Course Name & Code : Microprocessors and Microcontrollers – 20EC15
L-T-P Structure : 3-0-0
Credits : 3
Program : B.Tech.,
A.Y : 2023 – 24
Course Instructor : D r . B V N R Siva Kumar, Associate Professor

Pre requisite:

Course Educational Objective: In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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

CO 1	Understand the architecture of 8086, 8051 and ARM Controller **(Understand)**
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**

CO's / PO's								Course Name with code : MPMC,20EC15							
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO3	2	3	2	1	-	-	-	-	-	-	-	2	-	3	-
CO4	1	2	3	2	-	-	-	-	-	-	-	2	-	3	-

Prescribed Syllabus:

UNIT-I: 8086 MICROPROCESSOR [9 HRS]

Architecture, Pin diagram, Register organization, Minimum mode and Maximum mode, timing diagrams. Addressing modes, Instruction set, Interrupt vector table, Assembly language programming - data transfer, arithmetic, logical and decision making operations.

UNIT- II: 8051 MICROCONTROLLER [8 HRS]

Architecture, Input/output Ports, Registers, Counter and Timers, Serial port, Interrupts, addressing modes, instruction set and Programming - data transfer, arithmetic, logical and decision making operations.

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [9 HRS]

History, Architecture, ARM design philosophy, Registers, Program status register, Instruction pipeline, Interrupts and vector table, ARM processor families, Instruction set: Data processing instructions, Addressing modes, Branch, Load-Store instructions, PSR instructions, and Conditional instructions.

UNIT – IV: ARM PROGRAMMING [8 HRS]

Assembly programming, General structure of assembly language, Writing programs, Branch instructions, Loading constrains, load and store instructions, Read only and read/write Memory, Multiple Register Load and

Store.

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS [8 HRS]

Interfacing - A/D and D/A converter, LEDs, Switches, Relays, LCD, Stepper Motors, Real Time Clock, Serial Communication, GSM and GPS.

Text Books:

1. Ray and Burchandi, "Advanced Microprocessors and Interfacing", Tata McGraw–Hill.

2. M.A.Mazidi,S.Naimi and S.Naimi, "The AVR Microcontroller and Embedded Systems Using Assembly and C", 1st Edition Pearson Publications, 2013.

Reference Books:

1. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

2. Dhananjay V. Gadre, "Programming and Customizing The AVR Microcontroller", Tata McGraw-Hill publications, 2012.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): VI Sem, A Section

UNIT-I: 8086 MICROPROCESSOR [14 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.	1-20 bits table.	1	07-12-2023		**TLM 1**	
2.	Register organization	1	08-12-2023		**TLM 1**	
3.	Data Transfer Instructions, ALP	1	09-12-2023		**TLM 1**	
4.	Arithmetic Instructions, ALP	1	13-12-2023		**TLM 1**	
5.	Logical Instructions, ALP	1	14-12-2023		**TLM 1**	
6.	Flags, Instructions	1	15-12-2023		**TLM 1**	
7.	Instructions	1	16-12-2023		**TLM 1**	
8.	Addressing modes	1	20-12-2023		**TLM 1**	
9.	ALP s	1	21-12-2023		**TLM 1**	
10.	Architecture	1	22-12-2023		**TLM 1**	
11.	Pin Functionality	1	23-12-2023		**TLM 1**	
11.	Minimum mode	1	27-12-2023		**TLM 1**	
12.	Timing Diagrams	1	28-12-2023		**TLM 1**	
13.	Interrupt vector table	1	29-12-2023		**TLM 1**	
14.	Maximum mode	1	30-12-2023		**TLM 1**	

UNIT- II: 8051 MICROCONTROLLER [7 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
15	Architecture, Registers, Flags	1	03-01-2024		TLM 1	
16.	Memory Map, SFRs, I / O Ports	1	04-01-2024		TLM 1	
17.	Addressing modes, Instructions, ALP	1	05-01-2024		TLM 1	
18.	Instructions, ALP	1	06-01-2024		TLM 1	
19.	Counter and Timers	1	10-01-2024		TLM 1	
20.	Serial port, Interrupts	1	11-01-2024		TLM 1	
21.	8086 & 8051Revision	1	12-01-2024		TLM 1	

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [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
22.	Registers, Program status register		18-01-2024		TLM 1	
23.	Instruction pipeline, Interrupts and vector table		19-01-2024		TLM 1	
24.	History & Architecture		20-01-2024		TLM 1	
25.	ARM design philosophy		24-01-2024		TLM 2	
26.	Revise Unit I	1	25-01-2024			
27.	Revise Unit II	1	27-01-2024			
28.	Mid paper solutions	1	07-02-2024			
29.	ARM Architecture	1	08-02-2024		TLM 2	
30.	ARM processor families	1	09-02-2024		TLM 1	
31.	Instruction set: Data processing instructions	1	10-02-2024		TLM 1	
32.	Addressing modes	1	14-02-2024		TLM 1	
33.	Branch, Load-Store instructions	1	15-02-2024		TLM 1	
34.	PSR instructions, and Conditional instructions	1	16-02-2024		TLM 1	
35.	Comparison of Programs	1	17-02-2024		TLM 1	

UNIT – IV: ARM PROGRAMMING [8 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
36.	Assembly programming,	1	21-02-2024		TLM 1	
37.	General structure of assembly language,	1	22-02-2024		TLM 1	
38.	Writing programs,	1	23-02-2024		TLM 1	
39.	Branch instructions	1	24-02-2024		TLM 1	
40.	Loading constrains	1	28-02-2024		TLM 1	
41.	load and store instructions	1	29-02-2024		TLM 1	
42.	Read only and read/write Memory	1	01-03-2024		TLM 1	
43.	Multiple Register Load and Store	1	02-03-2024		TLM 1	

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS [8 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.	Interfacing - A/D converter	1	06-03-2024		TLM 1	
45.	Interfacing - D/A converter	1	07-03-2024		TLM 1	
46.	Interfacing - LEDs & Switches	1	13-03-2024		TLM 1	
47.	Interfacing – Relays & LCD	1	14-03-2024		TLM 1	
48.	Interfacing - Stepper Motors	1	15-03-2024		TLM 1	
49.	Interfacing - Real Time Clock	1	16-03-2024		TLM 1	
50.	Interfacing - Serial Communication	1	20-03-2024		TLM 1	

51.	Interfacing - GSM and GPS	1	21-03-2024		**TLM 1**
	Revision	1	22-03-2024		
	Revision	1	23-03-2024		

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.	MSP430 Instruction Set	1	27-03-2024		**TLM 2**	
2.	MSP430 Digital in-outs	1	28-03-2024		**TLM 2**	
3.	MSP430 Timer, Communication	1	30-03-2024		**TLM 2**	

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: 2023 – 24 (VI Semester)

B.Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**04-12-2024**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	04-12-2023	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
II Phase Instructions	05-02-2024	30-03-2024	8 Weeks
II Mid Examinations	**01-04-2024**	**06-04-2024**	1 Week
Preparation & Practicals	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**27-04-2024**	2 Weeks
Internship	29-04-2024	22-06-2024	6 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 architecture of 8086, 8051 and ARM Controller **(Understand)**	Describe, Explain, Paraphrase, Restate ,Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**	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

Course Instructor & Coordinator	**Module Coordinator**	**HOD**
[Mr. B.V.N.R.Siva Kumar]	**[Dr.P.LACHI REDDY]**	**[Dr.Y. AMAR BABU]**

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt.M.Ramya Harika
Course Name & Code : VLSI DESIGN– 20EC16
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- A A.Y : 2023-24

PRE-REQUISITE: Electronic Devices and Circuits, Digital Circuits
COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential sub system CMOS circuit designs used in VLSI Design. This course also gives the complete information regarding design tools and CMOS testing techniques.

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

CO1:	**Understand** semiconductor technology and MOS fabrication process (L2-Understand)
CO2:	**Apply** layout design rules for NMOS, CMOS logic circuit designs. (L3-Apply)
CO3:	**Analyze** the IC building blocks. (L4-Analyze)
CO4:	**Apply** CMOS testing techniques to test different digital designs. (L3-Apply)

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	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	3	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	3	-	4	-
CO4	2	2	1	-	-	-	-	-	-	-	-	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 Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI Publishers, 2005.

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

BOS APPROVED REFERENCE BOOKS:

R1 Neil. H. E. Weste and Kamaran Eshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rdEdition.

R2 Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: IC FABRICATION TECHNOLOGY& BASIC ELECTRICAL PROPERTIES OF MOS AND BICMOS 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.	IC fabrication Technology: Silicon semiconductor technology–wafer processing	1	04.12.2023			
2.	Oxidation, epitaxy, Lithography	1	06.12.2023			
3.	ion implantation, Diffusion, silicon gate process	1	07.12.2023			
4.	NMOS fabrication	1	09.12.2023			
5.	CMOS fabrication	1	11.12.2022			
6.	BiCMOS technology, Comparison between CMOS and bipolar technologies	1	13.12.2023			
7.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	14.12.2023			
8.	Ids –Vds relationships	1	16.12.2023			
9.	MOS transistor threshold Voltage, MOS transistor gm, gds	1	18.12.2023			
10.	Pass transistor	1	20.12.2023			
11.	NMOS Inverter, Various pull up	1	21.12.2023			
12.	CMOS Inverter analysis and design	1	23.12.2023			
13.	BiCMOS Inverters	1	27.12.2023			
14.	Assignment	1	28.12.2023			
No. of classes required to complete UNIT-I :		18	No. of classes taken:			

UNIT-II : VLSI CIRCUIT DESIGN PROCESSES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	VLSI Circuit Design Processes: VLSI design flow	1	30.12.2023			

16.	MOS Layers, Stick Diagrams	1	03.01.2024			
17.	Design Rules and Layout, 5μm CMOS	1	04.01.2024			
18.	Design rules for wires, Design rules for Contacts, transistor	1	06.01.2024			
19.	Layout Diagrams for NMOS, CMOS Inverters and Gates,	1	08.01.2024			
20.	Scaling of MOS circuits, Limitations of Scaling	1	10.01.2024			
21.	Basic Circuit Concepts: Sheet Resistance	1	11.01.2024			
22.	Area Capacitance calculations	1	13.01.2024			
23.	Inverter Delays	1	15.01.2024			
24.	Assignment	1	17.01.2024			
No. of classes required to complete UNIT-II		14	No. of classes taken:			

UNIT-III : DIGITAL IC BUILDING BLOCKS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Digital IC Building Blocks: Logic gates: combinational logic functions	1	18.01.2024			
26.	Static complementary gates	1	20.01.2024			
27.	Switch logic	1	22.01.2024			
28.	Standard cell based layout	1	24.01.2024			
29.	Logic and interconnect design	1	25.01.2024			
30.	power optimization	1	27.01.2024			
31.	Realization of Latches and Flip-Flops using switch logic	1	05.02.2024			
32.	Sub system design flow	1	07.02.2024			

33.	4x4 array multiplier	1	08.02.2024			
34.	Design of 4bit ALU using adder	1	10.02.2024			
35.	Synchronous up/down counters, Registers	1	12.02.2024			
36.	Assignment	1	14.02.2024			
No. of classes required to complete UNIT-III		12	No. of classes taken:			

UNIT-IV : ANALOG IC BUILDING BLOCKS

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.	Introduction	1	15.02.2024			
38.	Analog IC Building Blocks: MOS Diode/Active resistor	1	17.02.2024			
39.	Simple current sinks, Basic current mirrors	1	19.02.2024			
40.	Advanced current mirrors	1	21.02.2024			
41.	Current and Voltage references	1	22.02.2024			
42.	Band-gap references	1	24.02.2024			
43.	Op-Amp, One Stage OP-Amp.	1	26.02.2024			
44.	Two Stage OP-Amp	1	28.02.2024			
45.	Gain boosting	1	29.02.2024			
46.	Common Mode Feedback	1	02.03.2024			
47.	Noise in Op Amps	1	04.03.2024			
48.	Assignment	1	06.03.2024			
No. of classes required to complete UNIT-IV		12		No. of classes taken:		

UNIT-V : TEST AND TESTABILITY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Introduction	1	07.03.2024			
48.	Test and Testability : System Partitioning	1	09.03.2024			

49.	Layout and Testability, Reset/Initialization	1	11.03.2024			
50.	Design for Testability (DFT)	1	13.03.2024			
51.	Testing Combinational Logic	1	14.03.2024			
53.	Testing Sequential Logic	1	16.03.2024			
55.	Practical Design for Test Guidelines	2	18.03.2024 20.03.2024			
56.	Scan Design Techniques	1	21.03.2024			
57.	Built-In-Self-Test (BIST),	1	23.03.2024			
58.	Future Trends	1	27.03.2024			
59.	Assignment	1	28.03.2024			
No. of classes required to complete UNIT-V:		12		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
60.	Introduction to FINFET	1	30.03.2024			

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.
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.M.RamyaHarika	Smt.T.Kalpana	Dr. P Lachi Reddy	Dr.Y.Amar Babu

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT
PART-A

Course Name & Code : MICROWAVE ENGINEERING-20EC17
L-T-P Structure : 3-0-0
Credits : 3
Program : B.Tech.,
A.Y : 2023 – 24

Pre requisite: Vector calculus, Coordinate Systems, Basics of electromagnetics

Course Educational Objective: This course provides the knowledge on different types of waveguides and resonators. The course will give an idea about microwave communication in terms of various bands, advantages, applications. The course also gives the complete information regarding the microwave tubes and passive devices along with microwave bench setup and microwave measurements.

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

CO 1	**Understand** the microwave sources, components and measurements of microwave parameters **(Understand – L2)**
CO 2	**Develop** the TE, TM fields in waveguides and microwave signals using microwave tubes and solid-state devices **(Apply – L3)**
CO 3	**Apply** the properties of S-parameters to model the S-matrix of waveguide components **(Apply – L3)**
CO 4	**Analyze** the flow of microwave fields in waveguides, components and efficiency of microwave tubes **(Analyze – L4)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	-	-
CO4	3	3	2	1	1	-		-	-	-	-	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. Samuel Y. Liao, "Microwave Devices and Circuits", PHI Publishers, 3rdEdition, 2003.
2. David M.Pozar, "Microwave Engineering", John Wiley Publishers,4thEdition.

