 4	Adapt effective communication, presentation and report writing skills. (Apply – L3)

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	3	1	3	-	-	-	-	-	-	2	-	3	-
CO 2	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	2	-	3	-
CO 4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: **'-'**

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to VLSI Design Lab experiments,COs,Pos and PSOs.	3	02.12.2025		TLM4	
2.	Design and implementation of an inverter	3	09.12.2025		TLM4	
3.	Design and implementation of universal gates	3	16.12.2025		TLM4	
4.	Design and implementation of full adder	3	23.12.2025		TLM4	
5.	Design and implementation of full Subtractor	3	30.12.2025		TLM4	
6.	Design and implementation of RS-latch	3	06.01.2026		TLM4	
7.	Design and implementation of D-latch	3	13.01.2026		TLM4	
8.	Design and implementation asynchronous counter	3	20.01.2026		TLM4	
9.	Design and Implementation of static RAM cell	3	03.02.2026		TLM4	
10.	Design and Implementation of differential amplifier	3	10.02.2026		TLM4	
11.	Design and Implementation of ring oscillator	3	17.02.2026		TLM4	
12.	Revision	3	24.02.2026		TLM4	
13.	Revision	3	03.03.2026		TLM4	
14.	Revision	3	10.03.2026		TLM4	
15.	Revision	3	17.03.2026		TLM4	
16.	Revision	3	24.03.2026		TLM4	
17.	Lab Internal Examination	3	31.03.2026			
No. of classes required:51				**No. of classes taken:**		

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to VLSI Design Lab experiments ,COs, Pos and PSOs.	3	04.12.2025		TLM4	
2	Design and implementation of an inverter	3	11.12.2025		TLM4	
3	Design and implementation of universal gates	3	18.12.2025		TLM4	
4	Design and implementation of full adder	3	08.01.2025		TLM4	
5	Design and implementation of full Subtractor	3	15.01.2025		TLM4	
6	Design and implementation of RS-latch	3	22.01.2025		TLM4	
7	Design and implementation of D-latch	3	05.02.2026		TLM4	
8	Design and implementation asynchronous counter	3	12.02.2026		TLM4	
9	Design and Implementation of static RAM cell	3	19.02.2026		TLM4	
10	Design and Implementation of differential amplifier	3	26.02.2026		TLM4	
11	Design and Implementation of ring oscillator	3	05.03.2026		TLM4	
12	Revision	3	12.03.2026		TLM4	
13	Lab Internal Examination	3	02.04.2026			
No. of classes required:39				**No. of classes taken:**		

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work	1,2,3,4,5,6,7,8…	A1 =10
Record and observation	1,2,3,4,5,6,7,8…	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8…	**C1=15**
Cumulative Internal Examination (CIE):(A1+B1+C1)	1,2,3,4,5,6,7,8…	**30**
Semester End Examination (SEE)	1,2,3,4,5,6,7,8…	**70**
Total Marks=CIE+SEE		**100**

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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 modelling 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   Course Coordinator   Module Coordinator   HOD

Smt. T. Kalpana   Dr. K. Rani Rudrama   Dr. P.Lachi Reddy   Dr. G. Srinivasulu

Dr. K. Rani Rudrama

Mr. K. Sreedhar Reddy

DEPARTMENTOFELECTRONICSANDCOMMUNICATIONENGINEERINGC

OURSEHANDOUT

PART-A

CourseName &Code	**:Microprocessorsand MicrocontrollersLab–23EC60**
L-T-PStructure	:0-0-3
Credits	:3
Program	:B.Tech.VI SemesterECE- ASection
A.Y	**:2025 – 26**
CourseInstructor	:Dr.B.V.N.R. Siva Kumar

COURSE OBJECTIVE:

The lab to provide hands-on experience with microprocessors, microcontrollers, and ARM-based systems. It aims to understand instruction sets, programming techniques, and hardware interfacing. This equip students with practical skills in peripheral interfacing, sensor integration, and embedded system development through real-time applications, preparing them for careers in embedded systems and automation.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the MASM / TASM tool for developing Assembly Language Programs.
CO2	Apply the Assembly Language instructions of Processor and Controller for logical operations.
CO3	Develop the ARM based interfacing systems for Real time applications.
CO4	Adapt effective communication, presentation and report writing skills.

COURSEARTICULATIONMATRIX(Correlationbetween Cos&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	2	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: EnterCorrelationLevels:**1** or**2**or**3**.
Ifthereisnocorrelation:**put'-'**
1-Slight(Low),**2-**Moderate(Medium),**3-**Substantial(High).

PART-B
LABSCHEDULE(LESSONPLAN):Section-C

LISTOF EXPERIMENTS   (Minimum12Experimentstobeconducted) TUESDAY

S. No.	Experimentstobeconducted	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
		CYCLE-1				
1.	IntroductiontoLab	3	16-12-2025		**TLM2**	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n- BCD numbers	3	23-12-2025		**TLM8**	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	30-12-2025		**TLM8**	
4.	Interfacing Of DAC	3	06-01-2026		**TLM8**	
5.	Interfacing of Stepper Motor	3	13-01-2026		**TLM8**	
6.	Interfacing of Seven segment Display	3	20-01-2026		**TLM8**	
7.	Review of 8086 based Experiments	3			**TLM8**	
		CYCLE-2				
8.	8051-ADD, SUB, Series, MUL & DIV		03-02-2026			
9.	8051 - 1&0, Average, Odd & Even	3	10-02-2026		**TLM8**	
10.	8051- InterfacingoftrafficLightcontroller	3	17-02-2026		**TLM8**	
11.	8051- Interfacing LM 35	3	24-02-2026		**TLM8**	
12.	Review of 8051 based Experiments		03-02-2026			
13.	ARM- MUL, SUM	3	10-03-2026		**TLM8**	
14.	ARM- Toggle LED, Running Lights	3	17-03-2026		**TLM8**	
15.	ARM – Revision	3	24-03-2026		**TLM8**	
16.	Internal LabExam	3	31-03-2026		**TLM8**	
No.ofclasses requiredtocomplete:		48	No. ofclassesconducted:			

LISTOF EXPERIMENTS   (Minimum12Experimentstobeconducted) THURSDAY

S. No.	Experimentstobeconducted	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
1.	IntroductiontoLab	3			**TLM2**	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n- BCD numbers	3	11-12-2025		**TLM8**	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	18 -12-2025		**TLM8**	
4.	Interfacing Of DAC	3	01-01-2026		**TLM8**	
5.	Interfacing of Stepper Motor	3	08-01-2026		**TLM8**	
6.	Interfacing of Seven segment Display	3	22-01-2026		**TLM8**	
7.	Review of 8086 based Experiments	3			**TLM8**	
	CYCLE-2					
8.	8051-ADD, SUB, Series, MUL & DIV		05-02-2026			
9.	8051 - 1&0, Average, Odd & Even	3	12-02-2026		**TLM8**	
10.	8051-InterfacingoftrafficLightcontroller	3	19-02-2026		**TLM8**	
11.	8051- Interfacing LM 35	3	26-02-2026		**TLM8**	
12.	Review of 8051 based Experiments					
13.	ARM- MUL, SUM	3	05-03-2026		**TLM8**	
14.	ARM- Toggle LED, Running Lights	3	12-03-2026		**TLM8**	
15.	ARM – Revision	3			**TLM8**	
16.	Internal LabExam	3	02-04-2026		**TLM8**	
No.ofclasses requiredtocomplete:		48	No. ofclassesconducted:			

<div align="center">**PART-C**</div>

TeachingLearningMethods					
TLM1	Chalk and Talk	**TLM4**	ProblemSolving	**TLM7**	SeminarsorGD
TLM2	PPT	**TLM5**	Programming	**TLM8**	LabDemo
TLM3	Tutorial	**TLM6**	AssignmentorQuiz	**TLM9**	CaseStudy

Academic Calendar: 2025 – 26 (VISemester)

B.Tech VI Semester – 2023 Admitted Batch			
Classwork Commence From	**01-12-2025**		
Description	**From**	**To**	**Weeks**
IPhaseofInstructions	01-12-2025	24-01-2026	8 Weeks
IMidExaminations	26-01-2026	31-01-2026	1Week
IIPhaseInstructions	02-02-2026	04-04-2026	8 Weeks
IIMidExaminations	06-04-2026	11-04-2026	1Week
Preparation&Practicals	13-04-2026	18-04-2026	1Week
SemesterEndExaminations	20-04-2026	02-05-2026	2 Weeks
Internship	04-05-2026	27-06-2026	8 Weeks

EVALUATIONPROCESS:

EvaluationTask	COs	Marks
DaytoDaywork	1,2,3,4	A=15
InternalLabExamination	1,2,3,4	B=15
TotalInternalMarks(A+B)		**C=30**
SemesterEndExaminations	1,2,3,4	**D=70**
TotalMarks:C+D	1,2,3,4	**100**

PART– D

PROGRAMMEOUTCOMES(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.
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PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuitsor systems and Implement real time applications in the field of VLSI and Embedded Systemsusingrelevanttools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

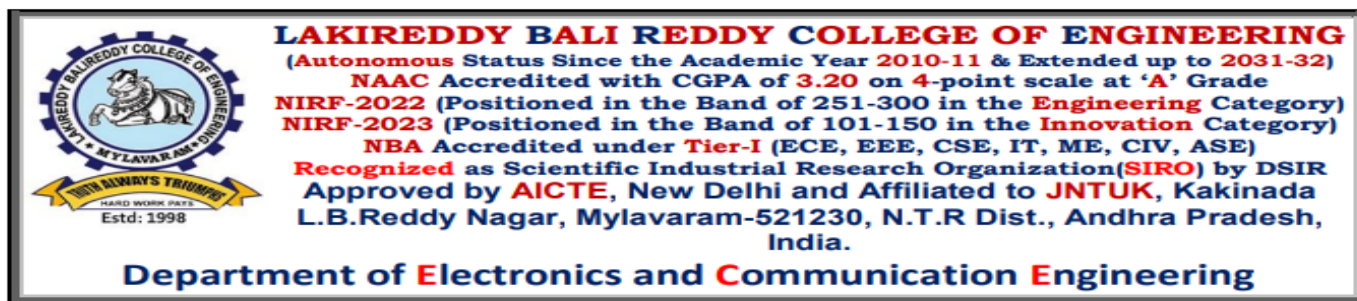| CourseInstructor	Course Coordinator	ModuleCoordinator	HOD
[Dr.B V N R SIVA KUMAR]	**[Mr.K.V.ASHOK]**	**[Dr. P.LACHIREDDY]**	**[Dr.G.SRINIVASULU]**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Program/Sem/Sec	: B.Tech., ECE, VI-Sem.
Course Instructor	: Dr. P. Lachi Reddy, Professor
	Mr. N. Dharma Chari, Assistant Professor
Course Name & Code	: CMOS Mixed Signal Design – 23ECH3
L-T-P-Cr Structure	: 3-0-0-3
Academic Year	**:** 2025 – 26

Pre requisite: EDC, STLD

Course Outcomes: (COs): At the end of the course, students are able to:

CO1:	Understand the design methodology for mixed-signal IC design.
CO2:	Analyze the design of PLL and operational amplifiers
CO3:	Design the CMOS digital circuits and implement its layout.
CO4:	Design the Switched Capacitor Circuits for different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	3	-	3	2

Prescribed Syllabus:

UNIT-I: Switched Capacitor Circuits: 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.

UNIT-II: Phased Lock Loop (PLL): 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.

UNIT-III: Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV: Nyquist Rate A/D Converters: 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.

UNIT-V: Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A.

TEXT BOOKS:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2016
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

<table>
<tr><td colspan="7" align="center">UNIT-I: Switched Capacitor Circuits [09 HRS]</td></tr>
<tr>
<td>S.No.</td>
<td align="center">Topics to be covered</td>
<td>No. of Classes Required</td>
<td>Tentative Date of Completion</td>
<td>Actual Date of Completion</td>
<td>Teaching Learning Methods</td>
<td>HOD Sign Weekly</td>
</tr>
<tr><td>1.</td><td>Introduction, Discussion of Syllabus and Course Outcomes</td><td>1</td><td>02-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>2.</td><td>Introduction to Switched Capacitor circuits-basic building blocks</td><td>1</td><td>03-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>3.</td><td>Operation and Analysis</td><td>1</td><td>04-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>4.</td><td>Non-ideal effects in switched capacitor circuits</td><td>1</td><td>09-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>5.</td><td>Switched capacitor integrators first order filters</td><td>1</td><td>10-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>6.</td><td>Switch sharing</td><td>1</td><td>11-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>7.</td><td>Biquad filters</td><td>1</td><td>16-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>8.</td><td>Activity: Students Presentation on Switched capacitor circuits</td><td>1</td><td>17-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>9.</td><td>Revision/Tutorial/Assignment</td><td>1</td><td>18-12-2025</td><td></td><td>TLM2</td><td></td></tr>
</table>

<table>
<tr><td colspan="7" align="center">UNIT- II: Phased Lock Loop (PLL) [10 HRS]</td></tr>
<tr>
<td>S.No.</td>
<td align="center">Topics to be covered</td>
<td>No. of Classes Required</td>
<td>Tentative Date of Completion</td>
<td>Actual Date of Completion</td>
<td>Teaching Learning Methods</td>
<td>HOD Sign Weekly</td>
</tr>
<tr><td>10.</td><td>Basic PLL topology</td><td>1</td><td>23-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>11.</td><td>Dynamics of simple PLL</td><td>1</td><td>24-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>12.</td><td>Charge pump PLLs-Lock acquisition</td><td>1</td><td>30-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>13.</td><td>Phase/Frequency detector and charge pump</td><td>1</td><td>31-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>14.</td><td>Basic charge pump PLL</td><td>1</td><td>06-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>15.</td><td>Non-ideal effects in PLLs-PFD/CP non-idealities</td><td>1</td><td>07-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>16.</td><td>Jitter in PLLs, Delay locked loops</td><td>1</td><td>08-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>17.</td><td>Applications</td><td>1</td><td>20-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>18.</td><td>Activity: Students Presentation on PLL</td><td>1</td><td>21-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>19.</td><td>Revision / Tutorial/Assignment</td><td>1</td><td>22-01-2026</td><td></td><td>TLM2</td><td></td></tr>
</table>

	UNIT – III: Data Converter Fundamentals [08 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20.	DC and dynamic specifications	1	03-02-2026		TLM2	
21.	Quantization noise	1	04-02-2026		TLM2	
22.	Nyquist rate D/A converters- Decoder-based converters	1	05-02-2026		TLM2	
23.	Binary-Scaled converters	1	10-02-2026		TLM2	
24.	Thermometer-code converters	1	11-02-2026		TLM2	
25.	Hybrid converters	1	12-02-2026		TLM2	
26.	**Activity: Students' presentations on Data converters design**	1	17-02-2026		TLM2	
27.	**Revision / Tutorial/Assignment**	1	18-02-2026		TLM2	

	UNIT – IV: Nyquist Rate A/D Converters [09 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Successive approximation converters	1	19-02-2026		TLM2	
29.	Flash converter	1	24-02-2026		TLM2	
30.	Two-step A/D converters	1	25-02-2026		TLM2	
31.	Interpolating A/D converters	1	26-02-2026		TLM2	
32.	Folding A/D converters	1	03-03-2026		TLM2	
33.	Pipelined A/D converters	1	05-03-2026		TLM2	
34.	Time-interleaved converters	1	10-03-2026		TLM2	
35.	**Activity: Students' presentations on A/D Converters design**	1	11-03-2026		TLM2	
36.	**Revision / Tutorial/Assignment**	1	12-03-2026		TLM2	

	UNIT – V: Oversampling Converters [07 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Noise shaping modulators	1	17-03-2026		TLM2	
38.	Decimating filters and interpolating filters	1	18-03-2026		TLM2	
39.	Higher order modulators	1	24-03-2026		TLM2	
40.	Delta sigma modulators with multibit quantizers	1	25-03-2026		TLM2	
41.	Delta sigma D/A	1	26-03-2026		TLM2	
42.	**Activity: Presentations on Design and Implementation D/A Converters**	1	31-03-2026		TLM2	
43.	**Revision / Tutorial/Assignment**	1	01-04-2026		TLM2	

	BEYOND THE SYLLABUS & REVISION [01 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
44.	Mixed Signal Design – Case Study	1	02-04-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART – C

Academic Calendar: 2025 – 26 (IV Semester)

B. Tech IV Semester - 2024 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	**26-01-2026**	**31-01-2026**	1 Week
II Phase Instructions	02-02-2026	04-04-2026	9 Weeks
II Mid Examinations	**06-04-2026**	**11-04-2026**	1 Week
Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III-Half of the Syllabus)	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III-Half of the Syllabus)	M1=15
I-Quiz Examination (Units-I, II & UNIT-III-Half of the Syllabus)	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	**100**

CO 1	Understand the design methodology for mixed-signal IC design.	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Analyze the design of PLL and operational amplifiers	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Design the CMOS digital circuits and implement its layout.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Design the Switched Capacitor Circuits for different applications.	Categorize, Analyze, Illustrate, Infer Select

PART – D

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:	**Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. Lachi Reddy] **[Mr. N. Dharma Chari]**	**[Mr. N. Dharma Chari]**	**[Dr. P. Lachi Reddy]**	**[Dr. G. Srinivasulu]**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

PROGRAM : B.Tech., VI-Sem, ECE

ACADEMIC YEAR : 2025-26

COURSE NAME & CODE : CMOS Mixed Signal Design Lab - 23ECH7

L-T-P STRUCTURE : 0-0-3

COURSE INSTRUCTOR : Dr. P. Lachi Reddy / Mr. N. Dharma Chari

COURSE OBJECTIVE:
To provide hands-on experience through practical experimentation, simulation and layout design using the Cadence Virtuoso tool.
❖ The Students are required to design and draw the schematic diagrams for various circuits.
❖ The following experiments are required to design and draw the schematic, later they are converted in to symbol and layouts.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the compensation techniques.
CO2	Design various analog and digital circuits.
CO3	Create the layout for various designed circuits.
CO4	Adapt effective communication, presentation and report writing skills.

COURSE ARTICULATION MATRIX (Correlation between Cos & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

LAB SCHEDULE (LESSON PLAN): Section-B
LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

S.No.	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
	Part-I:Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction, Syllabus Discussion & CO-PO Discussion	3	05-12-2025		**TLM2**	
2.	Practice of basic circuits (Logic Gates)	3	12-12-2025		**TLM8**	
3.	Fully compensated op-amp with resistor and miller compensation	3	19-12-2025		**TLM8**	
4.	High speed comparator design i. Two stage cross coupled clamped comparator	3	26-12-2025		**TLM8**	
5.	High speed comparator design ii. Strobed Flip-flop	3	02-01-2026		**TLM8**	
6.	Data converter	3	09-01-2026		**TLM8**	
	CYCLE-2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)					
7.	Switched capacitor circuits i. Parasitic sensitive integrator	3	23-01-2026		**TLM8**	
8.	Switched capacitor circuits ii. Parasitic insensitive integrator	3	06-02-2026		**TLM8**	
9.	Design of PLL	3	13-02-2026		**TLM8**	
10.	Design of VCO	3	20-02-2026		**TLM8**	
11.	Band gap reference circuit	3	27-02-2026		**TLM8**	
12.	Layouts of All the circuits Designed and Simulated	3	06-03-2026		**TLM8**	
13.	Internal Examination	3	13-03-2026		**TLM8**	
No. of classes required to complete:		39	No. of classes conducted:			

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

Academic Calendar: 2025 – 26

B. Tech IV Semester - 2024 Admitted Batch			
Class work Commence From	**01-12-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	**26-01-2026**	**31-01-2026**	1 Week
II Phase Instructions	02-02-2026	04-04-2026	9 Weeks
II Mid Examinations	**06-04-2026**	**11-04-2026**	1 Week
Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Day to Day work	1,2,3,4	A1=15
Internal Lab Examination	1,2,3,4	B=15
Total Internal Marks(A+B)		**C=30**
Semester End Examinations	1,2,3,4	**D=70**
Total Marks: C+D	1,2,3,4	**100**

PART-D

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy)			
(Mr. N. Dharma Chari)	**(Mrs. T. Kalpana)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
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L.B.REDDY NAGAR, MYLAVARAM. NTR District, AP, India. 521230.
hodads@lbrce.ac.in , ads@lbrce.ac.in , Phone: 08659-222933, Fax: 08659-222931
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr.P.Gandhi Prakash
Course Name & Code : Predictive Machine Learning Algorithms Lab (20ADM4)
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : B.Tech /VI Sem/M **A.Y.:**2025-26

PRE-REQUISITE: Probability and Statistics, Python Programming

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this lab is to make use of Data sets in implementing the machine learning algorithms in any suitable language of choice.