REFERENCE BOOKS

1. M Kulakarni, "Microwave and Radar Engineering", Umesh Publications, New Delhi 5th Edition
2. Jordan and Balmain, "Electromagnetic fields and Radiating systems", Pearson education.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:[9HRS]						
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, Microwave Spectrum and Bands	1	08-12-2023			
2.	Advantages and Applications of Microwaves	1	09-12-2023			
3.	Rectangular Waveguides: Impossibility of TEM waves in waveguides	1	12-12-2023			
4.	Transverse Magnetic and Transverse Electric Waves in Rectangular Waveguides	1	13-12-2023			
5.	Field Expressions, characteristics of TE and TM Waves-Cutoff frequency	1	15-12-2023			
6.	Dominant mode in Rectangular Waveguides, phase velocity, group velocity	1	16-12-2023			
7.	relation between cutoff, guided and free space wavelengths	1	19-12-2023			
8.	Wave impedances for TE and TM cases.	1	20-12-2023			
9.	Circular Waveguides: TM and TE waves in circular guides	1	22-12-2023			
10.	Field Expressions, Dominant mode in circular waveguide.	1	23-12-2023			
11.	**Tutorial /Assignment**	1	26-12-2023			

UNIT- II: [8 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**
12.	Resonators: Rectangular cavity resonators	1	27-12-2023			
13.	Circular cavity resonators	1	29-12-2023			
14.	Field Expressions, Re-entrant Cavities	1	30-12-2023			
15.	Microwave Tubes: Limitations of conventional tubes at microwave frequencies	1	02-01-2024			
16.	Klystron Tubes: Two Cavity Klystrons – Structure	1	03-01-2024			
17.	Microwave tubes – O type and M type classifications	1	05-01-2024			
18.	Velocity Modulation Process and Applegate Diagram,	1	06-01-2024			
19.	Reflex Klystrons – Structure, Applegate Diagram and Principle of working,	1	09-01-2024			

20.	Power Output, Efficiency, output Characteristics	1	10-01-2024			
21.	**Tutorial/Assignment**	1	12-01-2024			

UNIT – III[9 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**
22.	Helix TWT: Types and Characteristics of Slow Wave Structures;	1	17-01-2024			
23.	Structure of TWT	1	19-01-2024			
24.	Amplification Process in TWT	1	20-01-2024			
25.	M-Type Tubes: Cross-field effects	1	23-01-2024			
26.	Magnetrons – Different Types	1	24-01-2024			
27.	8-Cavity Cylindrical Travelling Wave Magnetron	1	27-01-2024			
28.	Hull Cut-off and Hartee Conditions	1	06-02-2024			
29.	PI-Mode Operation in Magnetrons	1	07-02-2024			
30.	Strapping in Magnetrons	1	09-02-2024			
31.	**Tutorial,/Assignment**	1	10-02-2024			

UNIT – IV[8 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**
32.	Microwave Solid State Devices: Negative resistance region	1	13-02-2024			
33.	Classification, Applications	1	14-02-2024			
34.	Transferred Electron Devices: Gunn Diode Principle,	1	16-02-2024			
35.	Two Valley Model Theory	1	17-02-2024			
36.	RWH Theory, Characteristics.	1	20-02-2024			
37.	Avalanche Transit Time Devices: IMPATT diode Principle of Operation and Characteristics,	1	21-02-2024			
38.	TRAPATT Diodes Principle of Operation and Characteristics,	1	23-02-2024			
39.	IMPATT, TRAPATT Diodes expressions	1	24-02-2024			
40.	**Tutorial,/Assignment**	1	27-02-2024			

UNIT – V [8 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**
41.	Waveguide Components: Scattering matrix	1	28-02-2024			
42.	Formulation and Properties. S Matrix	1	01-03-2024			
43.	Calculations for E plane and H plane Tees	1	02-03-2024			
44.	Calculations for Magic Tee, Directional Coupler	1	05-03-2024			
45.	Fundamentals of branch line, rat-race couplers	1	06-03-2024			
46.	microwave filters. Ferrites– Composition and Characteristics,	1	09-03-2024			
47.	Faraday Rotation; Ferrite Components – Gyrator	1	12-03-2024			
48.	Isolator, Circulator. Microwave attenuators.	1	13-03-2024			
49.	Isolator, Circulator. Microwave attenuators.	1	15-03-2024			

50.	**Microwave Measurements:** Description of Microwave Bench setup ,precautions		16-03-2024			
51.	Measurement of Attenuation		19-03-2024			
52.	Measurement of Frequency, VSWR.		20-03-2024			
53.	Measurement of Impedance, Power.		22-03-2024			
54.	**Tutorial,/Assignment**		23-03-2024			
55.	**Revision**		26-03-2024			

BEYOND THE SYLLABUS & REVISION						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
56.	Microwave devices in RADARcommunication	1	27-03-2024			
57.	RF Microwave Passive Devices	1	29-03-2024			
58.	Microwave devices in satellite communication	1	30-03-2024			

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: 2022 – 23 (VI Semester)

B.Tech VI Semester - 2020 Admitted Batch			
Class work Commence From	**21-02-2022**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**26-12-2022**	18-02-2023	8 Weeks
I Mid Examinations	**20-02-2023**	**25-02-2023**	1 Week
II Phase Instructions	27-02-2023	**22-04-2023**	8 Weeks
II Mid Examinations	**24-04-2023**	**29-04-2023**	1 Week
Preparation & Practicals	01-05-2023	06-05-2023	1 Week
Semester End Examinations	**08-05-2023**	**20-05-2023**	2 Weeks
Internship	22-05-2023	01-07-2023	6 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**

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
K. RANI RUDRAMA	Dr. V. RAVI SEKHARA REDDY	Dr. Y.V.N.R. SWAMY	Dr.Y. AMAR BABU

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : V.V.Rama Krishna
Course Name & Code : Satellite Communications & 20EC19
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- A A.Y : 2023-24

PRE-REQUISITE: Analog Communications & Digital Communications.

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

CO1:	Understand the orbital mechanics, concepts of satellite communication and its applications (Understand – L2)
CO2:	Summarize the concepts of satellite space segment, earth segment and satellite services (Understand – L2)
CO3:	Examine the satellite link budget calculations and orbital dynamics (Apply – L3)
CO4:	Apply the multiple-access techniques and mobile services for satellite Communications (Apply – L3)

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	1	-	-	-	-	3	3	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	3	1	-	-	-	-	1	2	-	-
CO3	1	-	1	2	-	-	-	-	-	-	-	-	2	-	-
CO4	1	1	1	-	-	3	1	-	-	-	-	-	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).

TEXT BOOKS:

T1 Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003.

T2 Dennis Roddy , "Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

.

REFERENCE BOOKS:

R1 D.C Agarwal , "Satellite communications", Khanna Publications, 5th Edition,2006.

R2 M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I : Introduction to Satellite Communication

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 Course. Course Outcomes	1	05-12-23		TLM1	
2.	Need of satellite communication	1	06-12-23		TLM1	
3.	Definition of a satellite and orbit	1	08-12-23		TLM1	
4.	Frequency allocations for satellite services	1	09-12-23		TLM1	
5.	General structure of satellite communication system	1	12-12-23		TLM1	
6.	Merits and demerits of satellite communication	1	13-12-23		TLM1	
7.	Types of launch vehicles: ELV &RLV	1	15-12-23		TLM1	
8.	Types of launch vehicles: ELV &RLV	1	16-12-23		TLM1	
9.	Problems	1	19-12-23		TLM1	
No. of classes required to complete UNIT-I : 9				No. of classes taken:		

UNIT-II : Orbital Dynamics and Satellite Launching:

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.	Introduction	1	20-12-23		TLM1	
11.	Kepler's Laws	1	22-12-23		TLM1	
12.	Definitions of Terms for EarthOrbiting Satellites	1	23-12-23		TLM1	
13.	Orbital Elements, Apogee and Perigee Heights	1	26-12-23		TLM1	
14.	Effects of non spherical earth, Atmospheric drag	1	27-12-23		TLM1	
15.	Orbital perturbations-need for station keeping	1	29-12-23		TLM3	
16.	Non geostationary orbits and geostationary orbits	1	30-12-23		TLM1	
17.	Orbital effects; Doppler shift, Range variation	1	02-01-24		TLM1	
18.	solar eclipse and sun transit outage	1	03-01-24		TLM1	
19.	Look angle determination: elevation angle and azimuth angle calculation,	1	05-01-24		TLM1	
20.	launching of geostationary satellites.	1	06-01-24		TLM1	
21.	Problems	1	09-01-24		TLM1	

No. of classes required to complete UNIT-II	12	No. of classes taken:

UNIT-III : Space Segment and 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
22.	Introduction to space segment	1	10-01-24		TLM1	
23.	Power supply, Attitude and orbital control: spinning satellite stabilization and momentum wheel stabilization	1	12-01-24		TLM1	
24.	Station keeping, Thermal control	1	17-01-24		TLM1	
25.	TT&C subsystem, Transponders,	1	19-01-24		TLM1	
26.	The wideband receiver, The input demultiplexer	1	20-01-24		TLM1	
27.	The power amplifier, Antenna subsystem	1	23-01-24		TLM1	
28.	Equivalent Isotropic Radiated Power, Free-space transmission, Feeder losses	1	24-01-24		TLM1	
29.	Antenna misalignment losses, Fixed atmospheric and ionospheric losses	1	06-02-24		TLM1	
30.	Link power budget equation, System Noise	1	07-02-24		TLM1	
31.	Carrier-to-Noise Ratio, The Uplink	1	09-02-24		TLM1	
32.	Saturation flux density, Input backoff	1	10-02-24		TLM1	
33.	Downlink, Output back-off	1	13-02-24		TLM1	
34.	Combined Uplink and Downlink C/N Ratio	1	14-02-24		TLM1	
No. of classes required to complete UNIT-III		13	No. of classes taken:			

UNIT-IV: Earth Segment and Satellite Access

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Introduction	1	16-02-24		TLM1	
36.	Design requirements for the selection of earth segment	1	17-02-24		TLM1	
37.	Transmit only earth station	1	20-02-24		TLM1	

38.	Receive only earth station	1	21-02-24		TLM1	
39.	Transmit -Receive (T/R) earth station.	1	23-02-24		TLM1	
40.	Single Access, Preassigned FDMA	1	24-02-24		TLM1	
41.	Demand-Assigned FDMA	1	27-02-24		TLM1	
42.	Spade System, TDMA	1	28-02-24		TLM1	
43.	Preassigned TDMA	1	01-03-24		TLM1	
44.	Demand-assigned TDMA,	1	02-03-24		TLM1	
45.	Satellite-Switched TDMA, CDMA.	1	05-03-24		TLM1	
No. of classes required to complete UNIT-IV		11		No. of classes taken:		

UNIT-V Satellite Services & Applications

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
46.	Introduction	1	06-03-24		TLM1	
47.	Global Positioning System	1	08-03-24		TLM1	
48.	architecture and location principle	1	09-03-24		TLM1	
49.	Direct Broadcast Satellite (DBS/DTH)-Home receiver block (Indoor & Outdoor Unit)	1	13-03-24		TLM1	
50.	Satellite Mobile Services	1	15-03-24		TLM1	
51.	VSAT	1	16-03-24		TLM1	
52.	MSAT	1	19-03-24		TLM1	
53.	RADARSAT	1	20-03-24		TLM1	
54.	IRNSS constellation	1	22-03-24		TLM1	
55.	Orbcomm, Iridium	1	23-03-24		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
56.	Free space optics	1	27-03-24		TLM1	

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	04-12-2023	27-01-2024	8
I Mid Examinations	29-01-2024	03-02-2024	1
II Phase of Instructions	05-02-2024	30-03-2024	8
II Mid Examinations	01-04-2024	06-04-2024	1
Preparation and Practical's	08-04-2024	13-04-2024	1
Semester End Examinations	15-04-2024	27-04-2024	2

PART-C

EVALUATION PROCESS:

Evaluation Task	Mark
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.
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
V.V.Rama Krishna	Dr.P.Venkata Rao	Dr.M.V.Sudhakar	Dr.Y.Amar Babu

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DEPARTMENT OF ELECTRONICS & COMMUNICATIONS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.V.Sankararao, Sr. Assistant Professor
Course Name & Code : Operations Research Techniques - 20ME83 **Regulation**: R20
L-T-P Structure : **4-0-0** **Credits:** 03
Program/Sem/Sec : B.Tech- ECE VI Sem A/S **A.Y.:** 2023-24

PREREQUISITE : **Nil**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to introduce the concepts of formulating an engineering problem into mathematical model to develop an optimal solution.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Apply linear programming approach for optimizing the objectives of industrial oriented problems. **(Applying-L3)**
CO2	Formulate and solve transportation models and assignment models**. (Applying-L3)**
CO3	Implement the strategies in competitive situations and able to sequence the jobs to be processed on machines. **(Applying-L3)**
CO4	Identify the replacement period of the equipment and analyze the waiting situations in an organization. **(Applying-L3)**
CO5	Determine the optimum inventory level and resolve the complex problem into simple problems by dynamic programming approach and apply optimum strategies. **(Applying-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
CO1	3	3	3	2	3				3			3		3	
CO2	3	3	1	2	1				3			3		3	
CO3	3	3	3	2	1				3			3		3	
CO4	3	2	3	2	3				1			3		3	
CO5	2	3	3	2	1				1			3		3	

TEXT BOOKS:

T1	S.D Sharma, ―Operation Research‖, Kedar Nath and RamNath - Meerut, 2008.
T2	Operations Research / N.V.S. Raju / SMS, 2009.

REFERENCE BOOKS:

R1	Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition, 2009.
R2	Hiller & Libermann, Introduction to O.R (TMH), 9th EDITION, 2009.
R3	Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publications, New Delhi, 14th Edition, 2008.
R4	A.M.Natarajan, P.Balasubramani, A. Tamilarasi, Operations Research, Pearson Education, 2nd edition, 2014.
R5	Taha, Introduction to O.R .PHI, 9th edition, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION & LINEAR PROGRAMMING PROBLEM

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**: Introduction To ORT & CEO, COs	1	05.12.2023		TLM1/TLM2	
2.	Operations Research Models, Phases & Applications	1	06.12.2023		TLM1/TLM2	
3.	**Linear Programming Problem (LPP)**: Formulation	1	07.12.2023		TLM1	
4.	Numericals	1	08.12.2023		TLM1	
5.	Graphical Solution For Special Cases Of LPP	1	12.12.2023		TLM1	
6.	Simplex Method	1	13.12.2023		TLM1	
7.	Numericals	1	14.12.2023		TLM1	
8.	Numericals	1	15.12.2023		TLM1	
9.	Big M Method	1	19.12.2023		TLM1	
10.	Numericals	1	20.12.2023		TLM1	
11.	Two Phase Simplex Method	1	21.12.2023		TLM1	
12.	Numericals	1	22.12.2023		TLM1	
13.	Big M method	1	26.12.2023		TLM1	
14.	Numericals	1	27.12.2023		TLM1	
No. of classes required to complete UNIT-I:		**14**		**No. of classes taken:**		

UNIT-II: TRANSPORTATION & ASSIGNMENT PROBLEMS

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction To TP, Terminology, Formulation	1	28.12.2023		TLM1/TLM2	
16.	Standard Form, Unbalanced TP	1	29.12.2023		TLM1	
17.	Numericals	1	02.01.2024		TLM1	
18.	IBFS: NWCM, LCM, VAM	1	03.01.2024		TLM1	
19.	Numericals	1	04.01.2024		TLM1	
20.	Test For Optimality: Stepping Stone Method, Modified Distribution Method (MODI Method)	1	05.01.2024		TLM1	

21.	Numericals	1	09.01.2024		TLM1	
22.	Degeneracy in TP, Numericals	1	10.01.2024		TLM1	
23.	Introduction to Assignment Problem	1	11.01.2024		TLM1	
24.	Variants of Assignment Problems	1	12.01.2024		TLM1	
25.	Optimal Solution, Numericals	1	16.01.2024		TLM1	
26.	Travelling Salesmen Problem	1	17.01.2024		TLM1	
27.	Numericals	1	18.01.2024		TLM1	
No. of classes required to complete UNIT-II		13		**No. of classes taken:**		

UNIT-III: GAME THEORY AND JOB SEQUENCING

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.	**Introduction to Games Theory**: Terminology	1	19.01.2024		TLM1/TLM2	
29.	Minimax or Maxmini Criterion,Optimal Strategy	1	23.01.2024		TLM1	
30.	Solution of games with saddle point	1	24.01.2024		TLM1	
31.	Rectangular games without saddle point, Numericals	1	25.01.2024		TLM1	
32.	2x2 games	1	06.02.2024		TLM1	
33.	mx2, 2xn, mxn games, Dominance Principle,	1	07.02.2024		TLM1	
34.	Graphical approach, Numericals	1	08.02.2024		TLM1	
35.	**Job Sequencing:** n jobs through 2 machines,	1	09.02.2024		TLM1	
36.	n jobs through 3 machines,	1	13.02.2024		TLM1	
37.	2 jobs through m machines	1	14.02.2024		TLM1	
38.	Numericals	1	15.02.2024		TLM1	
39.	Graphical model	1	16.02.2024		TLM1	
No. of classes required to complete UNIT-III		12		**No. of classes taken:**		

UNIT-IV: THEORY OF REPLACEMENT AND WAITING LINES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	**THEORY OF REPLACEMENT:** Introduction, Replacement of Equipment that Deteriorates Gradually	1	20.02.2024		TLM1/TLM2	
41.	Numericals	1	21.02.2024		TLM1	
42.	Replacement of Equipment that fails suddenly, Numericals	1	22.02.2024		TLM1	
43.	Numericals	1	23.02.2024		TLM1	
44.	Group Replacement Policy	1	27.02.2024		TLM1/TLM2	
45.	Numericals	1	28.02.2024		TLM1	
46.	**Introduction to Queuing Theory**	1	29.02.2024		TLM1/TLM2	
47.	Single Channel – Poisson arrivals –	1	01.03.2024		TLM1	

	exponential service times – with infinite population, Derivation					
48.	Numericals	1	05.03.2024		TLM1	
49.	Single Channel – Poisson arrivals – exponential service times – with finite population, Numericals	1	06.03.2024		TLM1/TLM2	
50.	Numericals	1	07.03.2024		TLM1	
51.	Numericals	1	08.03.2024		TLM1	
No. of classes required to complete UNIT-IV		12		**No. of classes taken:**		

UNIT-V: INVENTORY MODELS AND DYNAMIC PROGRAMMING

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52.	**INVENTORY MODELS-** terminology, EOQ	1	12.03.2024		TLM1/TLM2	
53.	Instantaneous Production, finite, continuous demand	1	13.03.2024		TLM1/TLM2	
54.	Shortages not Allowed	1	14.03.2024		TLM1	
55.	Purchase inventory models with one price break	1	15.03.2024		TLM1	
56.	Purchase inventory models with multiple price breaks	1	19.03.2024		TLM1	
57.	Numericals	1	20.03.2024		TLM1	
58.	**DYNAMIC PROGRAMMING (DP):** Introduction To DP	1	21.03.2024		TLM1/TLM2	
59.	Bellman's Principle of Optimality, Applications of Dynamic Programming	1	22.03.2024		TLM1/TLM2	
60.	Capital Budgeting Problem, Numericals	1	26.03.2024		TLM1	
61.	linear programming problem	1	27.03.2024		TLM1	
62.	Shortest path problems	1	28.03.2024		TLM1	
63.	Numericals	1	29.03.2024		TLM1	
No. of classes required to complete UNIT-V		12		**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

.

Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	04-12-2023	27-01-2024	8
I MID Examinations	29-01-2024	03-02-2024	1
II Phase of Instructions	05-02-2024	30-03-2024	8
II MID Examinations	01-04-2024	06-04-2024	1
Preparation and Practicals	08-04-2024	13-04-2024	1
Semester End Examinations	15-04-2024	27-04-2024	2

PART-C

EVALUATION PROCESS (R20 Regulation):

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
Mid Marks =80% of Max ((M1+Q1+A1),(M2+Q2+A2))+20% of Min((M1+Q1+A1),(M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE):M	30
Semester End Examination (SEE)	70
Total Marks = CIE+SEE	100

PART-D

PROGRAMME 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):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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 environmental considerations.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the ring 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.
PO12	**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	Design and develop modern communication technologies for building the interdisciplinary skills to meet current and future needs of industry.
PSO 2	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	Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mr.V.Sankararao	Mr.V.Sankararao	Dr.M.B.S.Sreekara Reddy	Dr.M.B.S.Sreekara Reddy
Signature				

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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 – 20EC59**
L-T-P Structure : 0-0-3
Credits : 1.5
Program : B. Tech. VI Semester ECE-A Section
A.Y : **2023 – 24**
Course Instructor : Dr. B.V.N.R. Siva Kumar

COURSEOBJECTIVE:

In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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.

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	3	2	2	-	1	1	-	-	-	2	-	2	-
CO2	3	3	3	2	2	-	1	1	-	-	-	3	-	3	-
CO3	3	3	3	3	3	-	1	1	-	-	-	3	-	3	-
CO4	-	-	-	2	-	-	-	1	2	3	-	1	-	-	-

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
LAB SCHEDULE (LESSONPLAN): Section-A

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					
1.	Introduction to Lab	3	08-12-2023		**TLM2**	
2.	Display, comparison and reverse the string	3	15-12-2023		**TLM8**	
3.	Factorial using Procedures	3	22-12-2023		**TLM8**	
4.	Sorting the signed and unsigned numbers	3	29-12-2023		**TLM8**	
5.	Checking the given string for Palindrome	3	05-01-2024		**TLM8**	
6.	Arithmetic operations like Addition, Subtraction, Multiplication and Division	3	12-01-2024		**TLM8**	
7.	Byte checking by using 8051, Addition of series of numbers	3	19-01-2024		**TLM8**	
8.	Checking the given numbers for Odd or Even	3	02-02-2024		**TLM8**	
	CYCLE-2					
9.	Interfacing of A/D and D/A converter	3	09-02-2024		**TLM8**	
10.	Interfacing of LEDs and Switches, Interfacing of LCD	3	16-02-2024		**TLM8**	
11.	Interfacing of Stepper Motor	3	23-02-2024		**TLM8**	
12.	Interfacing of traffic Light controller	3	01-03-2024		**TLM8**	
13.	Interfacing of Real Time Clock	3	15-03-2024		**TLM8**	
14.	Data loggers –Roll over display	3	22-03-2024		**TLM8**	
15.	Internal Lab Exam	3	29-03-2024		**TLM8**	
No. of classes required to complete:		45	No. of classes conducted:			

PART-C

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: 2023 – 24 (VI Semester)

B. Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**04-12-2023**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
II Phase Instructions	05-02-2024	**30-03-2024**	8 Weeks
II Mid Examinations	**01-04-2024**	**06-04-2024**	1 Week
Preparation & Practical's	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**24-04-2024**	2 Weeks
Internship	29-04-2024	22-06-2024	8 Weeks

EVALUATIONPROCESS:

Evaluation Task	**COs**	**Marks**
Day to Day work	1,2,3,4	A=10
Internal Lab Examination	1,2,3,4	B=5
Total Internal Marks (A+B)		**C=15**
Semester End Examinations	1,2,3,4	**D=35**
Total Marks : C+D	1,2,3,4	**50**

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. B V N R SIVA KUMAR]	[Mr. K.SASI BHUSHAN]	[Dr. P. LACHI REDDY]	[Dr. Y. AMAR BABU]

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 AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.M.Ramya Harika

Course Name & Code : VLSI DESIGN LAB– 20EC60

L-T-P Structure : 0-0-3 Credits : 1.5

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- A A.Y : 2023-24

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The course explores the design and implementation aspects of various combinational and sequential circuits used in VLSI Design. It also develops the knowledge in VLSI Front End and Back End Design in semi-custom and full-custom design.

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

CO1	**Implement** combinational and sequential circuits on FPGA/CPLD boards. (Apply – L3)
CO2	**Design** the Combinational and Sequential logic using NMOS and CMOS Technology. (Apply – L3)
CO3	**Analyze** combinational and sequential circuits using Static CMOS logic from schematic to layout. (Analyze –L4)
CO4	**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
CO1	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO2	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	1	2	3		1	-	-	-

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Batch-1

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	07.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	14.12.2023			
2	Experiment – 2	CO1	3	21.12.2023			
3	Experiment – 3	CO1	3	28.12.2023			
4	Experiment – 4	CO2,CO3	3	04.01.2024			
5	Experiment – 5	CO2,CO3	3	11.01.2024			
6	Experiment – 6	CO2,CO3	3	18.01.2024			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	25.01.2024			
8	Experiment – 8	CO2,CO3	3	08.02.2024			
9	Experiment – 9	CO2,CO3	3	15.02.2024			
10	Experiment – 10	CO2,CO3	3	22.02.2024			
11	Experiment – 11	CO2,CO3	3	29.02.2024			
12	Experiment beyond syllabus	CO2,CO3	3	07.03.2024			
13	Revision	CO2,CO3	3	21.03.2024			
14	Internal Examination	--	3	20.04.2024			

Batch-2

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	04.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	11.12.2023			
2	Experiment – 2	CO1	3	18.12.2023			
3	Experiment – 3	CO1	3	08.01.2024			
4	Experiment – 4	CO2,CO3	3	15.01.2024			
5	Experiment – 5	CO2,CO3	3	22.02.2024			
Cycle – II							
7	Experiment – 6	CO2,CO3	3	05.02.2024			
8	Experiment – 7	CO2,CO3	3	12.02.2024			
9	Experiment – 8	CO2,CO3	3	19.02.2024			
10	Experiment – 9	CO2,CO3	3	26.02.2024			
11	Experiment – 10	CO2,CO3	3	04.03.2024			
12	Experiment beyond syllabus	CO2,CO3	3	11.03.2024			
--	Internal Examination		3	18.03.2024			

Experiments to be conducted:

Exp. No	CYCLE-1	Exp. No	CYCLE-2
1	Implementation of Carry-Look-Ahead adder.	7	Design and analysis of CMOS NAND gate
2	Implementation of 4x4 Array Multiplier.	8	Design and analysis of Full Adder
3	Implementation of a 4-bit ALU.	9	Design and analysis of Decoder
4	Design and analysis of NMOS Inverter.	10	Design and analysis of 8- bit Binary Counter.
5	Design and analysis of CMOS Inverter	11	Design and analysis of Shift Register
6	Design and analysis of CMOS NOR gate		

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	**Expt. no's**	**Marks**
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A = 05
Record = **B**	1,2,3,4,5,6,7,8…	B = 05
Internal Test = **C**	1,2,3,4,5,6,7,8…	C = 05
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8…	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8…	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8…	**50**

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:	**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
Mrs.M.Ramya Harika	Mrs.M.Ramya Harika	Dr. P Lachi Reddy	Dr. Y. Amar Babu

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : Microwave Engineering Lab– 20EC61

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Dr.K.Rani Rudrama / Dr. V.Ravi Sekhar Reddy
Mr. P. James Vijay

COURSE COORDINATOR : Dr. K. Rani Rudrama

COURSE OBJECTIVES: This Lab deals with the measurements of the EM signals at microwave frequency range. It involves measurement of frequency, wavelength, VSWR, Impedance and scattering parameters of various microwave devices like Circulator, Direction Coupler, and Magic-Tee. Even the latest trend of software tool i.e. HFSS is also introduced and microwave devices will be verified by evaluating the related parameters.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1 : Demonstrate the functions of microwave bench setup **(Understand – L2)**
CO2 : Examine the properties of microwave passive devices using HFSS **(Apply – L3)**
CO3 : Estimate the frequency, wavelength, VSWR, impedance and scattering parameters of microwave devices **(Apply – L3)**
CO4 : 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
CO1	1	-	-	1	1	-	-	-	-	-	-	-	1	-	-
CO2	1	1	1	1	3	-	-	-	-	-	-	1	3	-	-
CO3	2	2	-	3	2	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	1	2	3	-	1	-	-	-

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

Batch-1

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1	Demonstration	3	04-12-2023		-	TLM1	
2	Experiment-1	3	11-12-2023		COs 1,3,4	TLM4	
3	Experiment-2	3	18-12-2023		COs 1,3,4	TLM4	
4	Experiment -3	3	01-01-2024		COs1,3,4	TLM4	
5	Experiment-4	3	08-01-2024		COs 1,3,4	TLM4	
6	Experiment-9	3	15-01-2024		COs 2,4	TLM4	
7	Experiment-10	3	22-01-2024		COs2,4	TLM4	
8	Experiment-5	3	05-02-2024		COs1,3,4	TLM4	
9	Experiment-6	3	12-02-2024		COs 1,3,4	TLM4	
10	Experiment-7	3	19-02-2024		COs 1,3,,4	TLM4	
11	Experiment-8	3	26-02-2024		COs 1,3,4	TLM4	
12	Experiment-11	3	04-03-2024		COs 2,4	TLM4	
13	Experiment-12	3	11-03-2024		COs 2,4	TLM4	
14	Revision	3	18-03-2024		COs 2,4	TLM4	
15	Internal exam	3	25-03-2024				

Batch-2

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1.	Demonstration	3	07-12-2023		COs 1,4	TLM1	
2.	Experiment-1	3	14-12-2023		COs 1,4	TLM4	
3.	Experiment-2	3	21-12-2023		COs 1,4	TLM4	
4.	Experiment-3	3	28-12-2024		COs 3,4	TLM4	
5.	Experiment-4	3	04-01-2024		COs2,4	TLM4	
6.	Experiment-9	3	11-01-2024		COs 2,4	TLM4	
7.	Experiment-10	3	18-01-2024		COs 2,4	TLM4	
8.	Experiment-5	3	25-01-2024		COs 1,3,4	TLM4	
9.	Experiment-6	3	08-02-2024		COs 1,3,4	TLM4	
10.	Experiment-7	3	15-02-2024		COs 1,3,4	TLM4	
11.	Experiment-8	3	22-02-2024		COs 1,3,4	TLM4	
12.	Experiment-11	3	29-02-2024		COs 2,4	TLM4	
13.	Experiment-12	3	07-03-2024		COs 2,4	TLM4	
14.	Revision	3	14-03-2024				
15.	Revision	3	21-03-2024				
16.	Internal exam	3	28-03-2024				

List of Experiments:

Exp. No	Experiments to be conducted	Exp. No	Experiments to be conducted
CYCLE-1			CYCLE-2
1.	Reflex Klystron Characteristics.	5.	Directional coupler characteristics
2.	Gunn diode Characteristics	6.	Impedance and frequency measurement
3.	Attenuation measurement	7.	Scattering parameters of circulator
4.	VSWR measurement .	8.	Scattering parameters of Magic tee
9.	Scattering parameters of branch line coupler	11.	Design and S-parameter measurement of microwave band stop filter
10	Scattering parameters of rat-race coupler	12.	Design and S-parameter measurement of microwave Balun

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	**Cos**	**Marks**
Day to Day Work	1,2,3,4	A=10
Record	1,2,3,4	B=10
Viva Voce	1,2,3,4	C=5
Internal Exam	1,2,3,4	D=10
Attendance	-	E=5
Cumulative Internal Examination :	1,2,3,4	**A+B+C+D+E=40**
Semester End Examinations	1,2,3,4	**F=60**
Total Marks: A+B+C+D+E+F	**1,2,3,4**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO2: To Function professionally in the rapidly changing world with advances in technology
PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner?