COURSE OUTCOMES (COs): At the end of the course, students can

CO 1	Apply the appropriate pre-processing techniques to the set. (Apply – L3)
CO 2	Implement supervised Machine Learning algorithms. (Apply – L3)
CO 3	Implement advanced Machine Learning algorithms (Apply – L3)
CO 4	Improve individual/teamwork skills, communication & report writing skills with ethical values.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	-	2	-	-	-	-	-	-	-	-	-	3
CO2	-	1	1	1	1	-	-	-	-	-	-	-	-	-	3
CO3	3	-	1	1	1	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

Note: Enter Correlation Levels **1** or **2,** or **3.** If there is no correlation, **put '-'**
   1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Basic statistical functions for data exploration	3	05-12-2025 12-12-2025 19-12-2025		TLM4	
2	Data visualisation: Box plot, scatter plot, histogram	3	26-12-2025		TLM4	
3	Data Pre-processing: Handling missing values, outliers, normalisation, Scaling	3	02-01-2026		TLM4	
4	Principal Component Analysis (PCA)	3	09-01-2026 23-01-2026		TLM4	
5	Singular Value Decomposition (SVD)	3	06-02-2026 13-02-2026		TLM4	
6	Linear Discriminant Analysis (LDA)	3	20-02-2026		TLM4	
7	Regression Analysis: Linear regression, Logistic regression, Polynomial regression	3	27-02-2026		TLM4	
8	Regularized Regression	3	06-03-2026		TLM4	
9	K-Nearest Neighbour (KNN) Classifier	3	13-03-2026		TLM4	
10	Support Vector Machines (SVMs)	3	20-03-2026		TLM4	
11	Random Forest model	3	27-03-2026		TLM4	
12	AdaBoost Classifier and XG Boost	3	03-04-2026		TLM4	
13	Internal Exam	3	17-04-2026		TLM4	

Teaching Learning Methods			
TLM1	Chalk and talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

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 the research literature, and analyze complex engineering problems, reaching substantiated conclusions using the first principles of mathematics, the natural sciences, and the 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 modelling, 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
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PO 9	**Individual and teamwork**: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using an open-source programming environment for the success of the organization.
PSO 2	The ability to design and develop computer programs in networking, web applications and IoT as per society's needs.
PSO 3	To inculcate an ability to analyze, design and implement database applications.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Mr P. Gandhi Prakash	Dr.D.Venkata Subbaiah	Dr V.Surya Narayana.	Dr.P.Bhagath
Signature				

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COURSE HANDOUT

PART: A

Program/Sem/Sec	: B.Tech., ECE., VI-Sem., Section – B
Academic Year	**:** 2025-26
Course Name & Code	: VLSI Design – 23EC15
L-T-P-Cr Structure	: 3-0-0-3
Course Instructor	: CH.Mallikharjuna Rao

Course Objectives:

1	To build a strong foundation in MOS transistors, CMOS technology, and VLSI fabrication processes.
2	To enable students to design and analyze CMOS combinational and sequential logic circuits.
3	To develop skills in digital IC design using simulation and verification tools.
4	To impart understanding of layout design, physical design flow, and design rules.
5	To prepare students for solving real-world VLSI challenges with professionalism and industry readiness.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.	
CO 2	Design basic building blocks in Analog IC design.	
CO 3	Design various CMOS logic circuits for design of Combinational logic circuits.	
CO 4	Analyze the behaviour of static and dynamic logic circuits.	

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	2	-	-	-	-	-	-	2	-	3	-
CO 2	3	2	3	1	3	-	-	-	-	-	-	2	-	3	-
CO 3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO 4	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: '-'

Textbooks (T) and References (R):

T1: Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.

T2: Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH, 2007.

T3: Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, 2016.

R1: Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons, reprint 2009.

R2: Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.

R3 : FinFETs and other multi-gate transistors, Colinge JP, Editor New York, Springer, 2008.

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	VLSI Design Flow, Introduction to IC technology	1	2.12.2025		TLM1	
2.	Fabrication process: nMOS, pMOS,CMOS	1	4.12.2025		TLM1	
3.	Ids versus Vds Relationships in MOS transistor	1	6.12.2025		TLM1	
4.	Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit	1	9.12.2025		TLM1	
5.	nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverte	1	11.12.2025		TLM1	
6.	**Activity: Flipped class room:**Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits	1	16.12.2025		TLM1	
7.	BiCMOS Inverter, Comparison between CMOS and BiCMOS technology	1	18.12.2025		TLM1	
8.	MOS Layers, Stick Diagrams	1	20.12.2025		TLM1	
9.	Design Rules and Layout	1	23.12.2025		TLM1	
10.	Layout Diagrams for MOS circuits	1	25.12.2025		TLM2	
No. of classes required to complete UNIT-I : 10			**No. of classes taken :**			

UNIT-II: BASIC CIRCUIT CONCEPTS & SCALING OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters	1	27.12.2025		TLM1	
2.	Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations	1	30.12.2025		TLM1	
3.	The Delay Unit, Inverter Delays	1	03.01.2026		TLM1	
4.	driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.	1	06.01.2026		TLM1	
5.	**Activity: Collaborative learning:** Scaling models and	1	08.01.2026		TLM1	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	scaling factors					
6.	Scaling factors for device parameters, Limitations of scaling	1	17.01.2026		TLM1	
7.	Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density.	1	20.01.2026		TLM1	

No. of classes required to complete UNIT-II : 7   **No. of classes taken :**

UNIT-III: BASIC BUILDING BLOCKS OF ANALOG IC DESIGN

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Regions of operation of MOSFET	1	22.012026		TLM2	
2.	**Activity: Open ended questions**: Modelling of transistor, body bias effect, biasing styles	1	24.01.2026		TLM1	
3.	single stage amplifier with resistive load	1	03.02.2026		TLM1	
4.	single stage amplifier with diode connected load	1	05.02.2026		TLM1	
5.	Common Source amplifier	1	07.02.2026		TLM1	
6.	Common Drain amplifier	1	10.02.2026		TLM1	
7.	Common Gate amplifier	1	12.02.2026		TLM1	
8.	current sources and sinks.	1	17.02.2026		TLM1	

No. of classes required to complete UNIT-III : 8   **No. of classes taken :**

UNIT-IV : CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Static CMOS Design: Complementary CMOS, Rationed Logic, Pass-Transistor Logic	1	19.02.2026		TLM1	
2.	**Activity: Think–Pair–Share:** design of Half adder, full adder	1	21.02.2026		TLM1	
3.	multiplexer, decoder	1	24.02.2026		TLM1	
4.	Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic	1	26.02.2026		TLM1	
5.	Issues in Dynamic Design, Cascading Dynamic Gates	1	28.02.2026		TLM1	
6.	Design examples of sequential circuits: Cross coupled NAND and NOR flip-flop	1	03.03.2026		TLM1	
7.	D flip-flop, SR flip flop	1	05.03.2026		TLM1	
8.	JK flip flop, JK Master Slave flip flop	1	07.03.2026		TLM2	

No. of classes required to complete UNIT-III : 8   **No. of classes taken :**

UNIT-V : FPGA DESIGN&INTRODUCTION TO ADVANCED TECHNOLOGIES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	FPGA design flow, Basic FPGA architecture	1	10.03.2026		TLM2	
2.	FPGA Technologies	1	12.03.2026		TLM2	

3.	Introduction to FPGA Families	1	17.03.2026		TLM1
4.	Activity: Case Study Method :Giga-scale dilemma, Short channel effects	1	24.03.2026		TLM1
5.	High–k, Metal Gate Technology	1	28.03.2026		TLM1
6.	FinFET, TFET	1	31.03.2026		TLM2
No. of classes required to complete UNIT-V : 6			**No. of classes taken :**		

Content beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to low power VLSI Architectures	1	02.04.2026		TLM2	
2.	Introduction to Approximate VLSI Arithmetic circuits.	1	04.04.2026		TLM2	

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C: EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II)	**A1=5**
I-Descriptive Examination (Units-I, II)	**M1=15**
I-Quiz Examination (Units-I, II)	**Q1=10**
Assignment-II (III,IV & V)	**A2=5**
II- Descriptive Examination (Unit-III,IV & V)	**M2=15**
II-Quiz Examination (Unit-III,IV & V)	**Q2=10**
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	**30**
Semester End Examination (SEE)(Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	**70**
Total Marks = CIE + SEE	**100**

PART-D: ROGRAMME OUTCOMES (POs) & PROGRAMME SPECIFIC OUTCOMES (PSOs):

Program 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 modelling 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:	**Ethic**s: 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Dt:24.11.2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.CH.Mallikharjuna Rao	Dr. G. Srinivasulu	Dr.P.Lachi Reddy	Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

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L B Reddy Nagar, Mylavaram-521 230, NTR District, Andhra Pradesh.

Department of Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Sasi Bhushan. K

Course Name & Code : Microprocessors & Microcontrollers - 23EC16

L-T-P-Cr Structure : 3-0-0-3

Program/Sem/Sec : **B.Tech., ECE., VI-Sem., Section- B**   **A.Y   : 2025-26**

Course Educational Objective: The objective is the course to provide fundamentals about architecture and functioning of microprocessors, microcontrollers, and ARM processors. It enables to analyze operating modes and interrupt systems, apply assembly language for programming, interfacing and design real-time solutions using various modules with advanced processors. The objective is to prepare students for embedded system design, automation, and IoT-based applications.

Course Outcomes (COs): At the end of the course, students are able to:

CO1	Understand the architecture of Microprocessor, Micro controllers and advanced processors, viz., ARM processors its operation
CO2	Applying assembler instructions of processors & controllers to interface with necessary peripherals
CO3	Analyze the various operating modes and interrupt structures of processors and controllers
CO4	Create interfacing with various modules with microprocessors and microcontrollers.

Course Articulation Matrix (Correlation between COs&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	1	3	-	-	-	-	-	-	2	-	3	-
CO3	3	3	2	2	3	-	-	-	-	-	-	2	-	3	-
CO4	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low),   **2-**Moderate(Medium),   **3-**Substantial (High).

TEXT BOOK(S):

T1	Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e 2.
T2	Microcontrollers and Embedded Systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2-Edition,2011
T3	The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph Yiu, Newnes Third edition.

REFERENCE BOOK(S):

R1 Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media, 2017. 2.

R2 Cortex-M3 Technical Reference Manual.

<div align="center">

<mark>PART-B</mark>
COURSE DELIVERY PLAN (LESSON PLAN) - Section-B

</div>

<mark>UNIT-I: Introduction</mark>

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	History and classifications of Microprocessor and Microcontroller	1	1-12-2025		TLM2	
2.	Microprocessor Unit versus Microcontroller Unit	1	3-12-2025		TLM2	
3.	Microprocessor Unit versus Microcontroller Unit	1	5-12-2025		TLM2	
4.	8086 Architecture: register organization, internal architecture of 8086	1	8-12-2025		TLM2	
5.	8086 Architecture: register organization, internal architecture of 8086	1	10-12-2025		TLM2	
6.	pin description of 8086	1	12-12-2025		TLM2	
7.	minimum mode and maximum mode of 8086 operation	1	15-12-2025		TLM2	
8.	minimum mode and maximum mode of 8086 operation	1	17-12-2025		TLM2	
9.	Timing Diagrams	1	19-12-2025		TLM2	
10.	Assignment	1	22-12-2025		TLM2	
No. of classes required to complete UNIT-I		*10*	*No. of classes taken*			

<mark>UNIT-II: 8086 Programming</mark>

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	8086 Programming: instruction set	1	24-12-2025		TLM2	
12.	addressing modes	1	26-12-2025		TLM2	
13.	assembler directives	1	29-12-2025		TLM2	
14.	programming with an assembler	1	31-12-2025		TLM2	
15.	writing simple programs	1	02-01-2026		TLM2	
16.	writing simple programs	1	05-01-2026		TLM2	
17.	interrupts and interrupt service routine	1	07-01-2026		TLM2	
18.	interrupt vector table	1	09-01-2026		TLM2	
19.	types of interrupts of 8086 system	1	19-01-2026		TLM2	
20.	Assignment	1	21-01-2026		TLM2	
No. of classes required to complete UNIT-II		*10*	*No. of classes taken*			

UNIT-III :8086 Interfacing

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Semiconductor memories interfacing (RAM, ROM)	1	02-02-2026		TLM2	
22.	Intel 8255 programmable peripheral interface	1	04-02-2026		TLM2	
23.	Intel 8251 USART architecture and interfacing	1	06-02-2026		TLM2	
24.	Intel 8257 / 8237 DMA controller	1	09-02-2026		TLM2	
25.	stepper motor interfacing	1	11-02-2026		TLM2	
26.	A/D and D/A converters	1	13-02-2026		TLM2	
27.	A/D and D/A converters	1	16-02-2026		TLM2	
28.	Need for 8259 programmable interrupt controllers	1	18-02-2026		TLM2	
29.	ICWs and OCWs	1	20-02-2026		TLM2	
30.	Assignment	1	16-2-2026		TLM2	
No. of classes required to complete UNIT-III		*10*	*No. of classes taken*			

UNIT-IV: Intel 8051 Microcontroller and Interfacing

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Intel 8051 MICROCONTROLLER and Interfacing: Architecture, Interfacing to	1	23-02-2026		TLM2	
32.	Input/output ports, internal /external memory, counters/timers	1	25-02-2026		TLM2	
33.	serial data input/output, interrupts.	1	27-02-2026		TLM2	
34.	Assembly language programming: Instructions, addressing modes, simple programs.	1	02-03-2026		TLM2	
35.	8051: Semiconductor memories interfacing with 8051 (RAM, ROM),	1	04-03-2026		TLM2	
36.	A/D and D/A Convertors	1	06-03-2026		TLM2	
37.	Stepper motor interface	1	09-03-2026		TLM2	
38.	LCD Interfacing	1	11-03-2026		TLM2	
39.	Traffic light control	1	13-03-2026		TLM2	
40.	Assignment	1	16-03-2026		TLM2	
No. of classes required to complete UNIT-IV		*10*	*No. of classes taken*			

UNIT-V: ARM Architectures and Processors

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41.	ARM Architectures and Processors: Introduction to CISC and RISC architecture	1	18-03-2026		TLM2	
42.	ARM Architecture, ARM design philosophy	1	20-03-2026		TLM2	
43.	ARM Processors Families, Registers, Program status register	1	23-03-2026		TLM2	
44.	Instruction pipeline, Interrupts and Interrupt vector table of ARM	1	25-03-2026		TLM2	
45.	Addressing modes, ARM Programming: Instruction set - Data processing instructions	1	27-03-2026		TLM2	
46.	Branch, Load-Store instructions	1	27-3-2026		TLM2	
47.	multiple register Load and Store instructions	1	30-3-2026		TLM2	
48.	PSR instructions and Conditional instructions ,programs on arithmetic, logical and bitwise operations	1	01-04-2026		TLM2	
49.	programs using branch instructions, Writing loops with counters	1	03-04-2026		TLM2	
50.	Assignment	1	08-04-2026		TLM2	
No. of classes required to complete UNIT-V		*10*	*No. of classes taken*			

Contents beyond the Syllabus:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51.	ARM based Embedded system Design	1	10-04-2026		TLM2	
52.	ARM based Embedded system Design	1	12-04-2026		TLM2	

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1 = 5M
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15M
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10M
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5M
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15M
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10M
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30M
Semester End Examination (SEE)(Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70M
Total Marks = CIE + SEE	**100M**

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PO 1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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PSO 3: **Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Sasi Bhushan K	Dr. Y. Amar Babu	Dr. P Lachi Reddy	Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (Autonomous)

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

Date:

PART-A

Name of Course Instructor : Mr.V.V.Rama Krishna
Course Name & Code : Digital Signal Processing-23EC17
L-T-P Structure : 3-0-0   Credits : 3
Program/Sem/Sec : B.Tech, ECE, VI-Sem-B-Section   A.Y   : 2025-26
PRE-REQUISITE **:** Signals & Systems.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course introduces discrete time signals and systems and operations performed on them. It introduces Discrete time Fourier Transform; Discrete Fourier transform meant for spectral analysis of discrete time signals and systems. It also introduces Fast Fourier Transform which is an efficient way of implementing DFT. The course also provides the basic knowledge about the design of both IIR and FIR filters. It also provides a overview about the architectures of Digital signal Processors.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand the concepts of discrete time signals and systems in time domain (L2- Understand)
CO 2	Examine the frequency domain representation of discrete time signals (L3-Apply)
CO 3	Design and realization of IIR Filters and FIR Filters (L3-Apply)
CO 4	Interpret the architectures of digital signal processors

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2	-	-	3
CO4	2	1	1	1	-	-	-	-	-	-	-	3	-	-	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
   1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

T1 John G. Proakis, Dimitris G. Manolakis "Digital Signal Processing, Principles, Algorithms & Applications", Pearson education, 4 th edition, 2008

T2 Deep Learning for Computer Architects, Brandon Reagen, Robert Adolf, Gu-Yeon Wei, David Brooks

REFERENCE BOOKS:

R1 Alan V Openheim, Ronald W. Schafer, "Digital Signal Processing", PHI learning, 1 st edition, 2010

R2 A. Nagoor Kani, "Digital Signal Processing", RBA Publications, 1st edition, 2005.

R3 P. Ramesh Babu, "Digital Signal Processing", Scitech Publications, 4 th edition, 2012 Pvt Ltd.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Discrete Time Signals & Discrete Time Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Objectives and Outcomes	**1**	01-12-2025		TLM1	
1.	Discrete Time Signals	1	02-12-2025		TLM1	
2.	Classification of Discrete Time Systems: Linear and Nonlinear, Shift Invariant and Variant	1	03-12-2025		TLM1	
3.	Causal and Non Causal, Stable and Unstable, static and dynamic, IIR and FIR systems	1	08-12-2025		TLM1	
4.	Analysis of Discrete Time Linear Time Invariant Systems	1	09-12-2025		TLM1	
5.	Discrete Time Systems Described by Difference Equations	1	10-12-2025		TLM1	
6.	Implementation of Discrete Time Systems	1	15-12-2025		TLM1	
7.	Convolution and Correlation of Discrete Time Signals.- **Simulation-Driven Learning**	1	16-12-2025		TLM1	
8.	DTFT of a Sequence, Frequency Response Properties of DTFT	1	17-12-2025		TLM1	
9.	Linear, Periodicity, Time Shifting, Frequency Shifting,	1	22-12-2025		TLM1	
10.	Time Reversal, Conjugate and Parseval's Theorem	1	23-12-2025		TLM1	
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: Discrete Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	DFT of a sequence, Relation between DTFT and DFT.	1	24-12-2025		TLM1	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
2.	Properties of Twiddle factor, Properties of DFT- Linearity, Periodicity, Time Shifting, Frequency Shifting, Time Reversal,	1	29-12-2025		TLM1	
3.	differentiation in frequency domain, Conjugate, Parseval's 1Theorem,	1	30-12-2025		TLM1	
4.	Circular Convolution	1	31-12-2025		TLM1	
5.	Linear Convolution through DFT and IDFT	1	05-01-2026		TLM1	
6.	Fast Fourier Transform: Need for FFT-**Flipped Classroom for Derivations**	1	06-01-2026		TLM1	
7.	Radix-2 Decimation in Time FFT Algorithm,	1	07-01-2026		TLM1	
8.	Radix-2 Decimation in Frequency FFT Algorithm,	1	12-01-2026		TLM1	
9.	Comparison between DIT and DIF Algorithms,	1	13-01-2026		TLM1	
10.	Inverse FFT.	1	14-01-2026		TLM1	

No. of classes required to complete UNIT-II:			No. of classes taken:	

UNIT-III: Realization of Discrete Time Systems & IIR Filters

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Structures for FIR and IIR Systems	1	20-01-2026		TLM1	
2.	Direct Form Structure	1	21-01-2026		TLM1	
3.	Cascade Form Structures, Parallel Form Structures.	1	02-02-2026		TLM1	
4.	Design of IIR digital filters - Impulse Invariant Transformation	1	03-02-2026		TLM1	
5.	Bilinear Transformation	1	04-02-2026		TLM1	
6.	Design of Low Pass Butterworth Filter	1	09-02-2026		TLM1	
7.	Design of Low Pass Butterworth Filter	1	10-02-2026		TLM1	
8.	Chebyshev Filter	1	11-02-2026		TLM1	
9.	Chebyshev Filter	1	16-02-2026		TLM1	
10.	Analog Frequency Transformations	1	17-02-2026		TLM1	
11.		1			TLM1	

No. of classes required to complete UNIT-III:			No. of classes taken:	

UNIT-IV : FIR Filters

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Symmetric FIR Filters	1	18-02-2026		TLM1	
2.	Ant symmetric FIR Filters	1	23-02-2026		TLM1	
3.	Design of Linear Phase FIR Filters	1	24-02-2026		TLM1	
4.	Rectangular Window, Triangular, Hanning	1	25-02-2026		TLM1	
5.	Hamming Window and Kaiser Window	1	02-03-2026		TLM1	
6.	Comparison of various Window Functions- **Lab-in-Class Approach**	1	03-03-2026		TLM1	
7.	Design of Linear Phase FIR Filters by the Frequency Sampling Method	1	04-03-2026		TLM1	
8.	Comparison between FIR and IIR Filters.	1	09-03-2026		TLM1	
No. of classes required to complete UNIT-IV:				No. of classes taken:		

UNIT-V : Introduction to programmable DSPs Architecture of TMS320C5X

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Multiplier and Multiplier Accumulator	1	09-03-2026		TLM1	
2.	Modified bus structures and memory access schemes in P-DSPs	1	10-03-2026		TLM1	
3.	Multiple Access Memory, Multi ported memory,	1	11-03-2026		TLM1	
4.	VLIW architecture,	1	16-03-2026		TLM1	
5.	Pipelining, Special addressing modes	1	17-03-2026		TLM1	
6.	On-Chip Peripherals	1	18-03-2026		TLM1	
7.	Bus Structure, Central Arithmetic Logic Unit	1	23-03-2026		TLM1	
8.	Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit -**Real-Time DSP Demonstrations (Hardware-Based)**	1	24-03-2026		TLM1	
9.	Memory mapped registers, program controller	1	25-03-2026		TLM1	
10.	Some flags in the status registers.	1	30-03-2026		TLM1	
No. of classes required to complete UNIT-V:				No. of classes taken:		

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.			31-03-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   Course Coordinator   Module Coordinator   HOD

V V Ramakrishna   Mr. M.Siva Sankara Rao   Dr.M.G.L.N.Murthy   Dr.G.Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–B
Academic Year	: 2025-26
Course Name & Code	: Satellite Communication– 23EC19
L-T-P-Cr	: 3-0-0-3
Course Instructure	: Dr. M. V. Sudhakar

Course Objective:

This course provides the technical knowledge of orbital dynamics, launching of satellite in to the orbit, various subsystems used in space segment, uplink and downlink aspects of satellite. This course will also give an idea about different multiple access techniques, design requirements for the selection of earth station and various real time applications.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Understand the basic principles, orbital mechanics, launch vehicles, and subsystems involved in satellite communication systems. (Understand – L2)
CO 2	Apply satellite link design principles including link budget equations, C/N and G/T ratios, to evaluate overall system performance. (Apply – L3)
CO 3	Summarize the concepts of multiple access techniques (FDMA, TDMA, CDMA) and analyze the components and architecture of earth stations. (Understand – L2)
CO 4	Describe the structure, operation, and applications of GNSS systems including GPS and IRNSS, and analyze their role in satellite-based navigation (Understand – L2)

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO 3	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 4	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: '-'

Textbooks (T) and References (R):

T1: Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications",WSE, Wiley Publications, 3RD Edition, 2020.