PROGRAMME OUTCOMES (POs)

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. **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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PO5. **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.
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PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: 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.
PO11: 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.
PO12: 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)

PSO1: Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

PSO2: 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

PSO3: Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Mrs. K.RaniRudrama	Mrs.K.RaniRudrama	Dr.B.Y.V.N.R.Swamy	Dr.Y.Amar Babu
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : N Dharmachari

Course Name & Code : VLSI Design Automation – 20ECH3
L-T-P Structure : 3-1-0 Credits : 4

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Honors A.Y : 2023-24

PRE-REQUISITE: VLSI Design

COURSE EDUCATIONAL OBJECTIVES (CEOs):
In this course student will learn about the design cycles, various techniques on Partitioning, Placement and Routing and addressing their problems

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

CO 1	Understand need for VLSI physical design automation. **(Understand – L2)**
CO 2	Analyze VLSI automation algorithms for partitioning **(Apply – L3)**
CO 3	Formulate placement, floor planning and pin assignment problems and simulate. **(Apply – L3)**
CO 4	Resolve routing issues using various algorithms **(Analyze – L4)**
CO 5	Illustrate physical design cycle for FPGAs **(Analyze – L4)**

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

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

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

TEXT BOOK:

1. Naveed Shervani, **"Algorithms for VLSI Physical Design Automation"**, Springer Publisher, Third edition

REFERENCE BOOKS:

1. ChristophnMeinel& Thorsten Theobold, **"Algorithm and Data Structures for VLSI Design"**, KAP, 2002.
2. Rolf Drechsheler :**"Evolutionary Algorithm for VLSI"**, Second edition.
3. Trimburger, **"Introduction to CAD for VLSI",** Kluwer Academic publisher, 2002

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: VLSI Physical Design Automation

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	General Interaction & Introduction to the course	1	05-12-2023		-	
2.	Course Objective and Outcomes, POs, PSOs and Mapping with COs	1	07-12-2023		-	
3.	Introduction	1	12-12-2023		TLM1	
4.	VLSI Design cycle	1	14-12-2023		TLM2	
5.	New trends in VLSI design cycle	2	16-12-2023		TLM2	
6.	New trends in Physical design cycle	1	19-12-2023		TLM2	
7.	Design styles	1	21-12-2023		TLM2	
8.	Full custom Basic terminology	2	23-12-2023		TLM2	
9.	Complex issues	1	26-12-2023		TLM2	
10.	Basic algorithms	1	28-12-2023		TLM2	
11.	Basic data structures, and algorithms	2	30-12-2023		TLM2	
No. of classes required to complete UNIT-I		**14**	**No. of classes taken**			

UNIT-II: VLSI Automation Algorithms

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Partitioning: problem formulation	1	02-01-2024		TLM2	
2.	Classification of partitioning algorithms	1	04-01-2024		TLM2	
3.	Group migration algorithms	3	06-01-2024 09-01-2024		TLM2	
4.	Simulated annealing & evolution.	2	11-01-2024 16-01-2024		TLM2	
5.	Other partitioning algorithms	3	18-01-2024 20-01-2024		TLM2	
No. of classes required to complete UNIT-II		**10**	**No. of classes taken**			

UNIT-III: Placement, Floor Planning & Pin Assignment

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Problem formulation	1	23-01-2024		TLM2	
2.	Simulation base placement algorithms	1	25-01-2024		TLM2	
3.	Other placement algorithms	2	27-01-2024		TLM2	
4.	Constraint based floor planning	2	06-02-2024 08-02-2024		TLM2	

5.	floor planning algorithms for mixed block & cell design	1	13-02-2024		TLM2	
6.	General & channel pin assignment	1	15-02-2024		TLM2	
No. of classes required to complete UNIT-III		**08**	**No. of classes taken**			

UNIT-IV: Global Routing, Detailed Routing and Over The Cell Routing & Via Minimization

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Problem formulation	2	17-02-2024		TLM2	
2.	Classification of global routing algorithms	1	20-02-2024		TLM2	
3.	Problem formulation, Classification of Detailed routing algorithms	1	22-02-2024		TLM2	
4.	Maze routing algorithm, line probe algorithm	2	24-02-2024		TLM2	
5.	Steiner Tree based algorithms, ILP based approaches	1	27-02-2024		TLM2	
6.	Single layer routing algorithms	1	29-02-2024		TLM2	
7.	Two layer channel routing algorithms	2	02-03-2024		TLM2	
8.	Three layer channel routing algorithms, Switchbox routing algorithms	1	05-03-2024		TLM2	
9.	Two layers over the cell routers	1	07-03-2024		TLM2	
10.	Constrained & unconstrained via minimization	1	12-03-2024		TLM2	
No. of classes required to complete UNIT-IV		**13**	**No. of classes taken**			

UNIT-V: Physical design Automation of FPGAs

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	14-03-2024		TLM2	
2.	FPGA Technologies	2	16-03-2024		TLM2	
3.	Physical design cycle for FPGAs, Partitioning	1	19-03-2024		TLM2	
4.	Routing	1	21-03-2024		TLM2	
5.	Routing algorithms for the non-segmented model	2	23-03-2024		TLM2	
6.	Routing algorithms for segmented model	1	26-03-2024		TLM2	
7.	routing algorithms for staggered model	1	28-03-2024		TLM2	
No. of classes required to complete UNIT-V		**09**	**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
1.	Semi-custom IC design flow	**2**	30-03-2024		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

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.
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 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. N.Dharmachari	Mr. N.Dharmachari	Dr. P.Lachi Reddy	Dr. Y. Amar Babu

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Name & Code : **Microprocessors and Microcontrollers – 20EC15**
L-T-P Structure : 4-0-0
Credits : 3
Program : B.Tech.,
A.Y : **2023 – 24**

Pre requisite:

Course Educational Objective: In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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

CO 1	Understand the architecture of 8086, 8051 and ARM Controller **(Understand)**
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**

CO's / PO's	Course Name with code : MPMC,20EC15														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO3	2	3	2	1	-	-	-	-	-	-	-	2	-	3	-
CO4	1	2	3	2	-	-	-	-	-	-	-	2	-	3	-

Prescribed Syllabus:

UNIT-I: 8086 MICROPROCESSOR [9 HRS]

Architecture, Pin diagram, Register organization, Minimum mode and Maximum mode, timing diagrams. Addressing modes, Instruction set, Interrupt vector table, Assembly language programming - data transfer, arithmetic, logical and decision making operations.

UNIT- II: 8051 MICROCONTROLLER [8 HRS]

Architecture, Input/output Ports, Registers, Counter and Timers, Serial port, Interrupts, addressing modes, instruction set and Programming - data transfer, arithmetic, logical and decision making operations.

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [9 HRS]

History, Architecture, ARM design philosophy, Registers, Program status register, Instruction pipeline, Interrupts and vector table, ARM processor families, Instruction set: Data processing instructions, Addressing modes, Branch, Load-Store instructions, PSR instructions, and Conditional instructions.

UNIT – IV: ARM PROGRAMMING [8 HRS]

Assembly programming, General structure of assembly language, Writing programs, Branch instructions, Loading constrains, load and store instructions, Read only and read/write Memory, Multiple Register Load and Store.

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS [8 HRS]

Interfacing - A/D and D/A converter, LEDs, Switches, Relays, LCD, Stepper Motors, Real Time Clock, Serial Communication, GSM and GPS.

Text Books:

1. Ray and Burchandi, “Advanced Microprocessors and Interfacing”, Tata McGraw–Hill.

2. M.A.Mazidi,S.Naimi and S.Naimi, “The AVR Microcontroller and Embedded Systems Using Assembly and C”, 1st Edition Pearson Publications, 2013.

Reference Books:

1. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press, 2010.

2. Dhananjay V. Gadre, “Programming and Customizing The AVR Microcontroller”, Tata McGraw-Hill publications, 2012.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: 8086 MICROPROCESSOR						
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.	Architecture	1	04-12-2023		TLM1	
2.	Pin diagram	1	06-12-2023		TLM2	
3.	Register organization	1	07-12-2023		TLM1	
4.	Minimum mode and Maximum mode, timing diagrams	1	09-12-2023		TLM2	
5.	Addressing modes	1	11-12-2023		TLM1	
6.	Instruction set	1	13-12-2023		TLM1	
7.	Interrupt vector table	1	14-12-2023		TLM1	
8.	Assembly language programming - data transfer, arithmetic operations	2	16-12-2023 18-12-2023		TLM1 TLM3	
9.	Assembly language programming - logical and decision making operations	2	20-12-2023 21-12-2023		TLM1 TLM3	
10.	**Tutorial,/Assignment**	1	**23-12-2023**		TLM3	

UNIT- II: 8051 MICROCONTROLLER						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
11.	Architecture	1	27-12-2023		TLM1	
12.	Input/output Ports	1	28-12-2023		TLM1	
13.	Registers, Counter and Timers	1	30-12-2023		TLM1	
14.	Serial port, Interrupts	1	03-01-2024		TLM1	
15.	Addressing modes	1	04-01-2024		TLM1	
16.	Instruction set	2	06-01-2023 08-01-2023		TLM1	
17.	Programming - data transfer, arithmetic operations	2	10-01-2024 17-01-2024		TLM1 TLM3	
18.	Programming - logical and decision making operations	1	18-01-2024		TLM1 TLM3	
19.	**Tutorial,/Assignment**	1	**20-01-2024**		TLM3	

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL						
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.	History & Architecture	1	22-01-2024		TLM1	
21.	ARM design philosophy	1	24-01-2024		TLM1	
22.	Registers, Program status register	1	25-01-2024		TLM1	
23.	Instruction pipeline, Interrupts and vector table	1	27-01-2024		TLM1	
24.	ARM processor families	1	05-02-2024		TLM1	
25.	Instruction set: Data processing instructions	1	07-02-2024		TLM2	
26.	Addressing modes	1	08-02-2024		TLM1	
27.	Branch, Load-Store instructions	1	10-02-2024		TLM2	
28.	PSR instructions, and Conditional instructions	1	12-02-2024		TLM2	
29.	**Tutorial,/Assignment**	1	14-02-2024		TLM1	

UNIT – IV: ARM PROGRAMMING						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
30.	Assembly programming,	1	15-02-2024		TLM3	
31.	General structure of assembly language	1	17-02-2024		TLM1	
32.	Writing programs	3	19-02-2024		TLM1	
33.	Branch instructions	1	24-02-2024		TLM1	
34.	Loading constrains	1	26-02-2024		TLM1	
35.	load and store instructions	1	28-02-2024		TLM1	
36.	Read only and read/write Memory	1	29-02-2024		TLM1	
37.	Multiple Register Load and Store	1	02-03-2024		TLM1	
38.	**Tutorial,/Assignment**	1	04-02-2024		TLM3	

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
39.	Interfacing - A/D converter	1	06-03-2024		TLM3	
40.	Interfacing - D/A converter	1	07-03-2024		TLM3	
41.	Interfacing - LEDs & Switches	1	09-03-2024		TLM3	
42.	Interfacing – Relays & LCD	1	11-03-2024		TLM3	
43.	Interfacing - Stepper Motors	1	13-03-2024		TLM3	
44.	Interfacing - Real Time Clock	1	14-03-2024		TLM3	
45.	Interfacing - Serial Communication	1	16-03-2024		TLM3	
46.	Interfacing - GSM and GPS	1	18-03-2024		TLM3	
47.	**Tutorial,/Assignment**	1	20-03-2024		TLM3	

BEYOND THE SYLLABUS & REVISION						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
48.	LPC1769/LPC2148 Instruction Set	2	21-03-2024		TLM2	
49.	LPC1769/LPC2148 Programming	2	25-03-2024		TLM2	
50.	LPC1769/LPC2148 Interfacing	1	30-03-2024		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: 2023 – 24 (VI Semester)

B.Tech VI Semester - 2020 Admitted Batch			
Class work Commence From	**21-02-2022**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
II Phase Instructions	05-02-2024	**30-03-2024**	8 Weeks
II Mid Examinations	**01-04-2024**	**06-04-2024**	1 Week
Preparation & Practicals	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**24-04-2024**	2 Weeks
Internship			6 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 architecture of 8086, 8051 and ARM Controller **(Understand)**	Describe, Explain, Paraphrase, Restate ,Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**	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

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

[Mr. K.SASI BHUSHAN] **[Mr. B.V.N.R.Siva Kumar]** **[Dr.P.LACHI REDDY]** **[Dr.Y. AMAR BABU]**

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DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor : Dr. G. Srinivasulu
Course Name & Code : VLSI DESIGN– 20EC16
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- B A.Y : 2023-24

PRE-REQUISITE: Electronic Devices and Circuits, Digital Circuits

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential sub system CMOS circuit designs used in VLSI Design. This course also gives the complete information regarding design tools and CMOS testing techniques.

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

CO1:	**Understand** semiconductor technology and MOS fabrication process (L2-Understand)
CO2:	**Apply** layout design rules for NMOS, CMOS logic circuit designs. (L3-Apply)
CO3:	**Analyze** the IC building blocks. (L4-Analyze)
CO4:	**Apply** CMOS testing techniques to test different digital designs. (L3-Apply)

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	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	3	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	3	-	4	-
CO4	2	2	1	-	-	-	-	-	-	-	-	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 Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI Publishers, 2005.

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

BOS APPROVED REFERENCE BOOKS:

R1 Neil. H. E. Weste and Kamaran Eshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rdEdition.

R2 Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.

Part-B
COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: IC Fabrication Technology& Basic Electrical Properties of MOS & BiCMOSCircuits

S.No.	*T*opics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	IC fabrication Technology: Silicon semiconductor technology–wafer processing	1	04.12.2023			

2.	Oxidation, epitaxy, Lithography	1	05.12.2023			
3.	ion implantation, Diffusion,silicon gate process	1	06.12.2023			
4.	NMOS fabrication	1	09.12.2023			
5.	CMOS fabrication	1	11.12.2022			
6.	BiCMOS technology, Comparison between CMOS and bipolar technologies	1	12.12.2023			
7.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	13.12.2023			
8.	Ids –Vds relationships	1	16.12.2023			
9.	MOS transistor threshold Voltage, MOS transistor gm,gds	1	18.12.2023			
10.	Pass transistor	1	19.12.2023			
11.	NMOS Inverter, Various pull up	1	20.12.2023			
12.	CMOS Inverter analysis and design	1	23.12.2023			
13.	BiCMOS Inverters	1	26.12.2023			
14.	Assignment	1	27.12.2023			
No. of classes required to complete UNIT-I :		18	No. of classes taken:			

UNIT-II : VLSI Circuit Design Processes

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	VLSI Circuit Design Processes: VLSI design flow	1	30.12.2023			
16.	MOS Layers, Stick Diagrams	1	02.01.2024			
17.	Design Rules and Layout, 5µm CMOS	1	03.01.2024			
18.	Design rules for wires, Design rules for Contacts, transistor	1	06.01.2024			
19.	Layout Diagrams for NMOS, CMOS Inverters and Gates,	1	08.01.2024			
20.	Scaling of MOS circuits, Limitations of Scaling	1	090.01.2024			
21.	Basic Circuit Concepts: Sheet Resistance	1	10.01.2024			
22.	Area Capacitance calculations	1	13.01.2024			

23.	Inverter Delays	1	15.01.2024			
24.	Assignment	1	17.01.2024			
No. of classes required to complete UNIT-II		14	No. of classes taken:			

UNIT-III : Digital IC Building Blocks

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Digital IC Building Blocks: Logic gates: combinational logic functions	1	20.01.2024			
26.	Static complementary gates	1	22.01.2024			
27.	Switch logic	1	23.01.2024			
28.	Standard cell based layout	1	23.01.2024			
29.	Logic and interconnect design	1	24.01.2024			
30.	power optimization	1	27.01.2024			
31.	Realization of Latches and Flip-Flops using switch logic	1	05.02.2024			
32.	Sub system design flow	1	06.02.2024			
33.	4x4 array multiplier	1	07.02.2024			
34.	Design of 4bit ALU using adder	1	10.02.2024			
35.	Synchronous up/down counters, Registers	1	12.02.2024			
36.	Assignment	1	13.02.2024			
No. of classes required to complete UNIT-III		12	No. of classes taken:			

UNIT-IV : Analog IC Building Blocks

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.	Introduction	1	14.02.2024			
38.	Analog IC Building Blocks: MOS Diode/Active resistor	1	17.02.2024			
39.	Simple current sinks, Basic current mirrors	1	19.02.2024			
40.	Advanced current mirrors	1	20.02.2024			
41.	Current and Voltage references	1	21.02.2024			
42.	Band-gap references	1	24.02.2024			
43.	Op-Amp, One Stage OP-Amp.	1	26.02.2024			

44.	Two Stage OP-Amp	1	27.02.2024			
45.	Gain boosting	1	28.02.2024			
46.	Common Mode Feedback	1	02.03.2024			
47.	Noise in Op Amps	1	04.03.2024			
48.	Assignment	1	05.03.2024			
No. of classes required to complete UNIT-IV		12		No. of classes taken:		

UNIT-V : TEST AND TESTABILITY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Introduction	1	06.03.2024			
48.	Test and Testability : System Partitioning	1	09.03.2024			
49.	Layout and Testability, Reset/Initialization	1	11.03.2024			
50.	Design for Testability (DFT)	1	12.03.2024			
51.	Testing Combinational Logic	1	13.03.2024			
53.	Testing Sequential Logic	1	16.03.2024			
55.	Practical Design for Test Guidelines	2	18.03.2024 19.03.2024			
56.	Scan Design Techniques	1	20.03.2024			
57.	Built-In-Self-Test (BIST),	1	23.03.2024			
58.	Future Trends	1	25.03.2024			
59.	Assignment	1	26.03.2024			
No. of classes required to complete UNIT-V:		12		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
60.	Introduction to FINFET	1	30.03.2024			

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.
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	Smt.T.Kalpana	Dr. P Lachi Reddy	Dr.Y.Amar Babu

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. V.Ravi Sekhara Reddy, Assoc. Professor
Course Name & Code : MICROWAVE ENGINEERING-20EC17
L-T-P Structure : 3-0-0
Credits : 3
Program/Sem/Sec : B. Tech. VI-Sem., ECE-B Sec
A.Y : 2023 – 24

Pre requisite: Vector calculus, Coordinate Systems, Basics of electromagnetics

Course Educational Objective: This course provides the knowledge on different types of waveguides and resonators. The course will give an idea about microwave communication in terms of various bands, advantages, applications. The course also gives the complete information regarding the microwave tubes and passive devices along with microwave bench setup and microwave measurements.