T2: Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, "Satellite Communications Engineering", Pearson Publications, 2nd Edition, 2003.

R1: M. Richharia, "Satellite Communications: Design Principles", BS Publications, 2nd Edition, 2003.

R2: D.C Agarwal, "Satellite Communication", Khanna Publications, 5th Ed.

R3: K.N. Raja Rao, "Fundamentals of Satellite Communications" PHI, 2004

R4: Dennis Roddy, "Satellite Communications", McGraw Hill, 2nd Edition, 1996.

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Introduction, Orbital Mechanics and Launchers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Origin of Satellite Communications	1	02-12-2025			
2.	Historical Back-ground	1	03-12-2025			
3.	Basic Concepts of Satellite Communications	1	05-12-2025			
4.	Frequency allocations for Satellite Services	1	09-12-2025			
5.	Applications of Satellite Communications	1	10-12-2025			
6.	Future Trends of Satellite Communications	1	12-12-2025			
7.	Orbital Mechanics	1	16-12-2025			
8.	Look Angle determination	1	17-12-2025			
9.	Orbital perturbations, Orbit determination	1	19-12-2025			
10.	**Launches and launch vehicles;** **Activity : flipped class.**	1	23-12-2025			
11.	Orbital effects in communication systems performance	1	24-12-2025			
12.	Revision	1	26-12-2025			
No. of classes required to complete UNIT-I: 12			**No. of classes taken:**			

UNIT-II: Satellite Subsystems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Attitude and orbit control system	1	30-12-2025			
2.	Telemetry	1	31-12-2025			
3.	Tracking	1	02-12-2025			
4.	Command and monitoring system	1	06-01-2026			
5.	Power systems	1	07-01-2026			
6.	Communication subsystems	1	09-01-2026			
7.	**Satellite antennas; Activity : Case study.**	1	13-01-2026			
8.	Equipment reliability	1	16-01-2026			
9.	Space qualification	1	20-01-2026			
10.	Revision	1	21-01-2026			
11.	Revision	1	23-01-2026			
No. of classes required to complete UNIT-II: 11			**No. of classes taken:**			

UNIT-III: Satellite Link Design

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Basic transmission theory, link equation	1	03-02-2026			
2.	C/N ratio, system noise temperature and G/T ratio	1	04-02-2026			
3.	Design of down links	1	06-02-2026			
4.	Uplink design	1	10-02-2026			
5.	**Design of satellite links for specified C/N;** **Activity : Problem Based Learning.**	1	11-02-2026			
6.	System design example	1	13-02-2026			

No. of classes required to complete UNIT-III: 06				No. of classes taken:			

UNIT-IV: Multiple Access, Earth Station Technology

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Frequency division multiple access (FDMA): Intermodulation, Calculation of C/N	1	17-02-2026			
2.	Time division Multiple Access (TDMA); Frame structure, Examples	1	20-02-2026			
3.	Code Division Multiple access (CDMA): Spread spectrum transmission and reception	1	24-02-2026			
4.	Introduction, basic architecture of earth station technology	1	25-02-2026			
5.	Transmitters, Receivers, Antennas	1	27-02-2026			
6.	**Tracking systems, Terrestrial interface; Activity : Debate.**	1	03-03-2026			
7.	Primary power test methods	1	06-03-2026			
No. of classes required to complete UNIT-IV: 07				No. of classes taken:		

UNIT-V: Low Earth Orbit and Geo-Stationary Satellite Systems, Global Navigation Satellite System (GNSS)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	LSO and GSO Orbit consideration, coverage and frequency considerations	1	10-03-2026			
2.	Delay & Throughput considerations	1	11-03-2026			
3.	System considerations, Operational NGSO Constellation designs.	1	13-03-2026			
4.	**GNSS Introduction, various GNSS: GPS, GLONASS, GALILEO; Activity : Quiz.**	1	17-03-2026			
5.	BeiDou, QZSS, IRNSS. GPS-location principle, GPS navigation message	1	18-03-2026			
6.	GPS receiver operation, differential GPS; IRNSS-introduction	1	20-03-2026			
7.	IRNSS satellites, IRNSS constellation	1	24-03-2026			
8.	IRNSS configuration, IRNSS services	1	25-03-2026			
9.	Navigation data, applications of IRNSS , Multi GNSS	1	27-03-2026			
No. of classes required to complete UNIT-V: 09				No. of classes taken		

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study on latest Indian Satellite Launching and Services	1	31-03-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	TLM 6	Assignment or Quiz
TLM 2	PPT	TLM 7	Seminar or GD
TLM 3	Tutorial	TLM 8	Lab

TLM 4	Problem Solving	TLM 9	Case Study
TLM 5	Programming	TLM 10	Others

PART-C:

Evaluation Process (R23)

Evaluation Task	Marks
Assignment-I (Unit-I & Unit-II)	**A1=5**
I-Descriptive Examination (Units-I & Unit-II)	**M1=15**
I-Quiz Examination (Unit-I & Unit-II)	**Q1=10**
Assignment-II (Unit-III, Unit-IV & Unit-V)	**A2=5**
II- Descriptive Examination (Unit-III, Unit-IV & Unit-V)	**M2=15**
II-Quiz Examination (Unit-III, Unit-IV & Unit-V)	**Q2=10**
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) +20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D:

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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.
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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.
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PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and

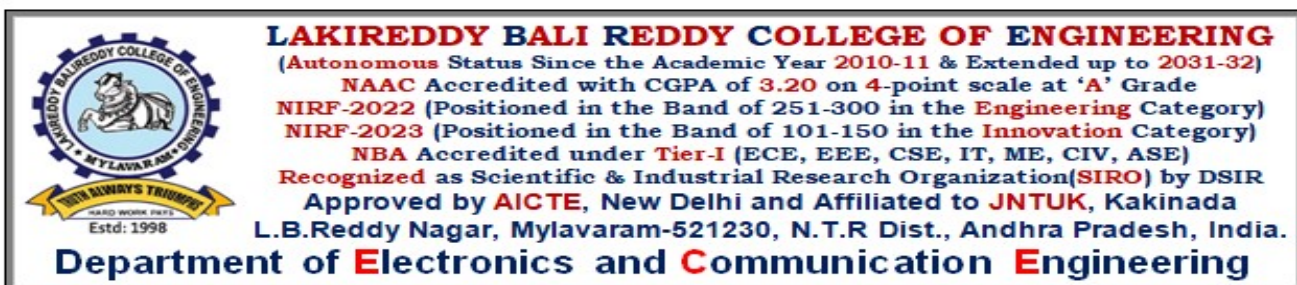|	
	norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community 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.
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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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   Course Coordinator   Module Coordinator   HOD
Dr. M.V.Sudhakar   Mrs.M.V.L.Bhavani   Dr. M. V. Sudhakar   Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr. K.V. Ashok

Course Name & Code : Embedded System

L-T-P Structure : 3-0-0   Credits : 3

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- B   A.Y : 2025-26

COURSE OBJECTIVE: The course aims to provide a comprehensive understanding of embedded systems, including their architecture, components, and operational principles. It enables learners to analyze and design embedded hardware and firmware through appropriate development tools and methodologies. Students will gain practical skills in real-time operating systems, hardware–software co-design, and embedded system implementation and testing for real-world applications.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO1	Understand the basics of embedded system, classification, memories, different communication interfaces and embedded firmware and its role in embedded system.
CO2	Demonstrate all communication devices in embedded system, and peripheral devices.
CO3	Distinguish concepts of C versus embedded C and compiler versus cross-compiler.
CO4	Choose an operating system, and learn how to choose an RTOS

COURSE ARTICULATION MATRIX (Correlation between COs &POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	2	-	3	-
CO2	3	2	2	1	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	3	2	2	2	3	-	-	-	-	-	-	2	-	3	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low),   **2-**Moderate(Medium),   **3-**Substantial (High).

TEXT BOOKS:

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications,2005
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications.

REFERENCE BOOKS:
1. Embedding system building blocks By Labrosse, CMP publishers.

<mark>PART-B</mark>

COURSE DELIVERY PLAN (LESSON PLAN): Section B

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded System, History, Classification,	1	03.12.2025			
2.	Application areas & Purpose	1	04.12.2025			
3.	Typical and Core embedded system	1	06.12.2025			
4.	Memory, Sensors and Actuators	1	10.12.2025			
5.	Communication Interface	1	11.12.2025			
6.	Embedded firmware	1	17.12.2025			
7.	**PCB and passive components Activity : Flipped class.**	1	18.12.2025			
8.	Characteristics, Quality attributes	1	20.12.2025			
9.	Application-specific and Domain-Specific	1	24.12.2025			
10.	Main processing elements	1	22.12.2025			
11.	Hardware and software partitions.		27.12.2025			
No. of classes required to complete UNIT-I		**10**	No. of classes taken			

UNIT-II: Embedded Hardware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analog and digital electronic components	1	31.12.2025			
2.	I/O types and examples	1	03.01.2026			
3.	Serial communication devices	1	07.01.2026			
4.	Parallel device ports	1	08.01.2026			
5.	**Timer and counting devices Activity : Case study**	1	21.01.2026			
6.	Watch dog timer,Real time clock	1	22.01.2026			
7.	Timer and counting devices, Watch dog timer	1	24.01.2026			
No. of classes required to complete UNIT-II		**07**	No. of classes taken			

UNIT-III: Embedded Firmware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded Firmware design	1	04.02.2026			
2.	Embedded Firmware development languages	1	05.02.2026			
3.	**ISR concept, Interrupt sources Activity : Quiz**	1	07.02.2026			
4.	Interrupt servicing mechanism, Multiple interrupts	1	11.02.2026			
5.	DMA, Device driver programming	1	12.02.2026			
6.	Concepts of C versus Embedded C	1	14.02.2026			
7.	Compiler versus Cross-compiler	1	18.02.2026			
No. of classes required to complete UNIT-III:**08**				No. of classes taken		

UNIT-IV: Real Time Operating System & Hardware Software Co-Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System Basics and Types	1	19.02.2026			
2.	Tasks, Process and Threads	1	19.02.2026			
3.	Multiprocessing and Multitasking	1	21.02.2026			
4.	Threads, Processes and Scheduling, Task Scheduling , Communication	1	25.02.2026			
5.	**Synchronisation, Device Drivers, RTOS.** **Activity : Problem Based Learning**	1	26.02.2026			
6.	Fundamental Issues in Hardware Software Co-Design	1	28.02.2026			
7.	Computational models in embedded design	1	04.03.2026			
8.	Integration of Hardware and Firmware, ICE.	1	05.03.2026			
No. of classes required to complete UNIT-IV:**08**				No. of classes taken		

UNIT-V: Embedded System Development, Implementation and Testing

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	The integrated development environment	1	07.03.2026			
2.	Types of files generated on cross-compilation, Dissembler/De-compiler, Simulators	1	11.03.2026			
3.	Emulators and Debugging, Target hardware debugging	1	12.03.2026			
4.	Boundary Scan, Embedded Software development process and tools	1	18.03.2026			
5.	**The main software utility tool, CAD and the hardware Activity : Debate**	1	19.03.2026			
6.	Translation tools-Pre-processors	1	21.03.2026			
7.	Interpreters, Compilers and Linkers, Debugging tools	1	25.03.2026			
8.	Quality assurance and testing of the design	1	26.03.2026			
9.	Testing on host-machine	1	28.03.2026			
10.	Simulators, Laboratory Tools	1	01.04.2026			
11.	Test and evolution of an embedded systems	1	02.04.2026			
No. of classes required to complete UNIT-V	**08**		No. of classes taken			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study-typical embedded system design flow	1	04.04.2026			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	01.12.2025	24.01.2026	8 W
I Mid Examinations	31.01.2026	31.01.2026	1 W
II Phase of Instructions	02.02.2026	04.04.2026	9 W
II Mid Examinations	06.04.2026	11.04.2026	1 W
Preparation and Practical's	13.04.2026	18.04.2026	1 W
Semester End Examinations	20.04.2026	02.05.2026	2 W
Internship	04.05.2026	27.06.2026	8 W

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
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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 modelling 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

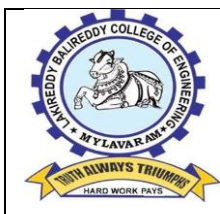| PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: 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.

(Row above: "development.")

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Mr K.V. Ashok	Mr T Anil Raju	Dr P. Lachi Reddy	Dr. G Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF INFORMATION TECHNOLOY

COURSE HANDOUT

PART-A

Name of Course Instructor : B. SARATH CHANDRA
Course Name & Code : -INTRODUCTION TO PROGRAMMING IN JAVA (23IT82) R23
L-T-P Structure : 3-0-0   **Credits** : 3
Program/Sem/Sec : B.Tech., IT., VI-Sem. B Secion,   **A.Y** : 2025-26

PRE-REQUISITE: Programming for Problem Solving Using C

COURSE EDUCATIONAL OBJECTIVES (CEOs): Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Technique in software development through JAVA.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand Object Oriented Programming Concepts through constructs of JAVA. (Understand - L2)
CO 2	Apply the concepts of Inheritance and Polymorphism on real-world applications. (Apply –L3)
CO 3	Apply reusability using interface and packages. (Apply- L3)
CO 4	Construct robust applications using exception handling & multithreading (Apply- L3).
CO 5	Understand and Implement Event Handling & Swings. (Understand - L2)

UNIT – I: Introduction to OOP & JAVA:
Java Basics: Java Buzzwords/Features OOP Concepts, Java History, Advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs. Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi- dimensional), String, StringBuffer, StringTokenizer Classes.

UNIT – II: Extending Classes/ Reusability:
Inheritance: Introduction, Derived Classes, Advantages and Types of Inheritance, Implementation, Inheritance and Member Accessibility. Overriding, super keyword, Abstract Classes and Methods, final keyword, Final Classes and Final Methods, Dynamic Binding, Polymorphism

UNIT – III: Interfaces & Packages:
Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces.
Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default and private). Wrapper Classes (Integer, Float, Double)

UNIT – IV: Exception Handling & Multithreading:
Exception Handling: Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception, assertions.
Multithreading: Thread life cycle, creating threads, synchronizing and intercommunication of threads.

UNIT – V: Event Handling & Swings:
Event Handling- Introduction, limitations of AWT, The Delegation event model- Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events. s
Exploring Swing Controls- JLabel and Image Icon, JText Field, JButton, JCheck Box, JRadio Button, JList, JCombo Box

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	3	-
CO2	3	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	1	1	2	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	3	-	-	-	1	1	-	1	-	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
    1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:
1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education

REFERENCE BOOKS:
1. The Java™ Programming Language: Ken Arnold, James Gosling, Pearson.
2. Introduction to Java Programming 7/e, Brief version, Y. Daniel Liang, Pearson
3. Java for Programmers, P.J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to OOP & JAVA:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Java Buzzwords / Features	1	3-12-2025		TLM1	
2.	Object Oriented Programming **(OOP)** concepts	1	5-12-2025		TLM1	
3.	Java History, Advantages, Datatypes, Operators, Expressions	1	6-12-2025		TLM1	
4.	Control Statements	1	10-12-2025		TLM1	
5.	Methods and recursion , Sample programs	1	12-12-2025		TLM1	
6.	Java Objects and References	1	13-12-2025		TLM1	
7.	Constructors, this keyword	2	17-12-2025 19-12-2025		TLM1 TLM6	
8.	Arrays (single and multi-dimensional),	1	20-12-2025		TLM1 TLM6	
9.	String, StringBuffer, StringTokenizer Classes	2	24-12-2025 26-12-2025		TLM1	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: Extending Classes/ Reusability:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	**Inheritance :** Introduction , Derived Classes, Advantages and Types of Inheritance	1	27-12-2025		TLM1	
11.	Implementation of Inheritance	2	31-12-2025 2-01-2025		TLM1	
12.	Inheritance and Member Accessibility	1	3-01-2025		TLM1	
13.	Overriding, super keyword	1	7-01-2025		TLM1 TLM6	
14.	abstract classes and methods	2	9-01-2025 10-0102025		TLM1 TLM6	
15.	final keyword, final methods and final classes	1	21-01-2025		TLM1	
16.	Dynamic Binding, Polymorphism	2	23-01-2025 24-01-2025		TLM1 TLM6	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: Interfaces & Packages:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	**Interfaces:** Differences between classes and interfaces	1	28-01-2025		TLM1	
18.	defining an interface	1	30-01-2025		TLM1	
19.	implementing interface	1	31-01-2025		TLM1 TLM6	
20.	variables in interface, extending interfaces	1	4-02-2025		TLM1	
21.	**Packages:** Defining, Creating	1	6-02-2025		TLM1	
22.	Accessing a Package	1	7-02-2025		TLM1	
23.	importing packages,	1	11-02-2025		TLM1, TLM6	
24.	access controls (public, protected, default and private).	1	13-02-2025		TLM1	
25.	Wrapper Classes (Like Integer, Float, Double).	1	14-02-2025		TLM1	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

UNIT-IV : Exception Handling & Multithreading:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	**Exception Handling:** Concepts of exception handling	1	18-02-2025		TLM1	
27.	usage of try, catch, multiple catch clause	1	20-02-2025		TLM1, TLM6	
28.	Nested try, throw,	1	21-02-2025		TLM1	
29.	Throws, Finally	1	25-02-2025		TLM1	
30.	creating own exception	2	27-02-2025 28-02-2025			

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Multithreading: Thread life cycle	1	6-03-2025		TLM1	
32.	creating threads (by extending thread class)	1	7-03-2025		TLM1, TLM6	
33.	creating threads (implementing Runnable Interface)	1	11-03-2025		TLM1, TLM6	
34.	Example programs on threads	1	13-03-2025		TLM1	
35.	Synchronization : method, Synchronization block	2	14-03-2025 18-03-2025		TLM1, TLM6	
36.	Inter thread Communication	2	20-03-2025 21-03-2025		TLM1, TLM6	
No. of classes required to complete UNIT-IV: 14				No. of classes taken:		

UNIT-V : Event Handling &Swings:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Event Handling – Introduction, Limitations of AWT	1	25-03-2025		TLM1	
38.	Delegation Event Model – Events, Event Sources, Event Listeners	1	27-03-2025		TLM1	
39.	Event Classes, Handling Mouse & Keyboard Events	1	28-03-2025		TLM1	
40.	Swing Controls – JLabel, ImageIcon, JTextField	1	1-04-2025		TLM1	
41.	Swing Buttons – JButton, JCheckBox, JRadioButton	1	3-04-2025		TLM1 TLM5	
42.	JList & JComboBox	1	4-04-2025		TLM1	
No. of classes required to complete UNIT-V: 06				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Problem Solving
TLM2	PPT	**TLM5**	Programming
TLM3	Tutorial	**TLM6**	Assignment or Quiz
TLM7	Seminars or GD	**TLM8**	Lab Demo
TLM9	Case Study		