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

CO 1	**Understand** the microwave sources, components and measurements of microwave parameters **(Understand – L2)**
CO 2	**Develop** the TE, TM fields in waveguides and microwave signals using microwave tubes and solid-state devices **(Apply – L3)**
CO 3	**Apply** the properties of S-parameters to model the S-matrix of waveguide components **(Apply – L3)**
CO 4	**Analyze** the flow of microwave fields in waveguides, components and efficiency of microwave tubes **(Analyze – L4)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	-	-
CO4	3	3	2	1	1	-		-	-	-	-	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. Samuel Y. Liao, "Microwave Devices and Circuits", PHI Publishers, 3rdEdition, 2003.
2. David M.Pozar, "Microwave Engineering", John Wiley Publishers,4thEdition.

REFERENCE BOOKS

1. M Kulakarni, "Microwave and Radar Engineering", Umesh Publications, New Delhi 5th Edition
2. Jordan and Balmain, "Electromagnetic fields and Radiating systems", Pearson education.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):B

UNIT-I:[11HRS]						
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, Microwave Spectrum and Bands	1	05-12-2023		TLM1	
2.	Advantages and Applications of Microwaves	1	06-12-2023		TLM1	
3.	Rectangular Waveguides: Impossibility of TEM waves in waveguides	1	07-12-2023		TLM1	
4.	Transverse Magnetic and Transverse Electric Waves in Rectangular Waveguides	1	08-12-2023		TLM1	
5.	Field Expressions, characteristics of TE and TM Waves-Cutoff frequency	1	12-12-2023		TLM1	
6.	Dominant mode in Rectangular Waveguides, phase velocity, group velocity	1	13-12-2023		TLM1	
7.	relation between cutoff, guided and free space wavelengths	1	14-12-2023		TLM1	
8.	Wave impedances for TE and TM cases.	1	15-12-2023		TLM1	
9.	Circular Waveguides: TM and TE waves in circular guides	1	19-12-2023		TLM1	
10.	Field Expressions, Dominant mode in circular waveguide.	1	20-12-2023		TLM2	
11.	**Tutorial,/Assignment**	1	21-12-2023		TLM1	

UNIT- II: [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**
12.	Resonators: Rectangular cavity resonators	1	22-12-2023		TLM1	
13.	Circular cavity resonators	1	26-12-2023		TLM1	
14.	Field Expressions, Re-entrant Cavities	1	27-12-2023		TLM1	
15.	Microwave Tubes: Limitations of conventional tubes at microwave frequencies	1	28-12-2023		TLM1	
16.	Klystron Tubes: Two Cavity Klystrons – Structure	1	29-12-2023		TLM1	
17.	Microwave tubes – O type and M type classifications	1	02-01-2024		TLM2	
18.	Velocity Modulation Process and Applegate Diagram,	1	03-01-2024		TLM1	

19.	Reflex Klystrons – Structure, Applegate Diagram and Principle of working,	1	04-01-2024		TLM1	
20.	Power Output, Efficiency, output Characteristics	1	05-01-2024		TLM1	
21.	**Tutorial,/Assignment**	1	09-01-2024		TLM1	

UNIT – III[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**
22.	Helix TWT: Types and Characteristics of Slow Wave Structures;	1	10-01-2024		TLM1	
23.	Structure of TWT	1	11-01-2024		TLM1	
24.	Amplification Process in TWT	1	18-01-2024		TLM1	
25.	M-Type Tubes: Cross-field effects	1	19-01-2024		TLM2	
26.	Magnetrons – Different Types	1	23-01-2024		TLM1	
27.	8-Cavity Cylindrical Travelling Wave Magnetron	1	24-01-2024		TLM1	
28.	Hull Cut-off and Hartee Conditions	1	25-01-2024		TLM1	
29.	PI-Mode Operation in Magnetrons	1	06-02-2024		TLM1	
30.	Strapping in Magnetrons	1	07-02-2024		TLM1	
31.	**Tutorial,/Assignment**	1	08-02-2024		TLM1	

UNIT – IV[9 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**
32.	Microwave Solid State Devices: Negative resistance region	1	09-02-2024		TLM1	
33.	Classification, Applications	1	13-02-2024		TLM1	
34.	Transferred Electron Devices: Gunn Diode Principle,	1	14-02-2024		TLM2	
35.	Two Valley Model Theory	1	15-02-2024		TLM1	
36.	RWH Theory, Characteristics.	1	16-02-2024		TLM1	
37.	Avalanche Transit Time Devices: IMPATT diode Principle of Operation and Characteristics,	1	20-02-2024		TLM1	
38.	TRAPATT Diodes Principle of Operation and Characteristics,	1	21-02-2024		TLM1	
39.	IMPATT, TRAPATT Diodes expressions	1	22-02-2024		TLM1	
40.	**Tutorial,/Assignment**	1	23-02-2024		TLM1	

UNIT – V [15 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**
41.	Waveguide Components: Scattering matrix	1	27-02-2024		TLM1	

42.	Formulation and Properties. S Matrix	1	28-02-2024		TLM1	
43.	Calculations for E plane and H plane Tees	1	29-02-2024		TLM1	
44.	Calculations for Magic Tee, Directional Coupler	1	01-03-2024		TLM1	
45.	Fundamentals of branch line, rat-race couplers	1	05-03-2024		TLM1	
46.	microwave filters. Ferrites– Composition and Characteristics,	1	06-03-2024		TLM1	
47.	Faraday Rotation; Ferrite Components – Gyrator	1	07-03-2024		TLM1	
48.	Isolator, Circulator. Microwave attenuators.	1	12-03-2024		TLM1	
49.	Isolator, Circulator. Microwave attenuators.	1	13-03-2024		TLM1	
50.	**Microwave Measurements:** Description of Microwave Bench setup ,precautions	2	14-03-2024 15-03-2024		TLM2	
51.	Measurement of Attenuation, Frequency, VSWR	2	19-03-2024 20-03-2024		TLM1	
52.	Measurement of Impedance, Power.	1	21-03-2024		TLM1	
53.	**Tutorial,/Assignment**	1	22-03-2024		TLM1	

BEYOND THE SYLLABUS & REVISION [3 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**
54.	Microwave devices in RADAR communication	1	26-03-2024		TLM1	
55.	RF Microwave Passive Devices	1	27-03-2024		TLM1	
56.	Microwave devices in sattelite communication	1	28-03-2024		TLM1	

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: 2022 – 23 (VI Semester)

B.Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**04-12-2023**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2023	8 Weeks
I Mid Examinations	**29-01-2023**	**03-02-2023**	1 Week
II Phase Instructions	05-02-2023	**30-03-2023**	8 Weeks
II Mid Examinations	**01-04-2023**	**06-04-2023**	1 Week
Preparation & Practicals	08-04-2023	13-04-2023	1 Week
Semester End Examinations	**15-04-2023**	**27-04-2023**	2 Weeks
Internship	29-04-2023	22-06-2023	8 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**

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. V.RAVISEKHARA REDDY]	[Dr.K.RANI RUDRAMA]	[Dr. M.V.SUDHAKAR]	[Dr. Y. AMAR BABU]

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Phone: 08659-222933, Fax: 08659-222931

Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. M.V.Sudhakar
Course Name & Code **:** SATELLITE COMMUNICATIONS, 20EC19
L-T-P Structure **:3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/VI/B **A.Y.:** 2023-2024

PREREQUISITE: Analog Communications & Digital Communications

COURSE EDUCATIONAL OBJECTIVES (CEOs): 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, student will be able to

CO1	**Understand** the orbital mechanics, concepts of satellite communication and its applications (Understand – L2)
CO2	**Summarize** the concepts of satellite space segment, earth segment and satellite services (Understand – L2)
CO3	**Examine** the satellite link budget calculations and orbital dynamics (Apply – L3)
CO4	**Apply** the multiple-access techniques and mobile services for satellite Communications (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
CO1	1	-	-	-	-	3	3	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	3	1	-	-	-	-	1	2	-	-
CO3	1	-	1	2	-	-	-	-	-	-	-	-	2	-	-
CO4	1	1	1	-	-	3	3	-	-	-	-	-	2	-	-
1 - Low **2 –**Medium **3 -** High															

TEXT BOOKS:

T1. Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003..

T2. Dennis Roddy , "Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

REFERENCE BOOKS:

R1	D.C Agarwal , "Satellite communications", Khanna Publications, 5th Edition,2006.
R2	M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Satellite Communication

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, COs	1	04-12-23			
2.	Need of satellite communication	1	05-12-23			
3.	Definition of a satellite and orbit	1	06-12-23			
4.	Different types of satellite orbits	1	09-12-23			
5.	Frequency allocations for satellite communication	1	11-12-23			
6.	General structure of satellite communication system	1	12-12-23			
7.	Merits and demerits of satellite communication	1	13-12-23			
8.	types of launch vehicles: ELV &RLV.	1	16-12-23			
9.	Applications of satellite communication	1	18-12-23			
10.	Advantages	1	19-12-23			
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: Orbital Dynamics and Satellite Launching

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Kepler's Laws	1	20-12-23			
12.	Definitions of Terms for Earth-Orbiting Satellites	1	23-12-23			
13.	Orbital Elements,	1	26-12-23			
14.	Apogee and Perigee Heights	1	27-12-23			
15.	Effects of non spherical earth, Atmospheric drag	1	30-01-24			
16.	Orbital perturbations-need for station keeping	1	02-01-24			
17.	Non geostationary orbits and geostationary orbits	1	03-01-24			
18.	Orbital effects: Doppler shift, Range variation	1	06-01-24			
19.	solar eclipse and sun transit outage	1	08-01-24			
20.	launching of geostationary satellites.	1	09-01-24			
21.	Look angle determination	1	10-01-24			
22.	elevation angle and azimuth angle calculation	1	13-01-24			
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: Space Segment and 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
23.	Introduction to space segment	1	20-01-24			
24.	Power supply unit	1	22-01-24			
25.	Attitude and orbital control	1	23-01-24			
26.	spinning satellite stabilization and momentum wheel stabilization	1	24-01-24			
27.	Station keeping	1	27-01-24			
28.	Thermal control	1	05-02-24			
29.	TT&C subsystem	1	06-02-24			
30.	Transponders, The wideband receiver, The input demultiplexer, The power amplifier	1	07-02-24			
31.	Antenna subsystem, Equivalent Isotropic Radiated Power, Free-space transmission	1	10-02-24			
32.	Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses	1	12-02-24			
33.	Link power budget equation, System Noise, Carrier-to-Noise Ratio	1	13-02-24			
34.	The Uplink, Saturation flux density, Input backoff, Downlink	1	14-02-24			
35.	Output back-off, Combined Uplink and Downlink C/N Ratio.	1	17-02-24			
No. of classes required to complete UNIT-III: 13				**No. of classes taken:**		

UNIT-IV: Earth segment and Satellite access

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Design requirements for the selection of earth segment	1	19-02-24			
37.	Transmit only earth station, Receive only earth station	1	20-02-24			
38.	Transmit -Receive (T/R) earth station	1	21-02-24			
39.	Single Access	1	24-02-24			
40.	Preassigned FDMA	1	26-02-24			
41.	Demand-Assigned FDMA	1	27-02-24			
42.	Spade System, TDMA	1	28-03-24			
43.	Preassigned TDMA	1	02-03-24			
44.	Demand-assigned TDMA	1	04-03-24			
45.	Satellite-Switched TDMA	1	05-03-24			
46.	CDMA	1	06-03-24			
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Satellite Services & Applications

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Different types of satellite services	1	09-03-24			
48.	Global Positioning System	1	11-03-24			
49.	architecture and location principle	1	12-03-24			
50.	Direct Broadcast Satellite	1	13-03-24			
51.	DBS/DTH	1	16-03-24			
52.	Home receiver block (Indoor & Outdoor Unit)	1	18-03-24			
53.	Satellite Mobile Services	1	19-03-24			
54.	VSAT, MSAT	1	20-03-24			
55.	RADARSAT	1	23-03-24			
56.	IRNSS constellation	1	25-03-24			
57.	Orbcomm, Iridium	1	26-03-24			
58.	Revision	1	27-03-24			
No. of classes required to complete UNIT-V: 12						

Concepts 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
59.	Case study on latest Indian satellite launching and services	1	30-03-24			

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 Regulation):

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
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	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
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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. M.V.Sudhakar**	**Dr. P. Venkat rao**	**Dr. M.V Sudhakar**	**Dr. Y.Amar babu**
Signature				

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Phone: 08659-222933, Fax: 08659-222931
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.Mallikarjuna Rao Dandu, Sr. Assistant Professor
Course Name & Code : Operations Research Techniques - 20ME83 **Regulation**: R20
L-T-P Structure : **4-0-0** **Credits:** 03
Program/Sem/Sec : B.Tech- ECE VI Sem B/S **A.Y.:** 2023-24

PREREQUISITE : **Nil**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to introduce the concepts of formulating an engineering problem into mathematical model to develop an optimal solution.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Apply linear programming approach for optimizing the objectives of industrial oriented problems. **(Applying-L3)**
CO2	Formulate and solve transportation models and assignment models**. (Applying-L3)**
CO3	Implement the strategies in competitive situations and able to sequence the jobs to be processed on machines. **(Applying-L3)**
CO4	Identify the replacement period of the equipment and analyze the waiting situations in an organization. **(Applying-L3)**
CO5	Determine the optimum inventory level and resolve the complex problem into simple problems by dynamic programming approach and apply optimum strategies. **(Applying-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
CO1	3	3	3	2	3				3			3		3	
CO2	3	3	1	2	1				3			3		3	
CO3	3	3	3	2	1				3			3		3	
CO4	3	2	3	2	3				1			3		3	
CO5	2	3	3	2	1				1			3		3	

TEXT BOOKS:

T1	S.D Sharma, ―Operation Research‖, Kedar Nath and RamNath - Meerut, 2008.
T2	Operations Research / N.V.S. Raju / SMS, 2009.