PART-C

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and Interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs.
PSO 3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr.K.Venu Gopal	Mr.B.SARATH CHANDRA	Dr. Phaneendra K	Dr. D. Ratna Kishore
Signature				

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Dt:25.11.2025

COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–B
Academic Year	: 2025-26
Course Name & Code	: VLSI Design Lab – 23EC59
L-T-P-Cr	: 0-0-3-1.5
Course Instructure	: Dr.K.Rani Rudramma, Mr.CH. MallikharjunaRao

Course Objectives: The objective of this laboratory course is to enable students to design, simulate, and implement CMOS-based digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools. Students are expected to develop a comprehensive understanding of schematic capture, layout design, and verification methodologies as per current CMOS technology standards.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Implement combinational and sequential circuits in Verilog	L3
CO 2	Design the Combinational and Sequential logic using NMOS and CMOS Technology	L3
CO 3	Analyze combinational and sequential circuits using Static CMOS logic from schematic to layout	L4
CO 4	Adapt effective communication, presentation and report writing skills.	L3

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	3	1	3	-	-	-	-	-	-	2	-	3	-
CO 2	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	2	-	3	-
CO 4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Correlation Levels: **1-**Slight (Low), **2-**Moderate (Medium), **3-**Substantial (High) and No correlation: '-'

S.No	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Cadence EDA tool	3	01.12.2025		TLM4	
2.	Introduction to Vivado/Cadence/ Mentor Graphics/EDA tool	3	08.12.2025		TLM4	
3.	Design and implementation of an inverter	3	15.12.2025		TLM4	
4.	Design and implementation of universal gates	3	22.12.2025		TLM4	
5.	Design and implementation of full adder	3	29.12.2025		TLM4	
6.	Design and implementation of full Subtractor	3	05.01.2026		TLM4	
7.	Design and implementation of RS-latch	3	19.01.2026		TLM4	
8.	Makeup Lab	3	02.02.2026		TLM4	
9.	Design and implementation of D-latch	3	09.02.2026		TLM4	
10.	Design and implementation asynchronous counter	3	16.02.2026		TLM4	
11.	Design and Implementation of static RAM cell	3	23.02.2026		TLM4	
12.	Design and Implementation of differential amplifier	3	02.03.2026		TLM4	
13.	Design and Implementation of ring oscillator	3	09.03.2026		TLM4	
14.	Design and Implementation of ring oscillator	3	16.03.2026		TLM4	
15.	Makeup-Lab	3	23.03.2026		TLM4	
16.	Internal Lab Examination	3	30.03.2026		TLM4	
No. of classes required:				**No. of classes taken:**		

PART-B: COURSE DELIVERY PLAN (LESSON PLAN):

S.No	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Vivado/Cadence/ Mentor Graphics/EDA tool	3	6.12.2025		TLM4	
2	Design and implementation of an inverter	3	20.12.2025		TLM4	
3	Design and implementation of universal gates	3	27.12.2025		TLM4	
4	Design and implementation of full adder	3	03.01.2026		TLM4	
5	Design and implementation of full Subtractor	3	17.01.2026		TLM4	
6	Design and implementation of RS-latch	3	24.01.2026		TLM4	
7	Design and implementation of D-latch	3	7.02.2026		TLM4	
8	Design and implementation asynchronous counter	3	21.02.2026		TLM4	
9	Design and Implementation of static RAM cell	3	28.02.2026		TLM4	
10	Design and Implementation of differential amplifier	3	07.03.2026		TLM4	
11	Design and Implementation of ring oscillator	3	21.03.2026		TLM4	
12	Makeup-Lab	3	28.03.2026		TLM4	
13	Internal Lab Examination	3	04.04.2026		TLM4	
No. of classes required:				**No. of classes taken:**		

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work	1,2,3,4,5,6,7,8…	A1 =10
Record and observation	1,2,3,4,5,6,7,8…	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8…	**C1=15**
Cumulative Internal Examination (CIE):(A1+B1+C1)	1,2,3,4,5,6,7,8…	**30**
Semester End Examination (SEE)	1,2,3,4,5,6,7,8…	**70**
Total Marks=CIE+SEE		**100**

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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.
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PO 8:	**Ethic**s: 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits orsystems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.K.Ranirudramma Mr.CH.Mallikharjuna Rao	Dr.K.Ranirudramma	Dr. P.Lachi Reddy	Dr. G.Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Course Name &Code	**:Microprocessors and Microcontrollers Lab–23EC60**
L-T-PStructure	:0-0-3
Credits	:3
Program	:B.Tech.VI Semester ECE- B Section
A.Y	**:2025 – 26**
Course Instructor(s)	:Mr. K.V.Ashok/Dr.B.V.N.R. Siva Kumar

COURSE OBJECTIVE:

The lab to provide hands-on experience with microprocessors, microcontrollers, and ARM-based systems. It aims to understand instruction sets, programming techniques, and hardware interfacing. This equip students with practical skills in peripheral interfacing, sensor integration, and embedded system development through real-time applications, preparing them for careers in embedded systems and automation.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the MASM / TASM tool for developing Assembly Language Programs.
CO2	Apply the Assembly Language instructions of Processor and Controller for logical operations.
CO3	Develop the ARM based interfacing systems for Real time applications.
CO4	Adapt effective communication, presentation and report writing skills.

COURSEARTICULATIONMATRIX(Correlationbetween Cos&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	2	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: EnterCorrelationLevels:**1** or**2**or**3.**
Ifthereisnocorrelation:**put'-'**
1-Slight(Low),**2-**Moderate(Medium),**3-**Substantial(High).

PART-B
LAB SCHEDULE(LESSON PLAN):Section-B
Batch-I(Monday)

S. No.	Name of the Experiment	No.of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching - Learning Methods	HOD Sign Weekly
			CYCLE-1			
1.	Introduction to Lab	3	01/12/2025		TLM2	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n-BCD numbers	3	08/12/2025		TLM8	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	15/12/2025		TLM8	
4.	Interfacing Of DAC	3	22/12/2025		TLM8	
5.	Interfacing of Stepper Motor	3	29/12/2025		TLM8	
6.	Interfacing of Seven segment Display	3	05/01/2026		TLM8	
7.	Review of 8086 based Experiments	3	19/01/2026		TLM8	
			CYCLE-2			
8.	8051-ADD, SUB, Series, MUL & DIV	3	02/02/2026			
9.	8051 - 1&0, Average, Odd & Even	3	09/02/2026		TLM8	
10.	8051- InterfacingoftrafficLight controller	3	16/02/2026		TLM8	
11.	8051- Interfacing LM 35	3	23/02/2026		TLM8	
12.	Review of 8051 based Experiments					
13.	ARM- MUL, SUM	3	02/03/2026		TLM8	
14.	ARM- Toggle LED, Running Lights	6	16/03/2026		TLM8	
15.	ARM – Revision	3	23/03/2026		TLM8	
16.	Internal LabExam	3	30/03/2026		TLM8	
No.of classes required to complete:		48	No. of classes conducted:			

Batch-II(Saturday)

S. No.	Name of the Experiment	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
			CYCLE-1			
1.	Introduction to Lab	3	06/12/2025		TLM2	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n- BCD numbers	3	20/12/2025		TLM8	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	27/12/2025		TLM8	
4.	Interfacing Of DAC	3	03/01/2026		TLM8	
5.	Interfacing of Stepper Motor	3	24/01/2026		TLM8	
6.	Interfacing of Seven segment Display	3	07/02/2026		TLM8	
7.	Review of 8086 based Experiments	3	14/02/2026		TLM8	
			CYCLE-2			
8.	8051-ADD, SUB, Series, MUL & DIV	3	21/02/2026			
9.	8051 - 1&0, Average, Odd & Even	3	28/02/2026		TLM8	
10.	8051-InterfacingoftrafficLightcontroller	3	07/03/2026		TLM8	
11.	8051- Interfacing LM 35	3	14/03/2026		TLM8	
12.	Review of 8051 based Experiments					
13.	ARM- MUL, SUM	3	21/03/2026		TLM8	
14.	ARM- Toggle LED, Running Lights, ARM – Revision	3	28/03/2026		TLM8	
15.	Internal LabExam	3	04/04/2026		TLM8	
No.of classes required to complete:		42	No. of classes conducted:			

PART-C

TeachingLearningMethods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	SeminarsorGD
TLM2	PPT	**TLM5**	Programming	**TLM8**	LabDemo
TLM3	Tutorial	**TLM6**	AssignmentorQuiz	**TLM9**	CaseStudy

Academic Calendar: 2025 – 26 (VI-Semester)

B.Tech VI Semester – 2023 Admitted Batch			
Classwork Commence From	**01-12-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	26-01-2026	31-01-2026	1Week
II Phase of Instructions	02-02-2026	04-04-2026	8 Weeks
II Mid Examinations	06-04-2026	11-04-2026	1Week
Preparation & Practicals	13-04-2026	18-04-2026	1Week
Semester End Examinations	20-04-2026	02-05-2026	2 Weeks
Internship	04-05-2026	27-06-2026	8 Weeks

EVALUATIONPROCESS:

EvaluationTask	COs	Marks
Day to Day work	1,2,3,4	A=15
Internal Lab Examination	1,2,3,4	B=15
Total Internal Marks(A+B)		**C=30**
Semester End Examinations	1,2,3,4	**D=70**
Total Marks: C+D	1,2,3,4	**100**

PART– D

PROGRAMMEOUTCOMES(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.

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuitsor systems and Implement real time applications in the field of VLSI and Embedded Systemsusingrelevanttools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

CourseInstructor	Course Coordinator	ModuleCoordinator	HOD
[Mr. K.V.Ashok]	[Mr.K.V.Ashok]	[Dr. P.Lachi Reddy]	[Dr.G.Srinivasulu]

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING, (AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
ISO 21001 : 2018, 50001 : 2018, 14001: 2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

COURSE HANDOUT
PART-A

Name of Course Instructor: D. Chaithanya
Course Name & Code   : Soft Skills & 23HSS1
L-T-P Structure   : 0-1-2   **Credits:** 02
Program/Sem/Sec   : B. Tech- VI SEM / ECE-B
Academic Year   : 2025-26

PREREQUISITE   : Basic language proficiency and cognitive skills with an exposure to academic contexts.

Course Objectives:

- To equip the students with the skills to effectively communicate in English.
- To train the students in interview skills, group discussions and presentation skills.
- To motivate the students to develop confidence.
- To enhance the students' interpersonal skills.
- To improve the students' writing skills.

COURSE OUTCOMES (COs): After completion of the course, the student will be able to

CO1	Demonstrate analytical thinking skills by effectively introducing themselves, evaluating their own strengths and weaknesses, and understanding the role of perception and attitude in personality development. **L2 -Understand**
CO2	Make use of self-management competencies, leadership qualities, and etiquette skills to function confidently and professionally in workplace environments. **L3 - Apply**
CO3	Utilize grammatical proficiency, writing skills, and documentation techniques to communicate clearly and professionally in academic and workplace settings. **L3 - Apply**
CO4	Take part in effectively in group discussions by demonstrating logical thinking, clarity of expression, and collaborative communication. **L4 - Analyze**
CO5	Identify the key factors that influence interpersonal relationships and analyze how they affect communication and collaboration. **L3 - Apply**

COURSE ARTICULATION MATRIX
(Correlation between COs & POs)

Course Outcomes PO's	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1.		1			2			3	3	3		3
CO2.		1			2			3	3	3		3
CO3.		1			2			3	3	3		3
CO4.		1			2			3	3	3		3
CO5.		1			2			3	3	3		3

1 = Slight (Low)   **2= Moderate (Medium)**   **3 = Substantial (High)**

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing.

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1**.** Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
References:
1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.
E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

COURSE DELIVERY PLAN (LESSON PLAN)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching learning method	HOD Sign
1.	*Analytical Thinking & Listening Skills:* Self-Introduction	1+2	04/12/2025		TLM1 TLM4	
2.	Self – Analysis, Developing Positive Attitude, Perception	1+2	11/12/2025		TLM1 TLM5	
3.	Verbal Communication; Non Verbal Communication (Body Language)	1+2	18/12/2025		TLM1 TLM4 TLM3	
4.	*Self-Management Skills:* Anger Management, Stress Management	1+2	08/01/2026		TLM2 TLM4	
5.	Time Management, Six Thinking Hats	1+2	22/01/2026		TLM2 TLM4	
6.	Team Building and Leadership Qualities	1+2	05/02/2026		TLM2 TLM4	
7.	*Standard Operation Methods :* Basic Grammars, Tenses, and Prepositions	1+2	12/02/2026		TLM1 TLM3	
8.	Pronunciation, Letter Writing	1+2	19/02/2026		TLM1 TLM3	
9.	Note Making, Note Taking, Minutes Preparation, Email	1+2	26/02/2026		TLM2 TLM5	
10.	*Job-Oriented Skills:* Group Discussion, Mock Group Discussions	1+2	05/03/2026		TLM4, TLM6	
11.	Resume Preparation	1+2	12/03/2026		TLM1, TLM5	
12.	Interview Skills, Mock Interviews	1+2	26/02/2026		TLM1, TLM6	
13.	**Interpersonal relationships:** Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships	1+2	19/03/2026		TLM1, TLM3 TLM5	
14.	Accommodating different styles, Consequences of interpersonal relationships	1+2	26/03/2026		TLM1, TLM3 TLM5	
No. of classes required to complete Syllabus:42						

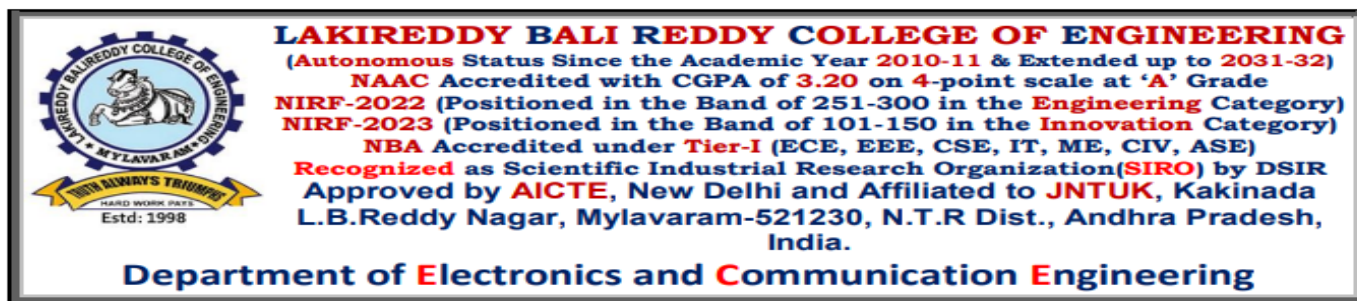| Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS/AI Tools)

TLM3	Tutorial	TLM6	Group Discussion/Interview skills

Evaluation Task	Marks
Day-to-Day Work	A1 = 10
Record & Observation	B1 = 5
Internal Exam	C1 = 15
Cumulative Internal Examination (CIE): (A1+B1+C1)	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

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.
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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 modelling 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
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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.

Title	Course Instructor	Lab. Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	D.Chaithanya	Dr. B. Samrajya Lakshmi	Dr. Padma Venkat	Dr. T. Satyanarayana
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Program/Sem/Sec : B.Tech., ECE, VI-Sem.

Course Instructor : Dr. P. Lachi Reddy, Professor

  Mr. N. Dharma Chari, Assistant Professor

Course Name & Code : CMOS Mixed Signal Design – 23ECH3

L-T-P-Cr Structure : 3-0-0-3

Academic Year **:** 2025 – 26

Pre requisite: EDC, STLD

Course Outcomes: (COs): At the end of the course, students are able to:

CO1:	Understand the design methodology for mixed-signal IC design.
CO2:	Analyze the design of PLL and operational amplifiers
CO3:	Design the CMOS digital circuits and implement its layout.
CO4:	Design the Switched Capacitor Circuits for different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	3	-	3	2

Prescribed Syllabus:

UNIT-I: Switched Capacitor Circuits: 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.

UNIT-II: Phased Lock Loop (PLL): 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.

UNIT-III: Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV: Nyquist Rate A/D Converters: 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.

UNIT-V: Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A.

TEXT BOOKS:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2016
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

	UNIT-I: Switched Capacitor Circuits [09 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Discussion of Syllabus and Course Outcomes	1	02-12-2025		TLM2	
2.	Introduction to Switched Capacitor circuits-basic building blocks	1	03-12-2025		TLM2	
3.	Operation and Analysis	1	04-12-2025		TLM2	
4.	Non-ideal effects in switched capacitor circuits	1	09-12-2025		TLM2	
5.	Switched capacitor integrators first order filters	1	10-12-2025		TLM2	
6.	Switch sharing	1	11-12-2025		TLM2	
7.	Biquad filters	1	16-12-2025		TLM2	
8.	**Activity: Students Presentation on Switched capacitor circuits**	1	17-12-2025		TLM2	
9.	**Revision/Tutorial/Assignment**	1	18-12-2025		TLM2	

	UNIT- II: Phased Lock Loop (PLL) [10 HRS]					
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Basic PLL topology	1	23-12-2025		TLM2	
11.	Dynamics of simple PLL	1	24-12-2025		TLM2	
12.	Charge pump PLLs-Lock acquisition	1	30-12-2025		TLM2	
13.	Phase/Frequency detector and charge pump	1	31-12-2025		TLM2	
14.	Basic charge pump PLL	1	06-01-2026		TLM2	
15.	Non-ideal effects in PLLs-PFD/CP non-idealities	1	07-01-2026		TLM2	
16.	Jitter in PLLs, Delay locked loops	1	08-01-2026		TLM2	
17.	Applications	1	20-01-2026		TLM2	
18.	**Activity: Students Presentation on PLL**	1	21-01-2026		TLM2	
19.	**Revision / Tutorial/Assignment**	1	22-01-2026		TLM2	

	UNIT – III: Data Converter Fundamentals [08 HRS]					
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
20.	DC and dynamic specifications	1	03-02-2026		TLM2	
21.	Quantization noise	1	04-02-2026		TLM2	
22.	Nyquist rate D/A converters- Decoder-based converters	1	05-02-2026		TLM2	
23.	Binary-Scaled converters	1	10-02-2026		TLM2	
24.	Thermometer-code converters	1	11-02-2026		TLM2	
25.	Hybrid converters	1	12-02-2026		TLM2	
26.	**Activity: Students' presentations on Data converters design**	1	17-02-2026		TLM2	
27.	**Revision / Tutorial/Assignment**	1	18-02-2026		TLM2	

	UNIT – IV: Nyquist Rate A/D Converters [09 HRS]					
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
28.	Successive approximation converters	1	19-02-2026		TLM2	
29.	Flash converter	1	24-02-2026		TLM2	
30.	Two-step A/D converters	1	25-02-2026		TLM2	
31.	Interpolating A/D converters	1	26-02-2026		TLM2	
32.	Folding A/D converters	1	03-03-2026		TLM2	
33.	Pipelined A/D converters	1	05-03-2026		TLM2	
34.	Time-interleaved converters	1	10-03-2026		TLM2	
35.	**Activity: Students' presentations on A/D Converters design**	1	11-03-2026		TLM2	
36.	**Revision / Tutorial/Assignment**	1	12-03-2026		TLM2	

	UNIT – V: Oversampling Converters [07 HRS]					
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
37.	Noise shaping modulators	1	17-03-2026		TLM2	
38.	Decimating filters and interpolating filters	1	18-03-2026		TLM2	
39.	Higher order modulators	1	24-03-2026		TLM2	
40.	Delta sigma modulators with multibit quantizers	1	25-03-2026		TLM2	
41.	Delta sigma D/A	1	26-03-2026		TLM2	
42.	**Activity: Presentations on Design and Implementation D/A Converters**	1	31-03-2026		TLM2	
43.	**Revision / Tutorial/Assignment**	1	01-04-2026		TLM2	

	BEYOND THE SYLLABUS & REVISION [01 HRS]					
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
44.	Mixed Signal Design – Case Study	1	02-04-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART – C

Academic Calendar: 2025 – 26 (IV Semester)

B. Tech IV Semester - 2024 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	**26-01-2026**	**31-01-2026**	1 Week
II Phase Instructions	02-02-2026	04-04-2026	9 Weeks
II Mid Examinations	**06-04-2026**	**11-04-2026**	1 Week
Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III-Half of the Syllabus)	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III-Half of the Syllabus)	M1=15
I-Quiz Examination (Units-I, II & UNIT-III-Half of the Syllabus)	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	**100**

CO 1	Understand the design methodology for mixed-signal IC design.	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Analyze the design of PLL and operational amplifiers	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Design the CMOS digital circuits and implement its layout.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Design the Switched Capacitor Circuits for different applications.	Categorize, Analyze, Illustrate, Infer Select

PART – D

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:	**Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
[Dr. P. Lachi Reddy] **[Mr. N. Dharma Chari]**	**[Mr. N. Dharma Chari]**	**[Dr. P. Lachi Reddy]**	**[Dr. G. Srinivasulu]**

COURSE HANDOUT

PART-A

PROGRAM   : B.Tech., VI-Sem, ECE

ACADEMIC YEAR   : 2025-26

COURSE NAME & CODE   : CMOS Mixed Signal Design Lab - 23ECH7

L-T-P STRUCTURE   : 0-0-3

COURSE INSTRUCTOR   : Dr. P. Lachi Reddy / Mr. N. Dharma Chari

COURSE OBJECTIVE:
To provide hands-on experience through practical experimentation, simulation and layout design using the Cadence Virtuoso tool.
❖ The Students are required to design and draw the schematic diagrams for various circuits.
❖ The following experiments are required to design and draw the schematic, later they are converted in to symbol and layouts.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the compensation techniques.
CO2	Design various analog and digital circuits.
CO3	Create the layout for various designed circuits.
CO4	Adapt effective communication, presentation and report writing skills.

COURSE ARTICULATION MATRIX (Correlation between Cos & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

LAB SCHEDULE (LESSON PLAN): Section-B
LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

S.No.	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
	Part-I:Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction, Syllabus Discussion & CO-PO Discussion	3	05-12-2025		TLM2	
2.	Practice of basic circuits (Logic Gates)	3	12-12-2025		TLM8	
3.	Fully compensated op-amp with resistor and miller compensation	3	19-12-2025		TLM8	
4.	High speed comparator design i. Two stage cross coupled clamped comparator	3	26-12-2025		TLM8	
5.	High speed comparator design ii. Strobed Flip-flop	3	02-01-2026		TLM8	
6.	Data converter	3	09-01-2026		TLM8	
	CYCLE-2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)					
7.	Switched capacitor circuits i. Parasitic sensitive integrator	3	23-01-2026		TLM8	
8.	Switched capacitor circuits ii. Parasitic insensitive integrator	3	06-02-2026		TLM8	
9.	Design of PLL	3	13-02-2026		TLM8	
10.	Design of VCO	3	20-02-2026		TLM8	
11.	Band gap reference circuit	3	27-02-2026		TLM8	
12.	Layouts of All the circuits Designed and Simulated	3	06-03-2026		TLM8	
13.	Internal Examination	3	13-03-2026		TLM8	
No. of classes required to complete:		39	No. of classes conducted:			

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

Academic Calendar: 2025 – 26

B. Tech IV Semester - 2024 Admitted Batch			
Class work Commence From	**01-12-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	**26-01-2026**	**31-01-2026**	1 Week
II Phase Instructions	02-02-2026	04-04-2026	9 Weeks
II Mid Examinations	**06-04-2026**	**11-04-2026**	1 Week
Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Day to Day work	1,2,3,4	A1=15
Internal Lab Examination	1,2,3,4	B=15
Total Internal Marks(A+B)		**C=30**
Semester End Examinations	1,2,3,4	**D=70**
Total Marks: C+D	1,2,3,4	**100**

PART-D

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy)			
(Mr. N. Dharma Chari)	**(Mrs. T. Kalpana)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

LAKIREDDYBALIREDDYCOLLEGEOFENGINEERING

(AnAutonomousInstitutionsince2010)
AccreditedbyNAACwith'A'Grade&NBA(UnderTier- I),
AnISO21001:2018,14001:2015,50001:2018CertifiedInstitution
ApprovedbyAICTE,NewDelhiandAffiliatedtoJNTUK, Kakinada
L.B.REDDYNAGAR,MYLAVARAM,KRISHNA DIST.,A.P.-521230.
hodcse@lbrce.ac.in,cseoffice@lbrce.ac.in,Phone:08659-222933,Fax:08659-222931

COURSEHANDOUT

PART-A

Nameof CourseInstructor: Mr. Y. Babu
CourseName&Code: SoftwareEngineering Fundamentals & 23CSM5

L-T-P Structure: **:3-0-0**   **Credits:**3
Program/Sem: :B.Tech,VI-Sem(Minors)   **A.Y.   :**2025-26

PREREQUISITE: ObjectOrientedProgramming.

COURSEEDUCATIONALOBJECTIVES(CEOs):

Theobjectiveofthecourseistoprovideanunderstandingofdifferents/wprocessmodelsand how to choose one among them by gathering the requirements from a client and specifying them. Usingthoserequirements inthedesignofthesoftwarearchitecturebased on thechoiceswiththe help ofmodules andinterfaces.Toenables/w development, by usingdifferent testing techniques likeunit, integration and functional testing, quality assurance can be achieved.

CO1	UnderstandthefundamentalsofsoftwareengineeringconceptsandsoftwareProcess models. **(Understand-L2)**
CO2	ApplytherequirementelicitationtechniquesforpreparingSRSanddesign engineering. **(Apply-L3)**
CO3	UnderstandingthebasicbuildingblocksofUML,Class,andobjectdiagrams. **(Understand-L2)**
CO4	Applybehavioralmodelsforrealworldapplications.**(Apply-L3)**
CO5	Demonstratedifferentsoftwaretestingapproachesfortestingrealtimeapplications. **(Understand-L2)**

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs,POs&PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		2											2	1	
CO3	3												3	2	
CO4		2												3	1
CO5	2	2													3
1 -Low				**2 –**Medium					**3 -**High						

TEXTBOOKS:

T1   RogerS.Pressman,"Softwareengineering-Apractitioner'sApproach",TMHInternationalEdition, 6thedition,2005.

T2   GradyBooch,JamesRumbaugh,Ivar Jacobson,"TheUnifiedModelingLanguage User Guide", PEARSON,4thImpression,2012.

REFERENCEBOOKS:

R1SoftwareEngineering-Conceptsandpractices:UgrasenSuman,Cengage learning

R2 Object- oriented analysis and design using UML",Mahesh P. Matha, PHI

R3FundamentalsofSoftwareEngineering,RajibMall,ThirdEdition,PHI **R4.**

https://onlinecourses.nptel.ac.in/noc20_cs68**[1,2,3,4,5]**

PART-B

COURSEDELIVERYPLAN(LESSONPLAN):

UNIT-I:SoftwareandsoftwareEngineering

S.No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	CEOsandCOs discussion	1	02/12/2025		TLM2	
2.	Theevolvingrole ofSoftware	1	03/12/2025		TLM2	
3.	CharacteristicsofSoftware	1	04/12/2025		TLM2	
4.	Importanceofsoftware Engineering	1	09/12/2025		TLM2	
5.	Changingnatureofsoftware	1	10/12/2025		TLM2	
6.	LegacySoftware, SoftwareMyths	1	11/12/2025		TLM2	
7.	Softwareprocessmodel:layered. technology	1	16/12/2025		TLM2	
8.	Processframework Theprocessandproduct	1	17/12/2025		TLM2	
9.	Waterfallmodel, Incrementalmodel	1	18/12/2025		TLM2	
10.	SpiralandVmodel	1	23/12/2025		TLM2	
11.	Componentbaseds/w development	1	24/12/2025		TLM2	
12.	UnifiedProcessmodel	1	30/12/2025		TLM2	
No.of classesrequiredtocompleteUNIT-I:12				**No.of classestaken:**		

UNIT-II:Requirements AnalysisandSoftwaredesign

S.No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Requirements gathering	1	31/12/2025		TLM2	
14.	Requirementanalysis	1	01/01/2026		TLM2	
15.	Softwarerequirementspecification	1	06/01/2026		TLM2	
16.	SRSdocumentcasestudy	1	07/01/2026		TLM2	
17.	Overviewof design process	1	08/01/2026		TLM2	
18.	Design concepts	1	20/01/2026		TLM2	
19.	Architecturalconcepts	1	21/01/2026		TLM2	
20.	Examples, Revision	1	22/01/2026		TLM2	
No.ofclassesrequiredtocomplete UNIT-II: 08				**No.of classestaken:**		

UNIT-III:DesignusingUML

S.No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	BuildingBlocksofUML	1	03/02/2026		TLM2	
22.	Definingthings	1	04/02/2026		TLM2	
23.	Definingrelationshipsanddiagrams	1	05/02/2026		TLM2	
24.	CommonMechanisminUML	1	10/02/2026		TLM2	
25.	Classdiagrams, Examples	1	11/02/2026		TLM2	
26.	Objectdiagramsand examples, Revision	1	12/02/2026		TLM2	
No.ofclassesrequiredtocomplete UNIT-III:06				**No.of classestaken:**		

UNIT-IV:BehavioralModeling

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Interactions	1	17/02/2026		TLM2	
28.	Interactiondiagrams	1	18/02/2026		TLM2	
29.	Use-cases	1	24/02/2026		TLM2	
30.	Use-casediagrams	1	25/02/2026		TLM2	
31.	Activitydiagrams	1	03/03/2026		TLM2	
32.	Eventsandsignals,state machines	1	04/03/2026		TLM2	
33.	processesandThreads,time, and space, Statechart diagrams	1	05/03/2026		TLM2	
34.	Componentdiagrams, Deployment diagrams, Revision	1	10/03/2026		TLM2	
No.ofclassesrequiredtocompleteUNIT-IV:08				**No.of classestaken:**		

UNIT-V:TestingTechniques

S.No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Softwaretestingfundamentals	1	11/03/2026		TLM2	
36.	Unittesting	1	12/03/2026		TLM2	
37.	Integrationtesting	1	17/03/2026		TLM2	
38.	Blackbox testing	1	18/03/2026		TLM2	
39.	Whitebox testing	1	24/03/2026		TLM2	
40.	Debugging	1	25/03/2026		TLM2	
41.	Systemtesting	1	26/03/2026			
42.	Examples, Revision	1	31/03/2026		TLM2	
No.ofclassesrequiredtocomplete UNIT-V: 08				**No.of classestaken:**		

ContentBeyondthe Syllabus:

SNo	Topicstobe covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
43.	Casestudyversion control	1	01/04/2026		TLM6	
44.	Casestudytestcasepreparation	1	02/04/2026		TLM6	

TeachingLearning Methods			
TLM1	ChalkandTalk	**TLM4**	Demonstration(Lab/FieldVisit)
TLM2	PPT	**TLM5**	ICT(NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial/Assignment	**TLM6**	GroupDiscussion/Project

PART-C

EVALUATIONPROCESS(R23 Regulation):

Evaluation Task	Marks
Assignment-I(Units-I&UNIT-II)	A1=5
I-DescriptiveExamination(Units-I,UNIT-II)	M1=15
I-QuizExamination(Units-I&UNIT-II)	Q1=10
Assignment-II(Unit-III,IV&V)	A2=5
II-DescriptiveExamination(UNIT-III,IV&V)	M2=15
II-QuizExamination(UNIT-III,IV&V)	Q2=10
MidMarks=80%ofMax((M1+Q1+A1),(M2+Q2+A2))+20%ofMin((M1+Q1+A1),(M2+Q2+A2))	M=30
CumulativeInternalExamination(CIE):M	30
SemesterEndExamination(SEE)	70
TotalMarks =CIE+SEE	100

PART-D

PROGRAMMEOUTCOMES(POs):

PO1	**Engineeringknowledge:**Applytheknowledgeofmathematics,science,engineering fundamentals,andanengineeringspecializationtothesolutionofcomplexengineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesof mathematics,naturalsciences,andengineeringsciences.
PO3	**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 environmentalconsiderations.
PO4	**Conductinvestigationsofcomplexproblems:**Useresearch-basedknowledgeand researchmethodsincludingdesignofexperiments,analysisandinterpretationofdata, andsynthesisofthe informationtoprovidevalidconclusions.
PO5	**Moderntoolusage:**Create,select,andapplyappropriatetechniques,resources,and modernengineeringandITtoolsincludingpredictionandmodellingtocomplex engineering activities with an understanding of the limitations
PO6	**Theengineerandsociety:Apply**reasoninginformedbythecontextualknowledgeto assesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilities relevant to the professional engineering practice
PO7	**Environmentandsustainability:**Understandtheimpactoftheprofessionalengineering solutionsin societalandenvironmentalcontexts,anddemonstratethe knowledge of,and needforsustainabledevelopment.
PO8	**Ethics:**Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesand normsoftheengineeringpractice.
PO9	**Individualand team work:**Function effectively as anindividual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:**Communicateeffectivelyoncomplexengineeringactivitieswiththe engineering community and with society at large, such as, being able to
PO11	**Projectmanagementandfinance:**Demonstrateknowledgeandunderstandingofthe engineeringandmanagementprinciplesandapplythesetoone'sownwork, asamember andleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
PO12	**Life-longlearning:**Recognizetheneedfor,andhavethepreparationandabilitytoengage in independent and life-long learning in the broadest context of technological change.

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO1	TheabilitytoapplySoftwareEngineeringpracticesandstrategiesinsoftwareproject developmentusingopen-sourceprogrammingenvironmentforthesuccessoforganization.
PSO2	Theabilitytodesignanddevelopcomputerprogramsinnetworking,webapplicationsand IoT as per the society needs.
PSO3	Toinculcateanabilitytoanalyze,designandimplementdatabaseapplications.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of theFaculty	**Mr.Y.Babu**	**Mr. Y.Babu**	**Dr.D.V.Subbaiah**	**Dr.S.NagarjunaReddy**
Signature				

LAKIREDDYBALIREDDYCOLLEGEOFENGINEERING
(AnAutonomousInstitutionsince2010)
AccreditedbyNAACwith'A'Grade&NBA(UnderTier- I),
AnISO21001:2018,14001:2015,50001:2018CertifiedInstitution
ApprovedbyAICTE,NewDelhiandAffiliatedtoJNTUK, Kakinada
L.B.REDDYNAGAR,MYLAVARAM,KRISHNA DIST.,A.P.-521230.
hodcse@lbrce.ac.in,cseoffice@lbrce.ac.in,Phone:08659-222933,Fax:08659-222931

COURSEHANDOUT

PART-A

Nameof CourseInstructor: Mr. Y. Babu
CourseName&Code: **Principles of Software Engineering Lab** & 23CSM10

L-T-P Structure: **: 0-0-3** **Credits:**1.5
Program/Sem: :B.Tech,VI-Sem(Minors) **A.Y.** :2025-26

PREREQUISITE: ObjectOrientedProgramming.

COURSEEDUCATIONALOBJECTIVES(CEOs):
The primary objective of this course is to Provide students with a comprehensive understanding of Object-Oriented Design principles along with fundamental Software Engineering principles, and to enable their effective application in real-world project environments. Students will develop the ability to critically analyze software applications and adopt a pragmatic, systematic, and process-oriented approach to software design and development.

CO1	Understanding the basic building blocks of UML, Class and object diagrams. **(Understand-L2)**
CO2	Analyze Software Requirements for the given Real-World Application using Use Cases.**(Analyze-L4)**
CO3	Develop the UML Diagrams to view Software System in Static and Dynamic Aspects. **(Analyze-L4)**
CO4	Improve individual / teamwork skills, communication & report writing skills with ethical Values.

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs,POs&PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		2											2	1	
CO3	3												3	2	
CO4		2												3	1
1 -Low				**2 –**Medium					**3 -**High						

TEXTBOOKS:

T1 Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language UserGuide", Pearson Education, 2nd Edition, ISBN: 0-201-57168-4, 1998.

T2 Meilir Page-Jones, "Fundamentals of Object-Oriented Design in UML", Pearson Education, 1st Edition, ISBN: 9788177586770, 8177586777, and 2007.

REFERENCEBOOKS:

R1. Object-oriented analysis and design using UML", Mahesh P. Matha, PHI

R2. Robert B. Jackson, Stephen D. Burd, John W. Satzinger, "Object-Oriented Analysis and Design with the Unified ` Process", Cengage Learning, 1st Edition, ISBN: 9788131502693, 8131502694, 2007.

R3. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", PHI, 3rd Edition, ISBN: 978-0131489066, 2004.

PART-B

COURSEDELIVERYPLAN(LESSONPLAN):

S.No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Cycle -1: Basics of UML	6	05/12/2025 12/12/2025		TLM4	
2.	Cycle-2: Analyse the Requirements for the following Case Studies.	6	19/12/2025 26/12/2025		TLM4	
3.	Cycle-3: Analyse the Requirements for the following Case Studies.	6	02/01/2026 09/01/2026		TLM4	
4.	Cycle-4: For each case study given earlier, Construct Use Case Diagram.	6	23/01/2026 06/02/2026		TLM4	
5.	Cycle-5: For each case study given earlier, Construct Class Diagram in the particular Manner.	3	13/02/2026		TLM4	
6.	Cycle-6: For each case study given earlier, Construct Interaction Diagram.	3	20/02/2026		TLM4	
7.	Cycle-7: For each case study given earlier, Construct Activity Diagram.	3	27/02/2026		TLM4	
8.	Cycle-8: For each case study given earlier, Construct State Chart Diagram.	3	06/03/2026		TLM4	
9.	Cycle-9: For each case study given earlier, Construct Component Diagram.	3	13/03/2026		TLM4	
10.	Cycle-10: For each case study given earlier, Construct Deployment Diagram.	3	20/03/2026		TLM4	
11.	Lab Internal Eaxam	3	27/03/2026		TLM4	

TeachingLearning Methods			
TLM1	ChalkandTalk	**TLM4**	Demonstration(Lab/FieldVisit)
TLM2	PPT	**TLM5**	ICT(NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial/Assignment	**TLM6**	GroupDiscussion/Project

PART-C

EVALUATIONPROCESS(R23 Regulation):

Evaluation Task	Marks
Day- To- Day Evalution	A=10
Record Evalution	B=5
Internal Exam	C=15
CumulativeInternalExamination(CIE):A+B+C	30
SemesterEndExamination(SEE)	70
TotalMarks =CIE+SEE	100

PART-D

PROGRAMMEOUTCOMES(POs):

PO1	**Engineeringknowledge:**Applytheknowledgeofmathematics,science,engineering fundamentals,andanengineeringspecializationtothesolutionofcomplexengineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesof mathematics,naturalsciences,andengineeringsciences.
PO3	**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 environmentalconsiderations.
PO4	**Conductinvestigationsofcomplexproblems:**Useresearch-basedknowledgeand researchmethodsincludingdesignofexperiments,analysisandinterpretationofdata, andsynthesisofthe informationtoprovidevalidconclusions.
PO5	**Moderntoolusage:**Create,select,andapplyappropriatetechniques,resources,and modernengineeringandITtoolsincludingpredictionandmodellingtocomplex engineering activities with an understanding of the limitations
PO6	**Theengineerandsociety:Apply**reasoninginformedbythecontextualknowledgeto assesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilities relevant to the professional engineering practice
PO7	**Environmentandsustainability:**Understandtheimpactoftheprofessionalengineering solutionsin societalandenvironmentalcontexts,anddemonstratethe knowledge of,and needforsustainabledevelopment.
PO8	**Ethics:**Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesand normsoftheengineeringpractice.
PO9	**Individualand team work:**Function effectively as anindividual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:**Communicateeffectivelyoncomplexengineeringactivitieswiththe engineering community and with society at large, such as, being able to
PO11	**Projectmanagementandfinance:**Demonstrateknowledgeandunderstandingofthe engineeringandmanagementprinciplesandapplythesetoone'sownwork, asamember andleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
PO12	**Life-longlearning:**Recognizetheneedfor,andhavethepreparationandabilitytoengage in independent and life-long learning in the broadest context of technological change.

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO1	TheabilitytoapplySoftwareEngineeringpracticesandstrategiesinsoftwareproject developmentusingopen-sourceprogrammingenvironmentforthesuccessoforganization.
PSO2	Theabilitytodesignanddevelopcomputerprogramsinnetworking,webapplicationsand IoT as per the society needs.
PSO3	Toinculcateanabilitytoanalyze,designandimplementdatabaseapplications.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of theFaculty	**Mr.Y.Babu**	**Mr. Y.Babu**	**Dr.D.V.Subbaiah**	**Dr.S.NagarjunaReddy**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Name of Course Instructor : Dr. G. Srinivasulu
Course Name & Code   :VLSI DESIGN– 23EC15
L-T-P Structure   : 3-0-0   Credits: 3
Program/Sem/Sec   : B.Tech., ECE., VI-Sem., Section- C   A.Y   : 2025-26

PRE-REQUISITE: EDC and STLD

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on IC Fabrication Technologies, basic electrical properties and scaling of MOS circuits. This course also gives a complete idea on analog IC design and also digital design of combinational and sequential logic circuit. This course also gives the complete information on FPGA design and an introduction to advanced technologies.

COURSE OUTCOMES (CO): At the end of the course, students will be able to

CO1:	Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
CO2:	Design basic building blocks in Analog IC design.
CO3:	Design various CMOS logic circuits for design of Combinational logic circuits.
CO4:	Analyze the behavior of static and dynamic logic circuits.

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	2	-	-	-	-	-	-	2	-	3	-
CO2	3	2	3	1	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
   1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1   Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell
     And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.

T2   Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH, 2007.