REFERENCE BOOKS:

R1	Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition, 2009.
R2	Hiller & Libermann, Introduction to O.R (TMH), 9th EDITION, 2009.
R3	Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publications, New Delhi, 14th Edition, 2008.
R4	A.M.Natarajan, P.Balasubramani, A. Tamilarasi, Operations Research, Pearson Education, 2nd edition, 2014.
R5	Taha, Introduction to O.R .PHI, 9th edition, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION & LINEAR PROGRAMMING PROBLEM

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**: Introduction To ORT & CEO, COs	1	04.12.2023		TLM1/TLM2	
2.	Operations Research Models, Phases & Applications	1	06.12.2023		TLM1/TLM2	
3.	**Linear Programming Problem (LPP)**: Formulation	1	07.12.2023		TLM1	
4.	Numericals	1	09.12.2023		TLM1	
5.	Graphical Solution For Special Cases Of LPP	1	11.12.2023		TLM1	
6.	Simplex Method	1	13.12.2023		TLM1	
7.	Numericals	1	14.12.2023		TLM1	
8.	Numericals	1	16.12.2023		TLM1	
9.	Big M Method	1	18.12.2023		TLM1	
10.	Numericals	1	20.12.2023		TLM1	
11.	Two Phase Simplex Method	1	21.12.2023		TLM1	
12.	Numericals	1	23.12.2023		TLM1	
13.	Big M method	1	27.12.2023		TLM1	
14.	Numericals	1	28.12.2023		TLM1	
No. of classes required to complete UNIT-I:		**14**		**No. of classes taken:**		

UNIT-II: TRANSPORTATION & ASSIGNMENT PROBLEMS

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction To TP, Terminology, Formulation	1	30.12.2023		TLM1/TLM2	
16.	Standard Form, Unbalanced TP	1	03.01.2024		TLM1	
17.	Numericals	1	04.01.2024		TLM1	
18.	IBFS: NWCM, LCM, VAM	1	06.01.2024		TLM1	
19.	Numericals	1	08.01.2024		TLM1	
20.	Test For Optimality: Stepping Stone Method, Modified Distribution Method (MODI Method)	1	10.01.2024		TLM1	
21.	Numericals	1	11.01.2024		TLM1	
22.	Degeneracy in TP, Numericals	1	13.01.2024		TLM1	
23.	Introduction to Assignment Problem	1	11.01.2024		TLM1	
24.	Variants of Assignment Problems	1	17.01.2024		TLM1	
25.	Optimal Solution, Numericals	1	18.01.2024		TLM1	
26.	Travelling Salesmen Problem	1	20.01.2024		TLM1	
27.	Numericals	1	22.01.2024		TLM1	
No. of classes required to complete UNIT-II		13		**No. of classes taken:**		

UNIT-III: GAME THEORY AND JOB SEQUENCING

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.	**Introduction to Games Theory**: Terminology	1	23.01.2024		TLM1/TLM2	
29.	Minimax or Maxmini Criterion,Optimal Strategy	1	24.01.2024		TLM1	
30.	Solution of games with saddle point	1	25.01.2024		TLM1	
31.	Rectangular games without saddle point, Numericals	1	27.01.2024		TLM1	
32.	2x2 games	1	05.02.2024		TLM1	
33.	mx2, 2xn, mxn games, Dominance Principle,	1	07.02.2024		TLM1	
34.	Graphical approach, Numericals	1	08.02.2024		TLM1	
35.	**Job Sequencing:** n jobs through 2 machines,	1	10.02.2024		TLM1	
36.	n jobs through 3 machines,	1	12.02.2024		TLM1	
37.	2 jobs through m machines	1	14.02.2024		TLM1	
38.	Numericals	1	15.02.2024		TLM1	
39.	Graphical model	1	17.02.2024		TLM1	
No. of classes required to complete UNIT-III		12		**No. of classes taken:**		

UNIT-IV: THEORY OF REPLACEMENT AND WAITING LINES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	**THEORY OF REPLACEMENT:** Introduction, Replacement of Equipment that Deteriorates Gradually	1	19.02.2024		TLM1/TLM2	
41.	Numericals	1	21.02.2024		TLM1	
42.	Replacement of Equipment that fails suddenly, Numericals	1	22.02.2024		TLM1	
43.	Numericals	1	24.02.2024		TLM1	
44.	Group Replacement Policy	1	26.02.2024		TLM1/TLM2	
45.	Numericals	1	28.02.2024		TLM1	
46.	**Introduction to Queuing Theory**	1	29.02.2024		TLM1/TLM2	
47.	Single Channel – Poisson arrivals – exponential service times – with infinite population, Derivation	1	02.03.2024		TLM1	
48.	Numericals	1	04.03.2024		TLM1	
49.	Single Channel – Poisson arrivals – exponential service times – with finite population, Numericals	1	06.03.2024		TLM1/TLM2	
50.	Numericals	1	07.03.2024		TLM1	
51.	Numericals	1	09.03.2024		TLM1	
No. of classes required to complete UNIT-IV		12		**No. of classes taken:**		

UNIT-V: INVENTORY MODELS AND DYNAMIC PROGRAMMING

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52.	**INVENTORY MODELS-** terminology, EOQ	1	11.03.2024		TLM1/TLM2	
53.	Instantaneous Production, finite, continuous demand	1	13.03.2024		TLM1/TLM2	
54.	Shortages not Allowed	1	14.03.2024		TLM1	
55.	Purchase inventory models with one price break	1	16.03.2024		TLM1	
56.	Purchase inventory models with multiple price breaks	1	18.03.2024		TLM1	
57.	Numericals	1	20.03.2024		TLM1	
58.	**DYNAMIC PROGRAMMING (DP):** Introduction To DP	1	21.03.2024		TLM1/TLM2	
59.	Bellman's Principle of Optimality, Applications of Dynamic Programming	1	23.03.2024		TLM1/TLM2	
60.	Capital Budgeting Problem, Numericals	1	27.03.2024		TLM1	
61.	linear programming problem	1	28.03.2024		TLM1	
62.	Shortest path problems	1	30.03.2024		TLM1	
63.	Numericals	1	30.03.2024		TLM1	
No. of classes required to complete UNIT-V		12		**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

.

Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	04-12-2023	27-01-2024	8
I MID Examinations	29-01-2024	03-02-2024	1
II Phase of Instructions	05-02-2024	30-03-2024	8
II MID Examinations	01-04-2024	06-04-2024	1
Preparation and Practicals	08-04-2024	13-04-2024	1
Semester End Examinations	15-04-2024	27-04-2024	2

PART-C

EVALUATION PROCESS (R20 Regulation):

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
Mid Marks =80% of Max ((M1+Q1+A1),(M2+Q2+A2))+20% of Min((M1+Q1+A1),(M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE):M	30
Semester End Examination (SEE)	70
Total Marks = CIE+SEE	100

PART-D

PROGRAMME 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):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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 environmental considerations.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the ring 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.
PO12	**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	Design and develop modern communication technologies for building the interdisciplinary skills to meet current and future needs of industry.
PSO 2	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	Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mr.Mallikarjuna Rao Dandu	Mr.V.Sankararao	Dr.M.B.S.Sreekara Reddy	Dr.M.B.S.Sreekara Reddy

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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 – 20EC59**

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

Credits : 1.5

Program : B.Tech VI Semester ECE-B Section.,

A.Y : **2023 – 24**

COURSEOBJECTIVE:

In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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

CO1	DemonstratetheMASM/TASMtoolfordevelopingAssemblyLanguagePrograms.
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(CorrelationbetweenCos&POs,PSOs):

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

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
LABSCHEDULE(LESSONPLAN):Section-B

LISTOFEXPERIMENTS (Minimum12Experimentstobeconducted)

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					
1.	Introduction to Lab	3	04-12-2023		**TLM2**	
2.	Display, comparison and reverse the string	3	11-12-2023		**TLM8**	
3.	Factorial using Procedures	3	18-12-2023		**TLM8**	
4.	Sorting the signed and unsigned numbers	3	01-01-2024		**TLM8**	
5.	Checking the given string for Palindrome	3	08-01-2024		**TLM8**	
6.	Arithmetic operations like Addition, Subtraction, Multiplication and Division	3	22-01-2024		**TLM8**	
7.	Byte checkingbyusing8051	3	29-01-2024		**TLM8**	
8.	Addition of series of numbers	3	05-02-2024		**TLM8**	
9.	Checking the given numbers for Odd or Even	3	12-02-2024		**TLM8**	
	CYCLE-2					
10.	Interfacing of A/D and D/A converter	3	19-02-2024		**TLM8**	
11.	Interfacing of LEDs and Switches	3	26-02-2024		**TLM8**	
12.	Interfacing of LCD	3	04-03-2024		**TLM8**	
13.	Interfacing of Stepper Motors	3	11-03-2024		**TLM8**	
14.	Interfacing of traffic Light controller	3	11-03-2024		**TLM8**	
15.	Interfacing of RealTime Clock	3	18-03-2024		**TLM8**	
16.	Data loggers –Roll over display	3	18-03-2024		**TLM8**	
17.	Internal Lab Exam	3	25-03-2024		**TLM8**	
No.of classes required to complete:		51	No.of classes conducted:			

PART-C

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: 2023 – 24 (VI Semester)

B.Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**21-02-2022**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
II Phase Instructions	05-02-2024	**30-03-2024**	8 Weeks
II Mid Examinations	**01-04-2024**	**06-04-2024**	1 Week
Preparation & Practicals	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**24-04-2024**	2 Weeks
Internship			6 Weeks

EVALUATIONPROCESS:

Evaluation Task	**COs**	**Marks**
Day to Day work	1,2,3,4	A=10
Internal Lab Examination	1,2,3,4	B=5
Total Internal Marks (A+B)		**C=15**
Semester End Examinations	1,2,3,4	**D=35**
Total Marks : C+D	1,2,3,4	**50**

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mr. K.SASI BHUSHAN]	[Mr. K.SASI BHUSHAN]	[Dr.P. LACHI REDDY]	[Dr. Y. AMAR BABU]

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 AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. G. Srinivasulu
Course Name & Code : VLSI DESIGN LAB– 20EC60
L-T-P Structure : 0-0-3 Credits : 1.5
Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- B A.Y : 2023-24

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The course explores the design and implementation aspects of various combinational and sequential circuits used in VLSI Design. It also develops the knowledge in VLSI Front End and Back End Design in semi-custom and full-custom design.

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

CO1	**Implement** combinational and sequential circuits on FPGA/CPLD boards. (Apply – L3)
CO2	**Design** the Combinational and Sequential logic using NMOS and CMOS Technology. (Apply – L3)
CO3	**Analyze** combinational and sequential circuits using Static CMOS logic from schematic to layout. (Analyze –L4)
CO4	**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
CO1	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO2	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	1	2	3		1	-	-	-

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Batch-1

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	05.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	12.12.2023			
2	Experiment – 2	CO1	3	19.12.2023			
3	Experiment – 3	CO1	3	26.12.2023			

4	Experiment – 4	CO2,CO3	3	02.01.2024			
5	Experiment – 5	CO2,CO3	3	09.01.2024			
6	Experiment – 6	CO2,CO3	3	16.01.2024			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	23.01.2024			
8	Experiment – 8	CO2,CO3	3	06.02.2024			
9	Experiment – 9	CO2,CO3	3	13.02.2024			
10	Experiment – 10	CO2,CO3	3	22.02.2024			
11	Experiment – 11	CO2,CO3	3	27.02.2024			
12	Experiment beyond syllabus	CO2,CO3	3	05.03.2024			
13	Revision	CO2,CO3	3	19.03.2024			
14	Internal Examination	--	3	26.04.2024			

Batch-2

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	08.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	15.12.2023			
2	Experiment – 2	CO1	3	22.12.2023			
3	Experiment – 3	CO1	3	29.12.2023			
4	Experiment – 4	CO2,CO3	3	05.01.2024			

5	Experiment – 5	CO2,CO3	3	12.01.2024			
Cycle – II							
7	Experiment – 6	CO2,CO3	3	02.02.2024			
8	Experiment – 7	CO2,CO3	3	09.02.2024			
9	Experiment – 8	CO2,CO3	3	16.02.2024			
10	Experiment – 9	CO2,CO3	3	23.02.2024			
11	Experiment – 10	CO2,CO3	3	01.03.2024			
12	Experiment beyond syllabus	CO2,CO3	3	08.03.2024			
--	Internal Examination		3	15.03.2024			

Experiments to be conducted:

Exp. No	CYCLE-1	Exp. No	CYCLE-2
1	Implementation of Carry-Look-Ahead adder.	7	Design and analysis of CMOS NAND gate
2	Implementation of 4x4 Array Multiplier.	8	Design and analysis of Full Adder
3	Implementation of a 4-bit ALU.	9	Design and analysis of Decoder
4	Design and analysis of NMOS Inverter.	10	Design and analysis of 8- bit Binary Counter.
5	Design and analysis of CMOS Inverter	11	Design and analysis of Shift Register
6	Design and analysis of CMOS NOR gate		

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	**Expt. no's**	**Marks**
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A = 05
Record = **B**	1,2,3,4,5,6,7,8…	B = 05
Internal Test = **C**	1,2,3,4,5,6,7,8…	C = 05
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8…	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8…	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8…	**50**

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:	**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	Mrs.M.Ramya Harika	Dr. P Lachi Reddy	Dr. Y. Amar Babu

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

COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : Microwave Engineering Lab– 20EC61

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Dr. V.Ravisekhara Reddy/Dr. B.Y.V.N.R. Swamy /Mr.M.Samba Siva Reddy

COURSE COORDINATOR : Dr. B.Y.V.N.R. Swamy

COURSE OBJECTIVES: This Lab deals with the measurements of the EM signals at microwave frequency range. It involves measurement of frequency, wavelength, VSWR, Impedance and scattering parameters of various microwave devices like Circulator, Direction Coupler, and Magic-Tee. Even the latest trend of software tool i.e. HFSS is also introduced and microwave devices will be verified by evaluating the related parameters.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1 : Demonstrate the functions of microwave bench setup **(Understand – L2)**
CO2 : Examine the properties of microwave passive devices using HFSS **(Apply – L3)**
CO3 : Estimate the frequency, wavelength, VSWR, impedance and scattering parameters of microwave devices **(Apply – L3)**
CO4 : 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
CO1	1	-	-	1	1	-	-	-	-	-	-	-	1	-	-
CO2	1	1	1	1	3	-	-	-	-	-	-	1	3	-	-
CO3	2	2	-	3	2	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	1	2	3	-	1	-	-	-

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

Batch-1

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1	Demonstration	3	05.12.2023		-	TLM1	
2	Experiment-1	3	12.12.2023		COs 1,3,4	TLM4	
3	Experiment-2	3	19.12.2023		COs 1,3,4	TLM4	
4	Experiment -3	3	26.12.2023		COs1,3,4	TLM4	
5	Experiment-4	3	02.01.2024		COs 1,3,4	TLM4	
6	Experiment-9	3	09.01.2024		COs 2,4	TLM4	
7	Experiment-10	3	23.01.2024		COs2,4	TLM4	
8	Experiment-5	3	06.02.2024		COs1,3,4	TLM4	
9	Experiment-6	3	13.02.2024		COs 1,3,4	TLM4	
10	Experiment-7	3	20.02.2024		COs 1,3,,4	TLM4	
11	Experiment-8	3	27.02.2024		COs 1,3,4	TLM4	
12	Experiment-11	3	05.03.2024		COs 2,4	TLM4	
13	Experiment-12	3	12.03.2024		COs 2,4	TLM4	
13	Revision	3	19.04.2024				
14	Internal exam	3	26.04.2024				

Batch-2

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1.	Demonstration	3	08.12.2023		COs 1,4	TLM1	
2.	Experiments-1	3	15.12.2023		COs 1,4	TLM4	
3.	Experiment-2	3	22.12.2023		COs 1,4	TLM4	
4.	Experiment-3,4	3	29.12.2023		COs 3,4	TLM4	
5.	Experiment-9	3	05.01.2024		COs2,4	TLM4	
6.	Experiment-10	3	19.01.2024		COs 2,4	TLM4	
7.	Experiment-5	3	09.02.2024		COs 2,4	TLM4	
8.	Experiment-6	3	16.02.2024		COs 1,3,4	TLM4	
9.	Experiment-7,8	3	23.02.2024		COs 1,3,4	TLM4	
10.	Experiment-11,12	3	01.03.2024		COs 1,3,4	TLM4	
11.	Revision	3	15.03.2024				
12.	Internal exam	3	22.03.2024				

List of Experiments:

Exp. No	Experiments to be conducted	Exp. No	Experiments to be conducted
CYCLE-1			CYCLE-2
1.	Reflex Klystron Characteristics.	5	Directional coupler characteristics
2.	Gunn diode Characteristics	6	Impedance and frequency measurement
3.	Attenuation measurement	7	Scattering parameters of circulator
4.	VSWR measurement .	8	Scattering parameters of Magic tee
9.	Scattering parameters of branch line coupler	11	Design and S-parameter measurement of microwave band stop filter
10	Scattering parameters of rat-race coupler	12	Design and S-parameter measurement of microwave balun

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	**Cos**	**Marks**
Day to Day Work	1,2,3,4	A=5
Record	1,2,3,4	B=5
Internal Exam	1,2,3,4	C=5
Cumulative Internal Examination :	1,2,3,4	**A+B+C=15**
Semester End Examinations	1,2,3,4	**D=35**
Total Marks: A+B+C+D	**1,2,3,4**	**50**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO2: To Function professionally in the rapidly changing world with advances in technology
PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner

PROGRAMME OUTCOMES (POs)

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. **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.
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 environmental considerations.
PO4. **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.
PO5. **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.
PO6. **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.
PO7: **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.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: 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.
PO11: 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.
PO12: 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)

PSO1: Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

PSO2: 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

PSO3: Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. V.RAVI SEKHARA REDDY]	[Dr. B.Y.V.N.R.SWAMY]	[Dr. M.V.SUDHAKAR]	[Dr. Y. AMAR BABU]

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.T.Kalpana

Course Name & Code : VLSI DESIGN LAB– 20EC60

L-T-P Structure : 0-0-3 Credits : 1.5

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- C A.Y : 2023-24

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The course explores the design and implementation aspects of various combinational and sequential circuits used in VLSI Design. It also develops the knowledge in VLSI Front End and Back End Design in semi-custom and full-custom design.