T3   Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, 2016.

BOS APPROVED REFERENCE BOOKS:

R1   Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons,
     reprint 2009.

R2   Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar
     Khanna, Springer India, 1st edition, 2016.

R3   FinFETs and other multi-gate transistors, Colinge JP, Editor New York, Springer, 2008.

COURSE DELIVERY PLAN (LESSON PLAN):
UNIT-I : INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	VLSI Design Flow, Introduction to IC technology	1	01.12.25			
2.	Fabrication process: nMOS.	1	02.12.25			
3.	Fabrication process: Pmos, CMOS	1	03.12.25			
4.	Ids versus Vds Relationships	1	08.12.25			
5.	Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit.	1	09.12.25			
6.	nMOS Inverter	1	10.12.25			
7.	Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter,	1	15.12.25			
8.	Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors.	1	16.12.25			
9.	Alternative forms of pull-up,The CMOS Inverter--**Flipped Class**	1	17.12.25			
10.	Latch-up in CMOS circuits, Bi- CMOS Inverter,	1	22.12.25			
11.	Comparison between CMOS and BiCMOS technology	1	23.12.25			
12.	MOS Layers, Stick Diagrams, Design Rules and Layout	1	24.12.25			
13.	Layout Diagrams for MOS circuits	1	29.12.25			
No. of classes required to complete UNIT-I :		13	No. of classes taken:			

UNIT-II :BASIC CIRCUIT CONCEPTS & SCALING OF MOS CIRCUITS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	BASIC CIRCUIT CONCEPTS: Sheet	1	30.12.25			

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	Resistance					
15.	Sheet Resistance concept applied to MOS transistors and Inverters,	1	31.01.26			
16.	Area Capacitance of Layers, Standard unit of capacitance	1	05.01.26			
17.	Some area Capacitance Calculations	1	06.01.26			
18.	The Delay Unit, Inverter Delays	1	07.01.26			
19.	Driving large capacitive loads	1	08.01.26			
20.	Propagation Delays, Wiring Capacitances, Choice of layers.	1	09.01.26			
21.	Scaling models and scaling factors— **Collaborative Learning**	1	19.01.26			
22.	Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents	1	20.01.26			
23.	Limits on logic levels and supply voltage due to noise and current density	1	21.01.26			
No. of classes required to complete UNIT-II		10	No. of classes taken:			

UNIT-III :BASIC BUILDING BLOCKS OF ANALOG IC DESIGN:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Regions of operation of MOSFET	1	02.02.26			
25.	Modelling of transistor, body bias effect—**Open ended Questions**	1	03.02.26			
26.	biasing styles	1	04.02.26			
27.	single stage amplifier with resistive load,	1	09.02.26			
28.	single stage amplifier with diode connected load	1	10.02.26			
29.	Common Source amplifier	1	11.02.26			
30.	Common Drain amplifier	1	16.02.26			
31.	Common Gate amplifier	1	17.02.26			

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Current sources and sinks.	1	21.02.26			
No. of classes required to complete UNIT-III		09	No. of classes taken:			

UNIT-IV :CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Static CMOS Design: Complementary CMOS,	1	22.02.26			
34.	Rationed Logic, Pass-Transistor Logic	1	23.02.26			
35.	design of Half adder, full adder, multiplexer, decoder— **Experimental Learning**	1	28.02.26			
36.	Dynamic CMOS Design**:** Dynamic Logic-Basic Principles,	1	02.03.26			
37.	Speed and Power Dissipation of Dynamic Logic	1	07.03.26			
38.	Issues in Dynamic Design	1	08.03.26			
39.	Cascading Dynamic Gates, Design examples of sequential circuits	1	09.03.26			
40.	Cross coupled NAND and NOR flip-flops,	1	14.03.26			
41.	D flip-flop, SR JK flip flop, SR Master Slave flip flop.	1	15.03.26			
No. of classes required to complete UNIT-IV		09	No. of classes taken:			

UNIT-V :FPGA DESIGN&INTRODUCTION TO ADVANCED TECHNOLOGIES:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	FPGA design flow, Basic FPGA architecture	1	16.03.26			
44.	FPGA Technologies	1	23.03.26			
45.	Introduction to FPGA Families	1	24.03.26			
46.	Giga-scale dilemma	1	25.03.26			
47.	Short channel effects—**Peer Teaching**	1	30.03.26			
48.	High–k, Metal Gate Technology,	1	31.04.26			
49.	FinFET, TFET	1	03.04.26			

No. of classes required to complete UNIT-V:	07	No. of classes taken:	

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
50.	Introduction to gate-all-around FET(GAA FET)	1	04.04.26			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

Evaluation Task	Marks
Assignment-I (Units-I, II)	**A1=5**
I-Descriptive Examination (Units-I, II)	**M1=15**
I-Quiz Examination (Units-I, II)	**Q1=10**
Assignment-II (Unit-III ,IV & V)	**A2=5**
II- Descriptive Examination (UNIT-III , IV & V)	**M2=15**
II-Quiz Examination (UNIT-III,IV & V)	**Q2=10**
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	**30**
Semester End Examination (SEE)(Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	**70**
Total Marks = CIE + SEE	**100**

PART-D

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

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 modelling 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: **Ethic**s: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: **Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

PSO 2: **VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools

PSO 3: **Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. G. Srinivasulu	Dr. G. Srinivasulu	Dr. P Lachi Reddy	Dr.G.Srinivasulu

Course Name & Code   : Microprocessors and Microcontrollers- 23EC16
L-T-P Structure   : 3-0-0
Credits   : 3
Program   : B.Tech.,
A.Y   : 2025 – 26
Course Instructor   : D r B V N R Siva Kumar Associate Professor

Prerequisite:

Course Educational Objective: The objective is the course to provide fundamentals about architecture and functioning of microprocessors, microcontrollers, and ARM processors. It enables to analyze operating modes and interrupt systems, apply assembly language for programming, interfacing and design real-time solutions using various modules with advanced processors. The objective is to prepare students for embedded system design, automation, and IoT-based applications.

CourseOutcomes (COs): At the end of the course, students are able to:

CO 1	Understand the architecture of Microprocessor, Micro controllers and Advanced processors. **(L2)**
CO 2	Applying Assembler instructions of Processors & Controllers to interface with necessary peripherals.**(L3)**
CO 3	Analyze the various operating modes and interrupt structures of processors and controllers **(L4)**
CO 4	Create interfacing of various Modules with microprocessors and microcontrollers.**(L4)**

CO's / PO's								Course Name with code : MPMC 23EC16						
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1 3	2	1	1	1	-	-	-	-	-	-	2	-	3	-
CO2 3	3	2	1	3	-	-	-	-	-	-	2	-	3	-
CO3 3	3	2	2	3	-	-	-	-	-	-	2	-	3	-
CO4 3	2	3	2	3	-	-	-	-	-	-	2	-	3	-

COURSEDELIVERYPLAN(LESSON PLAN):VISem,ASection

S.No.	Topicstobecovered	No.ofClasses Required	Tentative Dateof Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
	UNIT-I& 2:8086MICROPROCESSOR[14 HRS]					
1.	1-20 bits table. Introduction	1	03-12-2025		**TLM 1**	
2.	Registerorganization, Addressing modes	1	04-12-2025		**TLM 1**	
3.	Data Transfer Instructions, ALP	1	11-12-2025		**TLM 1**	
4.	Arithmetic Instructions, ALP	1	12-12-2025		**TLM 1**	
5.	Logical Instructions, ALP	1	16-12-2025		**TLM 1**	
6.	Flags, Instructions	1	17-12-2025		**TLM 1**	
7.	Instructions	1	18-12-2025		**TLM 1**	
8.	Addressingmodes	1	19-12-2025		**TLM 1**	
9.	ALP s	1	23-12-2025		**TLM 1**	
10.	Architecture	1	24-12-2025		**TLM 1**	
11.	Instructions, ALP	1	26-12-2025		**TLM 1**	
11.	PinFunctionality	1	30-12-2025		**TLM 1**	
12.	Minimummode	1	31-12-2025		**TLM 1**	
13.	Timing Diagrams	1	01-01-2026		**TLM 1**	
14.	DAC Interfacing	1	02-01-2026		**TLM 1**	
15.	Pin functionality	1	06-01-2026		**TLM 1**	
16.	Interrupts	1	07-01-2026		**TLM 1**	
17.	Interruptvectortable	1	08-01-2026		**TLM 1**	
18.	Stepper motor interfacing	1	09-01-2026		**TLM 1**	
19.	History & Classification, μp &μc	1	20-01-2026		**TLM 1**	
20.	Assembler Directives	1	21-01-2026		**TLM 1**	
21.	Maximum mode	1	22-01-2026		**TLM 1**	
22.	Seven segment Display Interface	1	23-01-2026		**TLM 1**	

S.No.	Topicstobecovered	No.ofClasses Required	Tentative Dateof Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
	UNIT–III:8086 INTERFACING[8HRS]					
23.	RAM & ROM Interfacing	1	03-02-2026		**TLM 1**	
24.	8255 PPI. Modes	1	04-02-2026		**TLM 1**	
25.	8251 USART Working & Interfacing	1	05-02-2026		**TLM 1**	
26.	DMAC	1	06-02-2026		**TLM 1**	
27.	ADC	1	10-02-2026		**TLM 1**	
28.	8259 PIC	1	11-02-2026		**TLM 1**	
29.	PROGRAMMING OF 8259	1	12-02-2026		**TLM 1**	

	UNIT- IV: 8051MICROCONTROLLER& INTERFACING [7HRS]					
S.No.	Topicstobecovered	No.of Classes Required	Tentative Date ofCompletion	Actual Date ofCompletion	Teaching Learning Methods	HOD Sign Weekly
30	Architecture, Registers, Flags, I/O Parts	1	13-02-2026		TLM 1	
31.	Memory Map, SFRs,	1	17-02-2026		TLM 1	
32.	Addressingmodes, Instructions, ALP	1	18-02-2026		TLM 1	
33.	Instructions, ALP	1	19-02-2026		TLM 1	
34.	CounterandTimers	1	20-02-2026		TLM 1	
35	Serialport,Interrupts	1	24-02-2026		TLM 1	
36.	Memory Intefacing	1	25-02-2026		TLM 1	
37.	LCD Interfacing	1	26-02-2026			
38.	Traffic Light Control	1	27-02-2026			
39.	REVISION	1	03-03-2026			

	UNIT–IV: ARMARCHITECTURE&PROGRAMMINGMODEL[10HRS]					
S.No.	Topicstobecovered	No.of Classes Required	Tentative Date ofCompletion	Actual Date ofCompletion	Teaching Learning Methods	HOD Sign Weekly
40.	Introduction to CISC and RISC architectures		04-03-2026		TLM 1	
41.	ARM design philosophy, Families		05-03-2026		TLM 1	
42.	Registers, Program status register		11-03-2026		TLM 1	
43.	Instruction pipeline		12-03-2026		TLM 2	
44.	Interrupts and Interrupt vector table of ARM	1	17-03-2026			
45.	Addressing modes	1	18-03-2026			
46.	Data processing instructions	1	19-03-2026			
47.	Branch, Load-Store instructions, Multiple Register	1	20-03-2026		TLM 2	
48.	PSR instructions and Conditional instructions	1	24-03-2026		TLM 1	
49.	programs on arithmetic, logical and bitwise operations	1	25-03-2026		TLM 1	
50.	programs using branch instructions	1	27-03-2026		TLM 1	
51.	programs using branch instructions	1	31-03-2026		TLM 1	
52.	REVISION		01-04-2026			

	BEYONDTHESYLLABUS&REVISION [8HRS]					
S.No.	**Topicstobecovered**	**No.ofClassesRequired**	**TentativeDateofCompletion**	**ActualDateofCompletion**	**Teaching Learning Methods**	**HOD Sign Weekly**
53	MSP430 Features	1	02-04-2026		TLM 2	

TeachingLearningMethods			
TLM1	ChalkandTalk	**TLM4**	Demonstration(Lab/FieldVisit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/MOOCS)
TLM3	Tutorial	**TLM6**	GroupDiscussion/Project

PART–C
Academic Calendar: 2025 – 26(VI Semester)

B.Tech VI Semester – 2023 Admitted Batch			
Class work Commence From	**01-12-2025**		
Description	**From**	**From**	**From**
IPhaseofInstructions	01-12-2025	01-12-2025	01-12-2025
IMidExaminations	26-01-2026	26-01-2026	26-01-2026
IIPhaseInstructions	02-02-2026	02-02-2026	02-02-2026
IIMidExaminations	06-04-2026	06-04-2026	06-04-2026
Preparation & Practicals	13-04-2026	13-04-2026	13-04-2026
SemesterEndExaminations	20-04-2026	20-04-2026	20-04-2026
Internship	04-05-2026	04-05-2026	04-05-2026

EVALUATIONPROCESS:

EvaluationTask	**Marks**
Assignment-I(Units-I,II&UNIT-III-HalfoftheSyllabus)	A1=5
I-DescriptiveExamination(Units-I,II&UNIT-III-HalfoftheSyllabus)	M1=15
I-QuizExamination(Units-I,II&UNIT-III-HalfoftheSyllabus)	Q1=10
Assignment-II(Unit-III (Remaining HalfoftheSyllabus),IV&V)	A2=5
II-DescriptiveExamination(UNIT-III(RemainingHalfoftheSyllabus),IV &V)	M2=15
II-QuizExamination(UNIT-III(Remaining HalfoftheSyllabus),IV&V)	Q2=10
CumulativeInternalExamination(CIE) 80%ofMax((M1+Q1+A1) ,(M2+Q2+A2)) +20%ofMin((M1+Q1+A1) ,(M2+Q2+A2))	30
SemesterEndExamination(SEE)(Unit-I,Unit–II, Unit–III, Unit-IVandUnit-V)	70
TotalMarks=CIE+SEE	**100**

PART–D

PROGRAMMEOUTCOMES (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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuitsor systems and Implement real time applications in the field of VLSI and Embedded Systemsusingrelevanttools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. BVNR. Siva Kumar]	[Dr.Y.AMARBABU]	[Dr.P.LACHIREDDY]	[Dr. G. SRINIVASULU]

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NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

Date:

PART-A

Name of Course Instructor	: Mr.V.V.Rama Krishna
Course Name & Code	: Digital Signal Processing-23EC17
L-T-P Structure	: 3-0-0 Credits : 3
Program/Sem/Sec	: B.Tech, ECE, VI-Sem-B-Section A.Y : 2025-26
PRE-REQUISITE	**:** Signals & Systems.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course introduces discrete time signals and systems and operations performed on them. It introduces Discrete time Fourier Transform; Discrete Fourier transform meant for spectral analysis of discrete time signals and systems. It also introduces Fast Fourier Transform which is an efficient way of implementing DFT. The course also provides the basic knowledge about the design of both IIR and FIR filters. It also provides a overview about the architectures of Digital signal Processors.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand the concepts of discrete time signals and systems in time domain (L2- Understand)
CO 2	Examine the frequency domain representation of discrete time signals (L3-Apply)
CO 3	Design and realization of IIR Filters and FIR Filters (L3-Apply)
CO 4	Interpret the architectures of digital signal processors

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2	-	-	3
CO4	2	1	1	1	-	-	-	-	-	-	-	3	-	-	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
   1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

T1 John G. Proakis, Dimitris G. Manolakis "Digital Signal Processing, Principles, Algorithms & Applications", Pearson education, 4 th edition, 2008

T2 Deep Learning for Computer Architects, Brandon Reagen, Robert Adolf, Gu-Yeon Wei, David Brooks

REFERENCE BOOKS:

R1 Alan V Openheim, Ronald W. Schafer, "Digital Signal Processing", PHI learning, 1 st edition, 2010

R2 A. Nagoor Kani, "Digital Signal Processing", RBA Publications, 1st edition, 2005.

R3 P. Ramesh Babu, "Digital Signal Processing", Scitech Publications, 4 th edition, 2012 Pvt Ltd.

R4 Anand kumar, "Digital Signal Processing", PHI Learning, 2 nd edition, 2016

PART-B
COURSE DELIVERY PLAN (LESSON PLAN):
UNIT-I: Discrete Time Signals & Discrete Time Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Objectives and Outcomes	**1**	02-12-2025		TLM1	
1.	Discrete Time Signals	1	04-12-2025		TLM1	
2.	Classification of Discrete Time Systems: Linear and Nonlinear, Shift Invariant and Variant	1	06-12-2025		TLM1	
3.	Causal and Non Causal, Stable and Unstable, static and dynamic, IIR and FIR systems	1	09-12-2025		TLM1	
4.	Analysis of Discrete Time Linear Time Invariant Systems	1	11-12-2025		TLM1	
5.	Discrete Time Systems Described by Difference Equations	1	13-12-2025		TLM1	
6.	Implementation of Discrete Time Systems	1	16-12-2025		TLM1	
7.	Convolution and Correlation of Discrete Time Signals.- **Simulation-Driven Learning**	1	18-12-2025		TLM4	
8.	DTFT of a Sequence, Frequency Response Properties of DTFT	1	20-12-2025		TLM1	
9.	Linear, Periodicity, Time Shifting, Frequency Shifting,	1	27-12-2025		TLM1	
10.	Time Reversal, Conjugate and Parseval's Theorem	1	30-12-2025		TLM1	
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: Discrete Fourier Transform

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	DFT of a sequence, Relation between DTFT and DFT.	1	01-01-2026		TLM1	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
2.	Properties of Twiddle factor, Properties of DFT-Linearity, Periodicity, Time Shifting, Frequency Shifting, Time Reversal,	1	03-01-2026		TLM1	
3.	differentiation in frequency domain, Conjugate, Parseval's 1Theorem,	1	06-01-2026		TLM1	
4.	Circular Convolution	1	08-01-2026		TLM1	
5.	Linear Convolution through DFT and IDFT	1	10-01-2026		TLM1	
6.	Fast Fourier Transform: Need for FFT-**Flipped Classroom for Derivations**	1	13-01-2026		TLM5	
7.	Radix-2 Decimation in Time FFT Algorithm,	1	15-01-2026		TLM1	
8.	Radix-2 Decimation in Frequency FFT Algorithm,	1	17-01-2026		TLM1	
9.	Comparison between DIT and DIF Algorithms,	1	20-01-2026		TLM1	
10.	Inverse FFT.	1	22-01-2026		TLM1	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: Realization of Discrete Time Systems & IIR Filters

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Structures for FIR and IIR Systems	1	24-01-2026		TLM1	
2.	Direct Form Structure	1	03-02-2026		TLM1	
3.	Cascade Form Structures, Parallel Form Structures.	1	05-02-2026		TLM1	
4.	Design of IIR digital filters - Impulse Invariant Transformation	1	07-02-2026		TLM1	
5.	Bilinear Transformation	1	10-02-2026		TLM1	
6.	Design of Low Pass Butterworth Filter	1	12-02-2026		TLM1	
7.	Design of Low Pass Butterworth Filter	1	14-02-2026		TLM1	
8.	Chebyshev Filter	1	17-02-2026		TLM1	
9.	Chebyshev Filter	1	19-02-2026		TLM1	
10.	Analog Frequency Transformations	1	21-02-2026		TLM1	
No. of classes required to complete UNIT-III: 10				No. of classes taken:		

UNIT-IV : FIR Filters

S.No.	Topics to be covered	No. of Classes	Tentative Date of	Actual Date of	Teaching Learning	HOD Sign

		Required	Completion	Completion	Methods	Weekly
1.	Symmetric FIR Filters	1	24-02-2026		TLM1	
2.	Ant symmetric FIR Filters	1	26-02-2026		TLM1	
3.	Design of Linear Phase FIR Filters	1	28-02-2026		TLM1	
4.	Rectangular Window, Triangular, Hanning	1	03-03-2026		TLM1	
5.	Hamming Window and Kaiser Window	1	05-03-2026		TLM1	
6.	Comparison of various Window Functions- **Lab-in-Class Approach**	1	07-03-2026		TLM4	
7.	Design of Linear Phase FIR Filters by the Frequency Sampling Method	1	10-03-2026		TLM1	
8.	Comparison between FIR and IIR Filters.	1	12-03-2026		TLM1	
No. of classes required to complete UNIT-IV: 8				No. of classes taken:		

UNIT-V : Introduction to programmable DSPs Architecture of TMS320C5X

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Multiplier and Multiplier Accumulator	1	14-03-2026		TLM1	
2.	Modified bus structures and memory access schemes in P-DSPs	1	17-03-2026		TLM1	
3.	Multiple Access Memory, Multi ported memory,	1	19-03-2026		TLM1	
4.	VLIW architecture,	1	21-03-2026		TLM1	
5.	Pipelining, Special addressing modes	1	24-03-2026		TLM1	
6.	On-Chip Peripherals	1	26-03-2026		TLM1	
7.	Bus Structure, Central Arithmetic Logic Unit	1	28-03-2026		TLM1	
8.	Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit -**Real-Time DSP Demonstrations (Hardware-Based)**	1	31-03-2026		TLM4	
9.	Memory mapped registers, program controller	1	02-04-2026		TLM1	
10.	Some flags in the status registers.	1	04-04-2026		TLM1	
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Multirate signal Processing		04-04-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
V V Ramakrishna	Mr. M.Siva Sankara Rao	Dr.M.G.L.N.Murthy	Dr.G.Srinivasulu

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–C
Academic Year	: 2025-26
Course Name & Code	: Satellite Communication– 23EC19
L-T-P-Cr	: 3-0-0-3
Course Instructure	: Dr. M. V. Sudhakar

Course Objective:

This course provides the technical knowledge of orbital dynamics, launching of satellite in to the orbit, various subsystems used in space segment, uplink and downlink aspects of satellite. This course will also give an idea about different multiple access techniques, design requirements for the selection of earth station and various real time applications.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Understand the basic principles, orbital mechanics, launch vehicles, and subsystems involved in satellite communication systems. (Understand – L2)
CO 2	Apply satellite link design principles including link budget equations, C/N and G/T ratios, to evaluate overall system performance. (Apply – L3)
CO 3	Summarize the concepts of multiple access techniques (FDMA, TDMA, CDMA) and analyze the components and architecture of earth stations. (Understand – L2)
CO 4	Describe the structure, operation, and applications of GNSS systems including GPS and IRNSS, and analyze their role in satellite-based navigation (Understand – L2)

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO 3	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 4	1	2	1	-	-	-	-	-	-	-	-	1	2	-	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: **'-'**

Textbooks (T) and References (R):

T1: Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications",WSE, Wiley Publications, 3RD Edition, 2020.

T2: Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, "Satellite Communications Engineering", Pearson Publications, 2nd Edition, 2003.

R1: M. Richharia, "Satellite Communications: Design Principles", BS Publications, 2nd Edition, 2003.

R2: D.C Agarwal, "Satellite Communication", Khanna Publications, 5th Ed.

R3: K.N. Raja Rao, "Fundamentals of Satellite Communications" PHI, 2004

R4: Dennis Roddy, "Satellite Communications", McGraw Hill, 2nd Edition, 1996.

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Introduction, Orbital Mechanics and Launchers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Origin of Satellite Communications	1	03-12-2025			
2.	Historical Back-ground	1	04-12-2025			
3.	Basic Concepts of Satellite Communications	1	06-12-2025			
4.	Frequency allocations for Satellite Services	1	10-12-2025			
5.	Applications of Satellite Communications	1	11-12-2025			
6.	Future Trends of Satellite Communications	1	13-12-2025			
7.	Orbital Mechanics	1	17-12-2025			
8.	Look Angle determination	1	18-12-2025			
9.	Orbital perturbations, Orbit determination	1	20-12-2025			
10.	**Launches and launch vehicles; Activity : flipped class.**	1	24-12-2025			
11.	Orbital effects in communication systems performance	1	27-12-2025			
12.	Revision	1	31-12-2025			
No. of classes required to complete UNIT-I: 12			**No. of classes taken:**			

UNIT-II: Satellite Subsystems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Attitude and orbit control system	1	01-01-2026			
2.	Telemetry	1	03-01-2026			
3.	Tracking	1	07-01-2026			
4.	Command and monitoring system	1	08-01-2026			
5.	Power systems	1	10-01-2026			
6.	Communication subsystems	1	15-01-2026			
7.	**Satellite antennas; Activity : Case study.**	1	17-01-2026			
8.	Equipment reliability	1	21-01-2026			
9.	Space qualification	1	22-01-2026			
10.	Revision	1	24-01-2026			
No. of classes required to complete UNIT-II: 11			**No. of classes taken:**			

UNIT-III: Satellite Link Design

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Basic transmission theory, link equation	1	04-02-2026			
2.	C/N ratio, system noise temperature and G/T ratio	1	05-02-2026			
3.	Design of down links	1	07-02-2026			
4.	Uplink design	1	11-02-2026			
5.	**Design of satellite links for specified C/N; Activity : Problem Based Learning.**	1	12-02-2026			
6.	System design example	1	14-02-2026			
No. of classes required to complete UNIT-III: 06			**No. of classes taken:**			

UNIT-IV: Multiple Access, Earth Station Technology

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Frequency division multiple access (FDMA): Intermodulation, Calculation of C/N	1	18-02-2026			
2.	Time division Multiple Access (TDMA); Frame structure, Examples	1	21-02-2026			
3.	Code Division Multiple access (CDMA): Spread spectrum transmission and reception	1	25-02-2026			
4.	Introduction, basic architecture of earth station technology	1	26-02-2026			
5.	Transmitters, Receivers, Antennas	1	28-02-2026			
6.	**Tracking systems, Terrestrial interface; Activity : Debate.**	1	05-03-2026			
7.	Primary power test methods	1	07-03-2026			
No. of classes required to complete UNIT-IV: 07			**No. of classes taken:**			

UNIT-V: Low Earth Orbit and Geo-Stationary Satellite Systems, Global Navigation Satellite System (GNSS)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	LSO and GSO Orbit consideration, coverage and frequency considerations	1	11-03-2026			
2.	Delay & Throughput considerations	1	12-03-2026			
3.	System considerations, Operational NGSO Constellation designs.	1	14-03-2026			
4.	**GNSS Introduction, various GNSS: GPS, GLONASS, GALILEO; Activity : Quiz.**	1	18-03-2026			
5.	BeiDou, QZSS, IRNSS. GPS-location principle, GPS navigation message	1	25-03-2026			
6.	GPS receiver operation, differential GPS; IRNSS-introduction	1	26-03-2026			
7.	IRNSS satellites, IRNSS constellation	1	28-03-2026			
8.	IRNSS configuration, IRNSS services	1	01-04-2026			
9.	Navigation data, applications of IRNSS , Multi GNSS	1	02-04-2026			
No. of classes required to complete UNIT-V: 09			**No. of classes taken**			

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study on latest Indian Satellite Launching and Services	1	04-04-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	TLM 6	Assignment or Quiz
TLM 2	PPT	TLM 7	Seminar or GD
TLM 3	Tutorial	TLM 8	Lab
TLM 4	Problem Solving	TLM 9	Case Study

TLM 5	Programming	TLM 10	Others

PART-C:
Evaluation Process (R23)

Evaluation Task	Marks
Assignment-I (Unit-I & Unit-II)	A1=5
I-Descriptive Examination (Units-I & Unit-II)	M1=15
I-Quiz Examination (Unit-I & Unit-II)	Q1=10
Assignment-II (Unit-III, Unit-IV & Unit-V)	A2=5
II- Descriptive Examination (Unit-III, Unit-IV & Unit-V)	M2=15
II-Quiz Examination (Unit-III, Unit-IV & Unit-V)	Q2=10
Cumulative Internal Examination (CIE) $=80\%$ of $\text{Max}((M1+Q1+A1), (M2+Q2+A2)) +20\%$ of $\text{Min}((M1+Q1+A1), (M2+Q2+A2))$	**30**
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	**70**
Total Marks = CIE + SEE	**100**

PART-D:
Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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 modelling 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:	**Ethic**s: 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor   Course Coordinator   Module Coordinator   HOD

Dr. M.V.Sudhakar   Mrs.M.V.L.Bhavani   Dr. M. V. Sudhakar   Dr. G. Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific & Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Name of Course Instructor   : Mr. T. Anil Raju

Course Name & Code   : Embedded System

L-T-P Structure   : 3-0-0   Credits : 3

Program/Sem/Sec   : B.Tech., ECE., VI-Sem., Section- C   A.Y   : 2025-26

COURSE OBJECTIVE: This course provides the fundamental concepts of Image Processing.
Image enhancement which is the most prominent preprocessing step will be learnt in both time and spectral domain. The course also gives the basics of color image fundamentals and knowledge about compression as well as segmentation.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO1	**Understand the basics of embedded system, classification, memories, different communication interfaces and embedded firmware and its role in embedded system.**
CO2	**Demonstrate all communication devices in embedded system, and peripheral devices.**
CO3	**Distinguish concepts of C versus embedded C and compiler versus cross-compiler.**
CO4	**Choose an operating system, and learn how to choose an RTOS**

COURSE ARTICULATION MATRIX (Correlation between COs &POs, PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															

 Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
 1-Slight(Low),   **2-**Moderate(Medium),   **3-**Substantial (High).

TEXT BOOKS:

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications,2005
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications.

REFERENCE BOOKS:
1. Embedding system building blocks By Labrosse, CMP publishers.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section C

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded System, History, Classification,	1	01.12.2025			
2.	Application areas & Purpose	1	03.12.2025			
3.	Typical and Core embedded system	1	04.12.2025			
4.	Memory, Sensors and Actuators	1	08.12.2025			
5.	Communication Interface	1	10.12.2025			
6.	Embedded firmware	1	11.12.2025			
7.	**PCB and passive components Activity : Flipped class.**	1	15.12.2025			
8.	Characteristics, Quality attributes	1	17.12.2025			
9.	Application-specific and Domain-Specific	1	18.12.2025			
10.	Main processing elements	1	22.12.2025			
11.	Hardware and software partitions.		24.12.2025			
No. of classes required to complete UNIT-I		**10**	No. of classes taken			

UNIT-II: Embedded Hardware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analog and digital electronic components	1	29.12.2025			
2.	I/O types and examples	1	31.12.2025			
3.	Serial communication devices	1	05.01.2026			
4.	Parallel device ports	1	07.01.2026			
5.	**Timer and counting devices Activity : Case study**	1	08.01.2026			
6.	Watch dog timer,Real time clock	1	19.01.2026			
7.	Timer and counting devices	1	21.01.2026			
8.	Watch dog timer	1	22.01.2026			
No. of classes required to complete UNIT-I		**08**	No. of classes taken			

UNIT-III: Embedded Firmware Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Embedded Firmware design	1	02.02.2026			
2.	Embedded Firmware development languages	1	04.02.2026			
3.	**ISR concept, Interrupt sources Activity : Quiz**	1	05.02.2026			
4.	Interrupt servicing mechanism, Multiple interrupts	1	09.02.2026			
5.	DMA, Device driver programming	1	11.02.2026			
6.	Concepts of C versus Embedded C	1	12.02.2026			
7.	Compiler versus Cross-compiler	1	16.02.2026			
No. of classes required to complete UNIT-III:**08**				No. of classes taken		

UNIT-IV: Real Time Operating System & Hardware Software Co-Design:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System Basics and Types	1	18.02.2026			
2.	Tasks, Process and Threads	1	19.02.2026			
3.	Multiprocessing and Multitasking	1	23.02.2026			
4.	Threads, Processes and Scheduling, Task Scheduling , Communication	1	25.02.2026			
5.	**Synchronisation, Device Drivers, RTOS.** **Activity : Problem Based Learning**	1	26.02.2026			
6.	Fundamental Issues in Hardware Software Co-Design	1	02.03.2026			
7.	Computational models in embedded design	1	04.03.2026			
8.	Integration of Hardware and Firmware, ICE.	1	05.03.2026			
No. of classes required to complete UNIT-IV:**08**				No. of classes taken		

UNIT-V: Embedded System Development, Implementation and Testing

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	The integrated development environment	1	09.03.2026			
2.	Types of files generated on cross-compilation, Dissembler/De-compiler, Simulators	1	11.03.2026			
3.	Emulators and Debugging, Target hardware debugging	1	12.03.2026			
4.	Boundary Scan, Embedded Software development process and tools	1	16.03.2026			
5.	**The main software utility tool, CAD and the hardware Activity : Debate**	1	18.03.2026			
6.	Translation tools-Pre-processors	1	19.03.2026			
7.	Interpreters, Compilers and Linkers, Debugging tools	1	23.03.2026			
8.	Quality assurance and testing of the design	1	25.03.2026			
9.	Testing on host-machine	1	26.03.2026			
10.	Simulators, Laboratory Tools	1	30.03.2026			
11.	Test and evolution of an embedded systems	1	01.04.2026			
No. of classes required to complete UNIT-V	**08**		No. of classes taken			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case study-typical embedded system design flow	1	02.04.2026			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	01.12.2025	24.01.2026	8 W
I Mid Examinations	31.01.2026	31.01.2026	1 W
II Phase of Instructions	02.02.2026	04.04.2026	9 W
II Mid Examinations	06.04.2026	11.04.2026	1 W
Preparation and Practical's	13.04.2026	18.04.2026	1 W
Semester End Examinations	20.04.2026	02.05.2026	2 W
Internship	04.05.2026	27.06.2026	8 W

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) = 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Mr T Anil Raju	Mr T Anil Raju	Dr P. Lachi Reddy	Dr. G Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade NIRF- 2022 (Positioned in the Band of 251-300 in the Engineering Category)NIRF- 2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

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COURSE HANDOUT

PART-A:

Program	: B.Tech. VI-Sem., ECE., Section–C
Academic Year	: 2025-26
Course Name & Code	: VLSI Design Lab – 23EC59
L-T-P-Cr	: 0-0-3-1.5
Course Instructure	: Mrs.T.Kalpana, Mr.CH. MallikharjunaRao

Course Objectives: The objective of this laboratory course is to enable students to design, simulate, and implement CMOS-based digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools. Students are expected to develop a comprehensive understanding of schematic capture, layout design, and verification methodologies as per current CMOS technology standards.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	Implement combinational and sequential circuits in Verilog	L3
CO 2	Design the Combinational and Sequential logic using NMOS and CMOS Technology	L3
CO 3	Analyze combinational and sequential circuits using Static CMOS logic from schematic to layout	L4
CO 4	Adapt effective communication, presentation and report writing skills.	L3

Course Articulation Matrix - Correlation between COs, POs & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	3	1	3	-	-	-	-	-	-	2	-	3	-
CO 2	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	2	-	3	-
CO 4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: '**-**'

PART-B: COURSE DELIVERY PLAN (LESSON PLAN):

S.No	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Cadence EDA tool	3	01.12.2025		TLM4	
2.	Introduction to Vivado/Cadence/ Mentor Graphics/EDA tool	3	08.12.2025		TLM4	
3.	Design and implementation of an inverter	3	15.12.2025		TLM4	
4.	Design and implementation of universal gates	3	22.12.2025		TLM4	
5.	Design and implementation of full adder	3	29.12.2025		TLM4	
6.	Design and implementation of full Subtractor	3	05.01.2026		TLM4	
7.	Design and implementation of RS-latch	3	19.01.2026		TLM4	
8.	Makeup Lab	3	02.02.2026		TLM4	
9.	Design and implementation of D-latch	3	09.02.2026		TLM4	
10.	Design and implementation asynchronous counter	3	16.02.2026		TLM4	
11.	Design and Implementation of static RAM cell	3	23.02.2026		TLM4	
12.	Design and Implementation of differential amplifier	3	02.03.2026		TLM4	
13.	Design and Implementation of ring oscillator	3	09.03.2026		TLM4	
14.	Design and Implementation of ring oscillator	3	16.03.2026		TLM4	
15.	Makeup-Lab	3	23.03.2026		TLM4	
16.	Internal Lab Examination	3	30.03.2026		TLM4	
No. of classes required:				**No. of classes taken:**		

PART-B: COURSE DELIVERY PLAN (LESSON PLAN):

S.No	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Cadence EDA tool	3	5.12.2025		TLM4	
2	Introduction to Vivado/Cadence/ Mentor Graphics/EDA tool	3	12.12.2025		TLM4	
3	Design and implementation of an inverter	3	19.12.2025		TLM4	
4	Design and implementation of universal gates	3	26.12.2025		TLM4	
5	Design and implementation of full adder	3	2.1.2026		TLM4	
6	Design and implementation of full Subtractor	3	9.1.2026		TLM4	
7	Design and implementation of RS-latch	3	23.1.2026		TLM4	
8	Makeup Lab	3	6.2.2026		TLM4	
9	Design and implementation of D-latch	3	13.2.2026		TLM4	
10	Design and implementation asynchronous counter	3	20.2.2026		TLM4	
11	Design and Implementation of static RAM cell	3	27.2.2026		TLM4	
12	Design and Implementation of differential amplifier	3	6.3.2026		TLM4	
13	Design and Implementation of ring oscillator	3	13.3.2026		TLM4	
14	Design and Implementation of ring oscillator	3	20.3.2026		TLM4	
15	Makeup-Lab	3	27.3.2026		TLM4	
16	Internal Lab Examination	3	3.4.2026		TLM4	
No. of classes required:				**No. of classes taken:**		

Teaching Learning Methods

TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work	1,2,3,4,5,6,7,8…	A1 =10
Record and observation	1,2,3,4,5,6,7,8…	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8…	**C1=15**
Cumulative Internal Examination (CIE):(A1+B1+C1)	1,2,3,4,5,6,7,8…	**30**
Semester End Examination (SEE)	1,2,3,4,5,6,7,8…	**70**
Total Marks=CIE+SEE		**100**

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO 2:	To Function professionally in the rapidly changing world with advances in technology.
PEO 3:	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO 4:	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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 modelling 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:	**Ethic**s: 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.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits orsystems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.CH.Mallikharjuna Rao Mrs.T.Kalpana	Dr.K.Ranirudramma	Dr. P.Lachi Reddy	Dr. G.Srinivasulu

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSEHANDOUT

PART-A

CourseName &Code	:Microprocessors and Microcontrollers Lab – 23EC60
L-T-PStructure	:0-0-3
Credits	:3
Program	:B.Tech.VI Semester ECE- C Section
A.Y	**:2025 – 26**
CourseInstructor	:Dr.B.V.N.R. Siva Kumar

COURSE OBJECTIVE:

The lab to provide hands-on experience with microprocessors, microcontrollers, and ARM-based systems. It aims to understand instruction sets, programming techniques, and hardware interfacing. This equip students with practical skills in peripheral interfacing, sensor integration, and embedded system development through real-time applications, preparing them for careers in embedded systems and automation.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the MASM / TASM tool for developing Assembly Language Programs.
CO2	Apply the Assembly Language instructions of Processor and Controller for logical operations.
CO3	Develop the ARM based interfacing systems for Real time applications.
CO4	Adapt effective communication, presentation and report writing skills.

COURSEARTICULATIONMATRIX(Correlation between Cos & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	2	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: Enter CorrelationLevels:**1** or**2**or**3.**
If there is no correlation: **put 1-**Slight(Low), **2-**Moderate(Medium), **3-**Substantial(High).

PART-B
LABSCHEDULE(LESSONPLAN): Section-C

LISTOF EXPERIMENTS   (Minimum12Experiments to be conducted) MONDAY

S. No.	Experimentstobeconducted	No. ofClasses Required	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
			CYCLE-1			
1.	Introduction to Lab	3	01- 12- 2025		**TLM2**	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n- BCD numbers	3	08-12-2025		**TLM8**	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	15-12-2025		**TLM8**	
4.	Interfacing Of DAC	3	22-12-2025		**TLM8**	
5.	Interfacing of Stepper Motor	3	29-12-2025		**TLM8**	
6.	Interfacing of Seven segment Display	3	05-01-2026		**TLM8**	
7.	Review of 8086 based Experiments	3	19-01-2026		**TLM8**	
			CYCLE-2			
8.	8051-ADD, SUB, Series, MUL & DIV		02-02-2026			
9.	8051 - 1&0, Average, Odd & Even	3	09-02-2026		**TLM8**	
10.	8051-InterfacingoftrafficLightcontroller	3	16-02-2026		**TLM8**	
11.	8051- Interfacing LM 35	3	23-02-2026		**TLM8**	
12.	Review of 8051 based Experiments		02-02-2026			
13.	ARM- MUL, SUM	3	09-03-2026		**TLM8**	
14.	ARM- Toggle LED, Running Lights	3	16-03-2026		**TLM8**	
15.	ARM – Revision	3	23-03-2026		**TLM8**	
16.	Internal LabExam	3	30-03-2026		**TLM8**	
No.ofclasses requiredtocomplete:		48	No. ofclassesconducted:			

LISTOF EXPERIMENTS   (Minimum12Experimentstobeconducted) **FRIDAY**

S. No.	Experimentstobeconducted	No. ofClasses Required	TentativeD ate ofCompleti on	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
1.	Introduction to Lab	3	05-12-2025		**TLM2**	
2.	(a) Addition of an Array of numbers (b) Addition & Subtraction of n- BCD numbers	3	12-12-2025 19 -12-2025		**TLM8**	
3.	(a) Multiplication and Division (b) Sorting an Array (c) Factorial of n Numbers	3	26 -12-2025		**TLM8**	
4.	Interfacing Of DAC	3	02-01-2026		**TLM8**	
5.	Interfacing of Stepper Motor	3	09-01-2026		**TLM8**	
6.	Interfacing of Seven segment Display	3	16-01-2026		**TLM8**	
7.	Review of 8086 based Experiments	3	23-01-2026		**TLM8**	
	CYCLE-2					
8.	8051-ADD, SUB, Series, MUL & DIV	3	06-02-2026		**TLM8**	
9.	8051 - 1&0, Average, Odd & Even	3	13-02-2026		**TLM8**	
10.	8051-InterfacingoftrafficLightcontroller	3	20-02-2026		**TLM8**	
11.	8051- Interfacing LM 35	3	27-02-2026		**TLM8**	
12.	Review of 8051 based Experiments		06-03-2026			
13.	ARM- MUL, SUM	3	13-03-2026		**TLM8**	
14.	ARM- Toggle LED, Running Lights	3	20-03-2026		**TLM8**	
15.	ARM – Revision	3	27-03-2026		**TLM8**	
16.	Internal LabExam	3	03-04-2026		**TLM8**	
No.ofclasses requiredtocomplete:		48	No. ofclassesconducted:			

PART-C

TeachingLearningMethods					
TLM1	Chalk and Talk	**TLM4**	ProblemSolving	**TLM7**	SeminarsorGD
TLM2	PPT	**TLM5**	Programming	**TLM8**	LabDemo
TLM3	Tutorial	**TLM6**	AssignmentorQuiz	**TLM9**	CaseStudy

AcademicCalendar:2025–26 (VI Semester)

B. Tech VI Semester - 2023Admitted Batch			
ClassworkCommenceFrom	**01-12-2025**		
Description	**From**	**To**	**Weeks**
IPhaseofInstructions	01-12-2025	24-01-2026	8 Weeks
IMidExaminations	26-01-2026	31-01-2026	1Week
IIPhaseInstructions	02-02-2026	04-04-2026	8 Weeks
IIMidExaminations	06-04-2026	11-04-2026	1Week
Preparation&Practicals	13-04-2026	18-04-2026	1Week
SemesterEndExaminations	20-04-2026	02-05-2026	2 Weeks
Internship	04-05-2026	27-06-2026	8 Weeks

EVALUATIONPROCESS:

EvaluationTask	COs	Marks
DaytoDaywork	1,2,3,4	A=15
InternalLabExamination	1,2,3,4	B=15
TotalInternalMarks(A+B)		**C=30**
SemesterEndExaminations	1,2,3,4	**D=70**
TotalMarks:C+D	1,2,3,4	**100**

PART– D

PROGRAMMEOUTCOMES(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.