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

CO1	**Implement** combinational and sequential circuits on FPGA/CPLD boards. (Apply – L3)
CO2	**Design** the Combinational and Sequential logic using NMOS and CMOS Technology. (Apply – L3)
CO3	**Analyze** combinational and sequential circuits using Static CMOS logic from schematic to layout. (Analyze –L4)
CO4	**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
CO1	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO2	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	2	1	2	2	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	1	2	3		1	-	-	-

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Batch-1(21761A04D0 to 21761A04G5) Saturday– AN

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	09.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	16.12.2023			
2	Experiment – 2	CO1	3	23.12.2023			
3	Experiment – 3	CO1	3	30.12.2023			
4	Experiment – 4	CO2,CO3	3	06.01.2024			
5	Experiment – 5	CO2,CO3	3	20.01.2024			
6	Experiment – 6	CO2,CO3	3	27.01.2024			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	10.02.2024			
8	Experiment – 8	CO2,CO3	3	17.02.2024			
9	Experiment – 9	CO2,CO3	3	24.02.2024			
10	Experiment – 10	CO2,CO3	3	02.03.2024			
11	Experiment – 11	CO2,CO3	3	09.03.2024			
12	Experiment beyond syllabus	CO2,CO3	3	16.03.2024			
--	Revision	--	3	23.03.2024			
--	Internal Examination	--	3	30.03.2024			

Batch-2 (21761A04G6 to 21761A04J4 & 22765A0416 to 22765A0423) Wednesday – FN

Expt. No	Experiment/s	COs	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
--	Introduction to VLSI Lab experiments, COs, POs and PSOs	--	3	06.12.2023			
Cycle – I							
1	Experiment – 1	CO1	3	13.12.2023			
2	Experiment – 2	CO1	3	20.12.2023			
3	Experiment – 3	CO1	3	27.12.2023			
4	Experiment – 4	CO2,CO3	3	03.01.2024			
5	Experiment – 5	CO2,CO3	3	10.01.2024			
6	Experiment – 6	CO2,CO3	3	17.01.2024			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	24.01.2024			
8	Experiment – 8	CO2,CO3	3	07.02.2024			
9	Experiment – 9	CO2,CO3	3	14.02.2024			
10	Experiment – 10	CO2,CO3	3	21.02.2024			
11	Experiment – 11	CO2,CO3	3	28.02.2024			
12	Experiment beyond syllabus	CO2,CO3	3	06.03.2024			
--	Revision	--	3	13.03.2024			
--	Revision	--	3	20.03.2024			
--	Internal Examination	--	3	27.03.2024			

Experiments to be conducted:

Exp. No	CYCLE-1	Exp. No	CYCLE-2
1	Implementation of Carry-Look-Ahead adder.	7	Design and analysis of CMOS NAND gate
2	Implementation of 4x4 Array Multiplier.	8	Design and analysis of Full Adder
3	Implementation of a 4-bit ALU.	9	Design and analysis of Decoder
4	Design and analysis of NMOS Inverter.	10	Design and analysis of 8- bit Binary Counter.
5	Design and analysis of CMOS Inverter	11	Design and analysis of Shift Register
6	Design and analysis of CMOS NOR gate		

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	Expt. no's	Marks
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A = 05
Record = **B**	1,2,3,4,5,6,7,8…	B = 05
Internal Test = **C**	1,2,3,4,5,6,7,8…	C = 05
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8…	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8…	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8…	**50**

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:	**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
Mrs.T.Kalpana	Mrs.M.Ramya Harika	Dr. P Lachi Reddy	Dr. Y. Amar Babu

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DEPARTMENT OF ELECTRONICS& COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt.T.Kalpana
Course Name & Code :VLSI DESIGN– 20EC16
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- C A.Y : 2023-24

PRE-REQUISITE: Electronic Devices and Circuits, Digital Circuits

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential sub system CMOS circuit designs used in VLSI Design. This course also gives the complete information regarding design tools and CMOS testing techniques.

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

CO1:	**Understand**semiconductor technology and MOS fabrication process (L2-Understand)
CO2:	**Apply** layout design rules for NMOS, CMOS logic circuit designs. (L3-Apply)
CO3:	**Analyze** the IC building blocks. (L4-Analyze)
CO4:	**Apply** CMOS testing techniques to test different digital designs. (L3-Apply)

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	2	1	1	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	3	-	2	-
CO3	2	3	2	-	-	-	-	-	-	-	-	3	-	4	-
CO4	2	2	1	-	-	-	-	-	-	-	-	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 Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI Publishers, 2005.

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

BOS APPROVED REFERENCE BOOKS:

R1 Neil. H. E. Weste and Kamaran Eshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rdEdition.

R2 Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):
UNIT-I : IC FABRICATION TECHNOLOGY& BASIC ELECTRICAL PROPERTIES OF MOS AND BICMOS 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.	IC fabrication Technology: Silicon semiconductor technology–wafer processing	1	06.12.2023			
2.	Oxidation, epitaxy	1	07.12.2023			
3.	Lithography, ion implantation	1	08.12.2023			
4.	Diffusion, ,silicon gate process	1	09.12.2023			
5.	NMOS and CMOS fabrication	1	13.12.2023			
6.	BiCMOS technology	1	14.12.2023			
7.	Comparison between CMOS and bipolar technologies	1	15.12.2023			
8.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	16.12.2023			
9.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	20.12.2023			
10.	Ids –Vds relationships	1	21.12.2023			
11.	MOS transistor threshold Voltage	1	22.12.2023			
12.	MOS transistor gm, gds	1	23.12.2023			
13.	Pass transistor, NMOS Inverter	1	27.12.2023			
14.	Various pull up,	1	28.12.2023			
15.	CMOS Inverter analysis and design	1	29.12.2023			
16.	BiCMOS Inverters	1	30.12.2023			
17.	Assignment	1	03.01.2024			
No. of classes required to complete UNIT-I :		17	No. of classes taken:			

UNIT-II : VLSI CIRCUIT DESIGN PROCESSES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18.	VLSI Circuit Design Processes: VLSI design flow	1	04.01.2024			
19.	MOS Layers, Stick Diagrams	1	05.01.2024			
20.	Design Rules and Layout, 5μm CMOS	1	06.01.2024			
21.	Design rules for wires, Contacts, Transistor	1	10.01.2024			
22.	Layout Diagrams for NMOS, CMOS Inverters and Gates	1	11.01.2024			
23.	Scaling of MOS circuits	1	12.01.2024			
24.	Limitations of Scaling	1	17.01.2024			
25.	Basic Circuit Concepts: Sheet Resistance	1	18.01.2024			
26.	Area Capacitance calculations, Inverter Delays	1	19.01.2024			
27.	Assignment	1	20.01.2024			
No. of classes required to complete UNIT-II		10	No. of classes taken:			

UNIT-III : DIGITAL IC BUILDING BLOCKS

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.	Digital IC Building Blocks: Logic gates: combinational logic functions	1	24.01.2024			
29.	Static complementary gates , Switch logic	1	25.01.2024			
30.	Standard cell based layout	1	26.01.2024			
31.	Logic and interconnect design	1	27.01.2024			
32.	power optimization	1	07.02.2024			
33.	Realization of Latches and Flip-Flops using switch logic	1	08.02.2024			

34.	Sub system design flow	1	09.02.2024			
35.	4x4 array multiplier	1	10.02.2024			
36.	Design of 4bit ALU using adder	1	14.02.2024			
37.	Synchronous up/down counters, Registers	1	15.02.2024			
38.	Assignment	1	16.02.2024			
No. of classes required to complete UNIT-III		11	No. of classes taken:			

UNIT-IV : ANALOG IC BUILDING BLOCKS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	Introduction	1	17.02.2024			
40.	Analog IC Building Blocks: MOS Diode/Active resistor	1	21.02.2024			
41.	Simple current sinks	1	22.02.2024			
42.	Basic current mirrors	1	23.02.2024			
43.	Advanced current mirrors	1	24.02.2024			
44.	Current and Voltage references	1	28.02.2024			
45.	Band-gap references	1	29.02.2024			
46.	Op-Amp, One Stage OP-Amp.	1	01.03.2024			
47.	Two Stage OP-Amp, Gain boosting	1	02.03.2024			
48.	Common Mode Feedback, Noise in Op Amps	1	06.03.2024			
49.	Assignment	1	07.03.2024			
No. of classes required to complete UNIT-IV		11		No. of classes taken:		

UNIT-V : TEST AND TESTABILITY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Introduction	1	09.03.2024			
48.	Test and Testability : System Partitioning	1	13.03.2024			
49.	Layout and Testability	1	14.03.2024			

50.	Reset/Initialization	1	15.03.2024			
51.	Design for Testability (DFT)	1	16.03.2024			
52.	Design for Testability (DFT)	1	20.03.2024			
53.	Testing Combinational Logic	1	21.03.2024			
54.	Testing Sequential Logic	1	22.03.2024			
55.	Practical Design for Test Guidelines	1	23.03.2024			
56.	Scan Design Techniques	1	27.03.2024			
57.	Built-In-Self-Test (BIST), Future Trends	1	28.03.2024			
58.	Assignment	1	29.03.2024			
No. of classes required to complete UNIT-V:		12				

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
60.	Introduction to Low Power VLSI	1	30.03.2024			

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.
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	Smt.T.Kalpana	Dr. P Lachi Reddy	Dr.Y.Amar Babu

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. B Siva Hari Prasad, Assoc. Professor
Course Name & Code : MICROWAVE ENGINEERING-20EC17
L-T-P Structure : 3-0-0
Credits : 3
Program/Sem/Sec : B. Tech. VI-Sem., ECE-C Sec
A.Y : 2023 – 24

Pre requisite: Vector calculus, Coordinate Systems, Basics of electromagnetics

Course Educational Objective: This course provides the knowledge on different types of waveguides and resonators. The course will give an idea about microwave communication in terms of various bands, advantages, applications. The course also gives the complete information regarding the microwave tubes and passive devices along with microwave bench setup and microwave measurements.

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

CO 1	**Understand** the microwave sources, components and measurements of microwave parameters **(Understand – L2)**
CO 2	**Develop** the TE, TM fields in waveguides and microwave signals using microwave tubes and solid-state devices **(Apply – L3)**
CO 3	**Apply** the properties of S-parameters to model the S-matrix of waveguide components **(Apply – L3)**
CO 4	**Analyze** the flow of microwave fields in waveguides, components and efficiency of microwave tubes **(Analyze – L4)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	2	3	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	-	-
CO4	3	3	2	1	1	-		-	-	-	-	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. Samuel Y. Liao, "Microwave Devices and Circuits", PHI Publishers, 3rdEdition, 2003.
2. David M.Pozar, "Microwave Engineering", John Wiley Publishers,4thEdition.

REFERENCE BOOKS

1. M Kulakarni, "Microwave and Radar Engineering", Umesh Publications, New Delhi 5th Edition
2. Jordan and Balmain, "Electromagnetic fields and Radiating systems", Pearson education.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):C

UNIT-I:[11HRS]						
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, Microwave Spectrum and Bands	1	05-12-2023		TLM1	
2.	Advantages and Applications of Microwaves	1	06-12-2023		TLM1	
3.	Rectangular Waveguides: Impossibility of TEM waves in waveguides	1	07-12-2023		TLM1	
4.	Transverse Magnetic and Transverse Electric Waves in Rectangular Waveguides	1	08-12-2023		TLM1	
5.	Field Expressions, characteristics of TE and TM Waves-Cutoff frequency	1	12-12-2023		TLM1	
6.	Dominant mode in Rectangular Waveguides, phase velocity, group velocity	1	13-12-2023		TLM1	
7.	relation between cutoff, guided and free space wavelengths	1	14-12-2023		TLM1	
8.	Wave impedances for TE and TM cases.	1	15-12-2023		TLM1	
9.	Circular Waveguides: TM and TE waves in circular guides	1	19-12-2023		TLM1	
10.	Field Expressions, Dominant mode in circular waveguide.	1	20-12-2023		TLM2	
11.	**Tutorial,/Assignment**	1	21-12-2023		TLM1	

UNIT- II: [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**
12.	Resonators: Rectangular cavity resonators	1	22-12-2023		TLM1	
13.	Circular cavity resonators	1	26-12-2023		TLM1	
14.	Field Expressions, Re-entrant Cavities	1	27-12-2023		TLM1	
15.	Microwave Tubes: Limitations of conventional tubes at microwave frequencies	1	28-12-2023		TLM1	
16.	Klystron Tubes: Two Cavity Klystrons – Structure	1	29-12-2023		TLM1	
17.	Microwave tubes – O type and M type classifications	1	02-01-2024		TLM2	
18.	Velocity Modulation Process and Applegate Diagram,	1	03-01-2024		TLM1	

19.	Reflex Klystrons – Structure, Applegate Diagram and Principle of working,	1	04-01-2024		TLM1	
20.	Power Output, Efficiency, output Characteristics	1	05-01-2024		TLM1	
21.	**Tutorial,/Assignment**	1	09-01-2024		TLM1	

UNIT – III[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**
22.	Helix TWT: Types and Characteristics of Slow Wave Structures;	1	10-01-2024		TLM1	
23.	Structure of TWT	1	11-01-2024		TLM1	
24.	Amplification Process in TWT	1	18-01-2024		TLM1	
25.	M-Type Tubes: Cross-field effects	1	19-01-2024		TLM2	
26.	Magnetrons – Different Types	1	23-01-2024		TLM1	
27.	8-Cavity Cylindrical Travelling Wave Magnetron	1	24-01-2024		TLM1	
28.	Hull Cut-off and Hartee Conditions	1	25-01-2024		TLM1	
29.	PI-Mode Operation in Magnetrons	1	06-02-2024		TLM1	
30.	Strapping in Magnetrons	1	07-02-2024		TLM1	
31.	**Tutorial,/Assignment**	1	08-02-2024		TLM1	

UNIT – IV[9 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**
32.	Microwave Solid State Devices: Negative resistance region	1	09-02-2024		TLM1	
33.	Classification, Applications	1	13-02-2024		TLM1	
34.	Transferred Electron Devices: Gunn Diode Principle,	1	14-02-2024		TLM2	
35.	Two Valley Model Theory	1	15-02-2024		TLM1	
36.	RWH Theory, Characteristics.	1	16-02-2024		TLM1	
37.	Avalanche Transit Time Devices: IMPATT diode Principle of Operation and Characteristics,	1	20-02-2024		TLM1	
38.	TRAPATT Diodes Principle of Operation and Characteristics,	1	21-02-2024		TLM1	
39.	IMPATT, TRAPATT Diodes expressions	1	22-02-2024		TLM1	
40.	**Tutorial,/Assignment**	1	23-02-2024		TLM1	