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuitsor systems and Implement real time applications in the field of VLSI and Embedded Systemsusingrelevanttools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

CourseInstructor   Course Coordinator   ModuleCoordinator   HOD
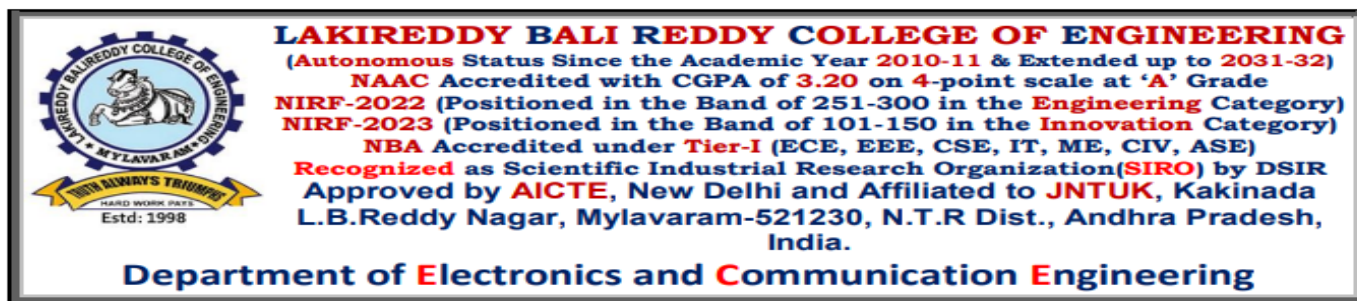
[Dr.B V N R SIVA KUMAR]   [Mr.K.V. ASHOK]   [Dr. P.LACHIREDDY]   [Dr.G.SRINIVASULU]

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Program/Sem/Sec	: B.Tech., ECE, VI-Sem.
Course Instructor	: Dr. P. Lachi Reddy, Professor
	Mr. N. Dharma Chari, Assistant Professor
Course Name & Code	: CMOS Mixed Signal Design – 23ECH3
L-T-P-Cr Structure	: 3-0-0-3
Academic Year	: 2025 – 26

Pre requisite: EDC, STLD

Course Outcomes: (COs): At the end of the course, students are able to:

CO1:	Understand the design methodology for mixed-signal IC design.
CO2:	Analyze the design of PLL and operational amplifiers
CO3:	Design the CMOS digital circuits and implement its layout.
CO4:	Design the Switched Capacitor Circuits for different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	3	-	3	2

Prescribed Syllabus:

UNIT-I: Switched Capacitor Circuits: 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.

UNIT-II: Phased Lock Loop (PLL): 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.

UNIT-III: Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV: Nyquist Rate A/D Converters: 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.

UNIT-V: Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A.

TEXT BOOKS:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2016
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

<table>
<tr><td colspan="7">UNIT-I: Switched Capacitor Circuits [09 HRS]</td></tr>
<tr>
<th>S.No.</th>
<th>Topics to be covered</th>
<th>No. of Classes Required</th>
<th>Tentative Date of Completion</th>
<th>Actual Date of Completion</th>
<th>Teaching Learning Methods</th>
<th>HOD Sign Weekly</th>
</tr>
<tr><td>1.</td><td>Introduction, Discussion of Syllabus and Course Outcomes</td><td>1</td><td>02-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>2.</td><td>Introduction to Switched Capacitor circuits-basic building blocks</td><td>1</td><td>03-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>3.</td><td>Operation and Analysis</td><td>1</td><td>04-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>4.</td><td>Non-ideal effects in switched capacitor circuits</td><td>1</td><td>09-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>5.</td><td>Switched capacitor integrators first order filters</td><td>1</td><td>10-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>6.</td><td>Switch sharing</td><td>1</td><td>11-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>7.</td><td>Biquad filters</td><td>1</td><td>16-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>8.</td><td>Activity: Students Presentation on Switched capacitor circuits</td><td>1</td><td>17-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>9.</td><td>Revision/Tutorial/Assignment</td><td>1</td><td>18-12-2025</td><td></td><td>TLM2</td><td></td></tr>
</table>

<table>
<tr><td colspan="7">UNIT- II: Phased Lock Loop (PLL) [10 HRS]</td></tr>
<tr>
<th>S.No.</th>
<th>Topics to be covered</th>
<th>No. of Classes Required</th>
<th>Tentative Date of Completion</th>
<th>Actual Date of Completion</th>
<th>Teaching Learning Methods</th>
<th>HOD Sign Weekly</th>
</tr>
<tr><td>10.</td><td>Basic PLL topology</td><td>1</td><td>23-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>11.</td><td>Dynamics of simple PLL</td><td>1</td><td>24-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>12.</td><td>Charge pump PLLs-Lock acquisition</td><td>1</td><td>30-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>13.</td><td>Phase/Frequency detector and charge pump</td><td>1</td><td>31-12-2025</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>14.</td><td>Basic charge pump PLL</td><td>1</td><td>06-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>15.</td><td>Non-ideal effects in PLLs-PFD/CP non-idealities</td><td>1</td><td>07-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>16.</td><td>Jitter in PLLs, Delay locked loops</td><td>1</td><td>08-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>17.</td><td>Applications</td><td>1</td><td>20-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>18.</td><td>Activity: Students Presentation on PLL</td><td>1</td><td>21-01-2026</td><td></td><td>TLM2</td><td></td></tr>
<tr><td>19.</td><td>Revision / Tutorial/Assignment</td><td>1</td><td>22-01-2026</td><td></td><td>TLM2</td><td></td></tr>
</table>

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
UNIT – III: Data Converter Fundamentals [08 HRS]						
20.	DC and dynamic specifications	1	03-02-2026		TLM2	
21.	Quantization noise	1	04-02-2026		TLM2	
22.	Nyquist rate D/A converters- Decoder-based converters	1	05-02-2026		TLM2	
23.	Binary-Scaled converters	1	10-02-2026		TLM2	
24.	Thermometer-code converters	1	11-02-2026		TLM2	
25.	Hybrid converters	1	12-02-2026		TLM2	
26.	**Activity: Students' presentations on Data converters design**	1	17-02-2026		TLM2	
27.	**Revision / Tutorial/Assignment**	1	18-02-2026		TLM2	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
UNIT – IV: Nyquist Rate A/D Converters [09 HRS]						
28.	Successive approximation converters	1	19-02-2026		TLM2	
29.	Flash converter	1	24-02-2026		TLM2	
30.	Two-step A/D converters	1	25-02-2026		TLM2	
31.	Interpolating A/D converters	1	26-02-2026		TLM2	
32.	Folding A/D converters	1	03-03-2026		TLM2	
33.	Pipelined A/D converters	1	05-03-2026		TLM2	
34.	Time-interleaved converters	1	10-03-2026		TLM2	
35.	**Activity: Students' presentations on A/D Converters design**	1	11-03-2026		TLM2	
36.	**Revision / Tutorial/Assignment**	1	12-03-2026		TLM2	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
UNIT – V: Oversampling Converters [07 HRS]						
37.	Noise shaping modulators	1	17-03-2026		TLM2	
38.	Decimating filters and interpolating filters	1	18-03-2026		TLM2	
39.	Higher order modulators	1	24-03-2026		TLM2	
40.	Delta sigma modulators with multibit quantizers	1	25-03-2026		TLM2	
41.	Delta sigma D/A	1	26-03-2026		TLM2	
42.	**Activity: Presentations on Design and Implementation D/A Converters**	1	31-03-2026		TLM2	
43.	**Revision / Tutorial/Assignment**	1	01-04-2026		TLM2	

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
BEYOND THE SYLLABUS & REVISION [01 HRS]						
44.	Mixed Signal Design – Case Study	1	02-04-2026		TLM2	

Teaching Learning Methods

TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART – C

Academic Calendar: 2025 – 26 (IV Semester)

B. Tech IV Semester - 2024 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	01-12-2025	24-01-2026	8 Weeks
I Mid Examinations	**26-01-2026**	**31-01-2026**	1 Week
II Phase Instructions	02-02-2026	04-04-2026	9 Weeks
II Mid Examinations	**06-04-2026**	**11-04-2026**	1 Week
Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III-Half of the Syllabus)	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III-Half of the Syllabus)	M1=15
I-Quiz Examination (Units-I, II & UNIT-III-Half of the Syllabus)	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Cumulative Internal Examination (CIE) 80% of Max((M1+Q1+A1) , (M2+Q2+A2)) + 20% of Min((M1+Q1+A1) , (M2+Q2+A2))	30
Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	**100**

CO 1	Understand the design methodology for mixed-signal IC design.	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Analyze the design of PLL and operational amplifiers	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Design the CMOS digital circuits and implement its layout.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Design the Switched Capacitor Circuits for different applications.	Categorize, Analyze, Illustrate, Infer Select

PART – D

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.
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PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor   **Course Coordinator**   **Module Coordinator**   **HOD**

[Dr. P. Lachi Reddy]
[Mr. N. Dharma Chari]   **[Mr. N. Dharma Chari]**   **[Dr. P. Lachi Reddy]**   **[Dr. G. Srinivasulu]**

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Estd: 1998

Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

PROGRAM	: B.Tech., VI-Sem, ECE
ACADEMIC YEAR	: 2025-26
COURSE NAME & CODE	: CMOS Mixed Signal Design Lab - 23ECH7
L-T-P STRUCTURE	: 0-0-3
COURSE INSTRUCTOR	: Dr. P. Lachi Reddy / Mr. N. Dharma Chari

COURSE OBJECTIVE:
To provide hands-on experience through practical experimentation, simulation and layout design using the Cadence Virtuoso tool.
❖ The Students are required to design and draw the schematic diagrams for various circuits.
❖ The following experiments are required to design and draw the schematic, later they are converted in to symbol and layouts.

Course Outcomes: At the end of the course, student will be able to:

CO1	Demonstrate the compensation techniques.
CO2	Design various analog and digital circuits.
CO3	Create the layout for various designed circuits.
CO4	Adapt effective communication, presentation and report writing skills.

COURSE ARTICULATION MATRIX (Correlation between Cos & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, **put '-'**
1- Slight(Low), 2 - Moderate(Medium), 3 - Substantial (High).

LAB SCHEDULE (LESSON PLAN): Section-B

LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

S.No.	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
	Part-I: Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction, Syllabus Discussion & CO-PO Discussion	3	05-12-2025		**TLM2**	
2.	Practice of basic circuits (Logic Gates)	3	12-12-2025		**TLM8**	
3.	Fully compensated op-amp with resistor and miller compensation	3	19-12-2025		**TLM8**	
4.	High speed comparator design i. Two stage cross coupled clamped comparator	3	26-12-2025		**TLM8**	
5.	High speed comparator design ii. Strobed Flip-flop	3	02-01-2026		**TLM8**	
6.	Data converter	3	09-01-2026		**TLM8**	
	CYCLE-2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS.					
	(Coo-Cox-Software-Platform)					
7.	Switched capacitor circuits i. Parasitic sensitive integrator	3	23-01-2026		**TLM8**	
8.	Switched capacitor circuits ii. Parasitic insensitive integrator	3	06-02-2026		**TLM8**	
9.	Design of PLL	3	13-02-2026		**TLM8**	
10.	Design of VCO	3	20-02-2026		**TLM8**	
11.	Band gap reference circuit	3	27-02-2026		**TLM8**	
12.	Layouts of All the circuits Designed and Simulated	3	06-03-2026		**TLM8**	
13.	Internal Examination	3	13-03-2026		**TLM8**	
No. of classes required to complete:		39	No. of classes conducted:			

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

Academic Calendar: 2025 – 26

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Preparation & Practicals	13-04-2026	18-04-2026	1 Week
Semester End Examinations	**20-04-2026**	**02-05-2026**	2 Weeks

EVALUATION PROCESS:

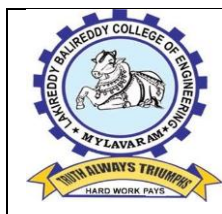| **Evaluation Task**	**COs**	**Marks**
Day to Day work	1,2,3,4	A1=15
Internal Lab Examination	1,2,3,4	B=15
Total Internal Marks(A+B)		**C=30**
Semester End Examinations	1,2,3,4	**D=70**
Total Marks: C+D	1,2,3,4	**100**

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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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 01-12-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy)			
(Mr. N. Dharma Chari)	**(Mrs. T. Kalpana)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF INFORMATION TECHNOLOY

COURSE HANDOUT

PART-A

Name of Course Instructor : B. SARATH CHANDRA
Course Name & Code : -INTRODUCTION TO PROGRAMMING IN JAVA (23IT82) R23
L-T-P Structure : 3-0-0   **Credits** : 3
Program/Sem/Sec : B.Tech., IT., VI-Sem. C Secion,   **A.Y** : 2025-26

PRE-REQUISITE: Programming for Problem Solving Using C

COURSE EDUCATIONAL OBJECTIVES (CEOs): Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Technique in software development through JAVA.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Understand Object Oriented Programming Concepts through constructs of JAVA. (Understand - L2)
CO 2	Apply the concepts of Inheritance and Polymorphism on real-world applications. (Apply –L3)
CO 3	Apply reusability using interface and packages. (Apply- L3)
CO 4	Construct robust applications using exception handling & multithreading (Apply- L3).
CO 5	Understand and Implement Event Handling & Swings. (Understand - L2)

UNIT – I: Introduction to OOP & JAVA:
Java Basics: Java Buzzwords/Features OOP Concepts, Java History, Advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs. Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi- dimensional), String, StringBuffer, StringTokenizer Classes.

UNIT – II: Extending Classes/ Reusability:
Inheritance: Introduction, Derived Classes, Advantages and Types of Inheritance, Implementation, Inheritance and Member Accessibility. Overriding, super keyword, Abstract Classes and Methods, final keyword, Final Classes and Final Methods, Dynamic Binding, Polymorphism

UNIT – III: Interfaces & Packages:
Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces.
Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default and private). Wrapper Classes (Integer, Float, Double)

UNIT – IV: Exception Handling & Multithreading:
Exception Handling: Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception, assertions.
Multithreading: Thread life cycle, creating threads, synchronizing and intercommunication of threads.

UNIT – V: Event Handling & Swings:
Event Handling- Introduction, limitations of AWT, The Delegation event model- Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events. s
Exploring Swing Controls- JLabel and Image Icon, JText Field, JButton, JCheck Box, JRadio Button, JList, JCombo Box

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	3	-
CO2	3	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	1	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	1	1	2	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	3	-	-	-	1	1	-	1	-	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
      1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:
1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education

REFERENCE BOOKS:
1. The Java™ Programming Language: Ken Arnold, James Gosling, Pearson.
2. Introduction to Java Programming 7/e, Brief version, Y. Daniel Liang, Pearson
3. Java for Programmers, P.J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to OOP & JAVA:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Java Buzzwords / Features	1	1-12-2025		TLM1	
2.	Object Oriented Programming **(OOP)** concepts	1	2-12-2025		TLM1	
3.	Java History, Advantages, Datatypes, Operators, Expressions	1	6-12-2025		TLM1	
4.	Control Statements	1	8-12-2025		TLM1	
5.	Methods and recursion , Sample programs	1	9-12-2025		TLM1	
6.	Java Objects and References	1	13-12-2025		TLM1	
7.	Constructors, this keyword	2	15-12-2025 16-12-2025		TLM1 TLM6	
8.	Arrays (single and multi-dimensional),	1	20-12-2025		TLM1 TLM6	
9.	String, StringBuffer, StringTokenizer Classes	2	22-12-2025 23-12-2025		TLM1	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: Extending Classes/ Reusability:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	**Inheritance :** Introduction , Derived Classes, Advantages and Types of Inheritance	1	27-12-2025		TLM1	
11.	Implementation of Inheritance	2	29-12-2025 30-01-2025		TLM1	
12.	Inheritance and Member Accessibility	1	3-01-2025		TLM1	
13.	Overriding, super keyword	1	5-01-2025		TLM1 TLM6	
14.	abstract classes and methods	2	6-01-2025 10-0102025		TLM1 TLM6	
15.	final keyword, final methods and final classes	1	12-01-2025		TLM1	
16.	Dynamic Binding, Polymorphism	2	13-01-2025 19-01-2025		TLM1 TLM6	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: Interfaces & Packages:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	**Interfaces:** Differences between classes and interfaces	1	20-01-2025		TLM1	
18.	defining an interface	1	24-01-2025		TLM1	
19.	implementing interface	1	27-01-2025		TLM1 TLM6	
20.	variables in interface, extending interfaces	1	31-01-2025		TLM1	
21.	**Packages:** Defining, Creating	1	2-02-2025		TLM1	
22.	Accessing a Package	1	3-02-2025		TLM1	
23.	importing packages,	1	7-02-2025		TLM1, TLM6	
24.	access controls (public, protected, default and private).	1	9-02-2025		TLM1	
25.	Wrapper Classes (Like Integer, Float, Double).	1	10-02-2025		TLM1	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

UNIT-IV : Exception Handling & Multithreading:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	**Exception Handling:** Concepts of exception handling	1	14-02-2025		TLM1	
27.	usage of try, catch, multiple catch clause	1	16-02-2025		TLM1, TLM6	
28.	Nested try, throw,	1	17-02-2025		TLM1	
29.	Throws, Finally	1	21-02-2025		TLM1	
30.	creating own exception	2	23-02-2025 24-02-2025			

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Multithreading: Thread life cycle	1	28-02-2025		TLM1	
32.	creating threads (by extending thread class)	1	2-03-2025		TLM1, TLM6	
33.	creating threads (implementing Runnable Interface)	1	3-03-2025		TLM1, TLM6	
34.	Example programs on threads	1	7-03-2025		TLM1	
35.	Synchronization : method, Synchronization block	2	9-03-2025 10-03-2025		TLM1, TLM6	
36.	Inter thread Communication	2	14-03-2025 16-03-2025		TLM1, TLM6	
No. of classes required to complete UNIT-IV: 14				No. of classes taken:		

UNIT-V : Event Handling &Swings:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Event Handling – Introduction, Limitations of AWT	1	17-03-2025		TLM1	
38.	Delegation Event Model – Events, Event Sources, Event Listeners	1	21-03-2025		TLM1	
39.	Event Classes, Handling Mouse & Keyboard Events	1	23-03-2025		TLM1	
40.	Swing Controls – JLabel, ImageIcon, JTextField	1	24-03-2025		TLM1	
41.	Swing Buttons – JButton, JCheckBox, JRadioButton	1	28-03-2025 30-03-2025		TLM1 TLM6	
42.	JList & JComboBox	2	31-03-2025 04-04-2025		TLM1	
No. of classes required to complete UNIT-V: 07				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Problem Solving
TLM2	PPT	**TLM5**	Programming
TLM3	Tutorial	**TLM6**	Assignment or Quiz
TLM7	Seminars or GD	**TLM8**	Lab Demo
TLM9	Case Study		

PART-C

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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and Interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs.
PSO 3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr.K.Venu Gopal	Mr.B.SARATH CHANDRA	Dr. Phaneendra K	Dr. D. Ratna Kishore
Signature				