UNIT – V [15 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**
41.	Waveguide Components: Scattering matrix	1	27-02-2024		TLM1	

42.	Formulation and Properties. S Matrix	1	28-02-2024		TLM1	
43.	Calculations for E plane and H plane Tees	1	29-02-2024		TLM1	
44.	Calculations for Magic Tee, Directional Coupler	1	01-03-2024		TLM1	
45.	Fundamentals of branch line, rat-race couplers	1	05-03-2024		TLM1	
46.	microwave filters. Ferrites– Composition and Characteristics,	1	06-03-2024		TLM1	
47.	Faraday Rotation; Ferrite Components – Gyrator	1	07-03-2024		TLM1	
48.	Isolator, Circulator. Microwave attenuators.	1	12-03-2024		TLM1	
49.	Isolator, Circulator. Microwave attenuators.	1	13-03-2024		TLM1	
50.	**Microwave Measurements:** Description of Microwave Bench setup ,precautions	2	14-03-2024 15-03-2024		TLM2	
51.	Measurement of Attenuation, Frequency, VSWR	2	19-03-2024 20-03-2024		TLM1	
52.	Measurement of Impedance, Power.	1	21-03-2024		TLM1	
53.	**Tutorial,/Assignment**	1	22-03-2024		TLM1	

BEYOND THE SYLLABUS & REVISION [3 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**
54.	Microwave devices in RADAR communication	1	26-03-2024		TLM1	
55.	RF Microwave Passive Devices	1	27-03-2024		TLM1	
56.	Microwave devices in sattelite communication	1	28-03-2024		TLM1	

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: 2022 – 23 (VI Semester)

B.Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**04-12-2023**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2023	8 Weeks
I Mid Examinations	**29-01-2023**	**03-02-2023**	1 Week
II Phase Instructions	05-02-2023	**30-03-2023**	8 Weeks
II Mid Examinations	**01-04-2023**	**06-04-2023**	1 Week
Preparation & Practicals	08-04-2023	13-04-2023	1 Week
Semester End Examinations	**15-04-2023**	**27-04-2023**	2 Weeks
Internship	29-04-2023	22-06-2023	8 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**

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 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. B SIVA HARI PRASAD]	[Dr. K. RANI RUDRAMA]	[Dr. M.V.SUDHAKAR]	[Dr. Y. AMAR BABU]

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COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : Microwave Engineering Lab– 20EC61

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Dr. B.Y.V.N.R. Swamy /Dr. K. Rani Rudrama /Mr. M. Samba Siva Reddy

COURSE COORDINATOR : Dr. B.Y.V.N.R. Swamy

COURSE OBJECTIVES: This Lab deals with the measurements of the EM signals at microwave frequency range. It involves measurement of frequency, wavelength, VSWR, Impedance and scattering parameters of various microwave devices like Circulator, Direction Coupler, and Magic-Tee. Even the latest trend of software tool i.e. HFSS is also introduced and microwave devices will be verified by evaluating the related parameters.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1 : Demonstrate the functions of microwave bench setup **(Understand – L2)**
CO2 : Examine the properties of microwave passive devices using HFSS **(Apply – L3)**
CO3 : Estimate the frequency, wavelength, VSWR, impedance and scattering parameters of microwave devices **(Apply – L3)**
CO4 : 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
CO1	1	-	-	1	1	-	-	-	-	-	-	-	1	-	-
CO2	1	1	1	1	3	-	-	-	-	-	-	1	3	-	-
CO3	2	2	-	3	2	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	1	2	3	-	1	-	-	-

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

Batch-1

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1	Demonstration	3	06.12.2023		-	TLM1	
2	Experiment-1	3	13.12.2023		COs 1,3,4	TLM4	
3	Experiment-2	3	20.12.2023		COs 1,3,4	TLM4	
4	Experiment -3	3	27.12.2023		COs1,3,4	TLM4	
5	Experiment-4	3	03.01.2024		COs 1,3,4	TLM4	
6	Experiment-9	3	10.01.2024		COs 2,4	TLM4	
7	Experiment-10	3	24.01.2024		COs2,4	TLM4	
8	Experiment-5	3	07.02.2024		COs1,3,4	TLM4	
9	Experiment-6	3	14.02.2024		COs 1,3,4	TLM4	
10	Experiment-7	3	21.02.2024		COs 1,3,4	TLM4	
11	Experiment-8	3	28.02.2024		COs 1,3,4	TLM4	
12	Experiment-11	3	06.03.2024		COs 2,4	TLM4	
13	Experiment-12	3	13.03.2024		COs 2,4	TLM4	
13	Revision	3	20.04.2024				
14	Internal exam	3	27.04.2024				

Batch-2

S. No.	Experiments	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Learning Outcome COs	Teaching Learning Methods	HOD Sign Weekly
1.	Demonstration	3	09.12.2023		COs 1,4	TLM1	
2.	Experiments-1	3	16.12.2023		COs 1,4	TLM4	
3.	Experiment-2	3	23.12.2023		COs 1,4	TLM4	
4.	Experiment-3,4	3	30.12.2023		COs 3,4	TLM4	
5.	Experiment-9	3	06.01.2024		COs2,4	TLM4	
6.	Experiment-10	3	20.01.2024		COs 2,4	TLM4	
7.	Experiment-5	3	10.02.2024		COs 2,4	TLM4	
8.	Experiment-6	3	17.02.2024		COs 1,3,4	TLM4	
9.	Experiment-7,8	3	24.02.2024		COs 1,3,4	TLM4	
10.	Experiment-11,12	3	02.03.2024		COs 1,3,4	TLM4	
11.	Revision	3	16.03.2024				
12.	Internal exam	3	23.03.2024				

List of Experiments:

Exp. No	Experiments to be conducted	Exp. No	Experiments to be conducted
CYCLE-1			CYCLE-2
1.	Reflex Klystron Characteristics.	5	Directional coupler characteristics
2.	Gunn diode Characteristics	6	Impedance and frequency measurement
3.	Attenuation measurement	7	Scattering parameters of circulator
4.	VSWR measurement .	8	Scattering parameters of Magic tee
9.	Scattering parameters of branch line coupler	11	Design and S-parameter measurement of microwave band stop filter
10	Scattering parameters of rat-race coupler	12	Design and S-parameter measurement of microwave balun

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	**Cos**	**Marks**
Day to Day Work	1,2,3,4	A=5
Record	1,2,3,4	B=5
Internal Exam	1,2,3,4	C=5
Cumulative Internal Examination :	1,2,3,4	**A+B+C=15**
Semester End Examinations	1,2,3,4	**D=35**
Total Marks: A+B+C+D	**1,2,3,4**	**50**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
PEO2: To Function professionally in the rapidly changing world with advances in technology
PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.
PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner

PROGRAMME OUTCOMES (POs)

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. **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.
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 environmental considerations.
PO4. **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.
PO5. **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.
PO6. **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.
PO7: **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.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: 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.
PO11: 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.
PO12: 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)

PSO1: Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

PSO2: 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

PSO3: Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. B.Y.V.N.R. SWAMY]	[Dr. B.Y.V.N.R. SWAMY]	[Dr. M.V.SUDHAKAR]	[Dr. Y. AMAR BABU]

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Name & Code : **Microprocessors and Microcontrollers – 20EC15**
L-T-P Structure : 4-0-0
Credits : 3
Program : B.Tech.
A.Y : **2023 – 24**
Course Instructor : Dr. P. Lachi Reddy

Pre requisite: Digital Logic Circuits

Course Educational Objective: In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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

CO 1	Understand the architecture of 8086, 8051 and ARM Controller **(Understand)**
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**

CO's / PO's	Course Name with code : MPMC,20EC15														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	-	3	-
CO3	2	3	2	1	-	-	-	-	-	-	-	2	-	3	-
CO4	1	2	3	2	-	-	-	-	-	-	-	2	-	3	-

Prescribed Syllabus:

UNIT-I: 8086 MICROPROCESSOR [9 HRS]

Architecture, Pin diagram, Register organization, Minimum mode and Maximum mode, timing diagrams. Addressing modes, Instruction set, Interrupt vector table, Assembly language programming - data transfer, arithmetic, logical and decision making operations.

UNIT- II: 8051 MICROCONTROLLER [8 HRS]

Architecture, Input/output Ports, Registers, Counter and Timers, Serial port, Interrupts, addressing modes, instruction set and Programming - data transfer, arithmetic, logical and decision making operations.

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [9 HRS]

History, Architecture, ARM design philosophy, Registers, Program status register, Instruction pipeline, Interrupts and vector table, ARM processor families, Instruction set: Data processing instructions, Addressing modes, Branch, Load-Store instructions, PSR instructions, and Conditional instructions.

UNIT – IV: ARM PROGRAMMING [8 HRS]

Assembly programming, General structure of assembly language, Writing programs, Branch instructions, Loading constrains, load and store instructions, Read only and read/write Memory, Multiple Register Load and Store.

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS [8 HRS]

Interfacing - A/D and D/A converter, LEDs, Switches, Relays, LCD, Stepper Motors, Real Time Clock, Serial Communication, GSM and GPS.

Text Books:

1. Ray and Burchandi, “Advanced Microprocessors and Interfacing”, Tata McGraw–Hill.
2. M.A.Mazidi,S.Naimi and S.Naimi, “The AVR Microcontroller and Embedded Systems Using Assembly and C”, 1st Edition Pearson Publications, 2013.

Reference Books:

1. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press, 2010.
2. Dhananjay V. Gadre, “Programming and Customizing The AVR Microcontroller”, Tata McGraw-Hill publications, 2012.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: 8086 MICROPROCESSOR						
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.	Architecture	1	04-12-2023		TLM1	
2.	Pin diagram	1	05-12-2023		TLM2	
3.	Register organization	1	06-12-2023		TLM1	
4.	Minimum mode and Maximum mode, timing diagrams	1	11-12-2023		TLM2	
5.	Addressing modes	1	12-12-2023		TLM1	
6.	Instruction set	1	13-12-2023		TLM1	
7.	Interrupt vector table	1	16-12-2023		TLM1	
8.	Assembly language programming - data transfer, arithmetic operations	2	18-12-2023 19-12-2023		TLM1 TLM3	
9.	Assembly language programming - logical and decision making operations	2	20-12-2023 23-12-2023		TLM1 TLM3	
10.	Tutorial,/Assignment	1	23-12-2023		TLM3	

UNIT- II: 8051 MICROCONTROLLER						
S. No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
11.	Architecture	1	26-12-2023		TLM2	
12.	Input/output Ports	1	27-12-2023		TLM2	
13.	Registers, Counter and Timers	1	30-12-2023		TLM2	
14.	Serial port, Interrupts	1	02-01-2024		TLM2	
15.	Addressing modes	1	03-01-2024		TLM2	
16.	Instruction set	2	06-01-2023 08-01-2023		TLM2	
17.	Programming - data transfer, arithmetic operations	2	09-01-2024 10-01-2024		TLM2 TLM3	
18.	Programming - logical and decision making operations	1	20-01-2024		TLM2 TLM3	
19.	Tutorial,/Assignment	1	22-01-2024		TLM3	

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL						
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.	History & Architecture	1	23-01-2024		TLM2	
21.	ARM design philosophy	1	24-01-2024		TLM2	
22.	Registers, Program status register	1	27-01-2024		TLM2	
23.	Instruction pipeline, Interrupts and vector table	1	05-02-2024		TLM2	
24.	ARM processor families	1	06-02-2024		TLM2	
25.	Instruction set: Data processing instructions	1	07-02-2024		TLM2	
26.	Addressing modes	1	12-02-2024		TLM2	
27.	Branch, Load-Store instructions	1	13-02-2024		TLM2	
28.	PSR instructions, and Conditional instructions	1	14-02-2024		TLM2	
29.	Tutorial,/Assignment	1	17-02-2024		TLM3	

UNIT – IV: ARM PROGRAMMING						
S. No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
30.	Assembly programming,	1	19-02-2024		TLM1	
31.	General structure of assembly language	1	20-02-2024		TLM1	
32.	Writing programs	1	21-02-2024		TLM1	
33.	Branch instructions	1	24-02-2024		TLM1	
34.	Loading constrains	1	26-02-2024		TLM1	
35.	load and store instructions	1	27-02-2024		TLM1	
36.	Read only and read/write Memory	1	28-02-2024		TLM1	
37.	Multiple Register Load and Store	1	02-03-2024		TLM1	
38.	Tutorial,/Assignment	1	04-02-2024		TLM3	

UNIT – V: INTERFACING ARM WITH EXTERNAL PERIPHERALS						
S. No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
39.	Interfacing - A/D converter	1	05-03-2024		TLM2	
40.	Interfacing - D/A converter	1	06-03-2024		TLM2	
41.	Interfacing - LEDs & Switches	1	11-03-2024		TLM2	
42.	Interfacing – Relays & LCD	1	12-03-2024		TLM2	
43.	Interfacing - Stepper Motors	1	13-03-2024		TLM2	
44.	Interfacing - Real Time Clock	1	16-03-2024		TLM2	
45.	Interfacing - Serial Communication	1	18-03-2024		TLM2	
46.	Interfacing - GSM and GPS	1	19-03-2024		TLM2	
47.	Tutorial,/Assignment	1	20-03-2024		TLM2	

BEYOND THE SYLLABUS & REVISION						
S. No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
48.	LPC1769/LPC2148 Instruction Set	1	23-03-2024		TLM1	
49.	LPC1769/LPC2148 Programming	1	26-03-2024		TLM1	
50.	LPC1769/LPC2148 Interfacing	1	27-03-2024		TLM1	

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: 2023 – 24 (VI Semester)

B.Tech VI Semester - 2020 Admitted Batch			
Class work Commence From	**21-02-2022**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	04-12-2023	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
II Phase Instructions	05-02-2024	30-03-2024	8 Weeks
II Mid Examinations	**01-04-2024**	**06-04-2024**	1 Week
Preparation & Practicals	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**27-04-2024**	2 Weeks
Internship	29-04-2024	22-06-2024	8 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 architecture of 8086, 8051 and ARM Controller **(Understand)**	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply Assembly Language instructions for Processor and Controller based applications **(Apply)**	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the operating modes and interrupt structures of processors and controllers **(Analyze)**	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Develop the ARM based interfacing systems for Real time applications **(Apply)**	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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. LACHI REDDY]	[Mr. B.V.N.R.Siva Kumar]	[Dr.P. LACHI REDDY]	[Dr. Y. AMAR BABU]

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Course Name & Code : **Microprocessors and Microcontrollers Lab – 20EC59**
L-T-P Structure : 0-0-3
Credits : 1.5
Program : B. Tech. VI Semester ECE-C Section
A.Y : **2023 – 24**
Course Instructor : Dr. P. Lachi Reddy

COURSEOBJECTIVE:

In this course student will learn about the architecture of 8086 Microprocessor, 8051 Microcontroller and ARM, programming using assembly language, interfacing of devices for real time applications.

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.

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	3	2	2	-	1	1	-	-	-	2	-	2	-
CO2	3	3	3	2	2	-	1	1	-	-	-	3	-	3	-
CO3	3	3	3	3	3	-	1	1	-	-	-	3	-	3	-
CO4	-	-	-	2	-	-	-	1	2	3	-	1	-	-	-

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
LAB SCHEDULE (LESSONPLAN): Section-C

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					
1.	Introduction to Lab	3	05-12-2023		**TLM2**	
2.	Display, comparison and reverse the string	3	12-12-2023		**TLM8**	
3.	Factorial using Procedures	3	19-12-2023		**TLM8**	
4.	Sorting the signed and unsigned numbers	3	26-12-2024		**TLM8**	
5.	Checking the given string for Palindrome	3	02-01-2024		**TLM8**	
6.	Arithmetic operations like Addition, Subtraction, Multiplication and Division	3	09-01-2024		**TLM8**	
7.	Byte checking by using 8051, Addition of series of numbers	3	23-01-2024		**TLM8**	
8.	Checking the given numbers for Odd or Even	3	06-02-2024		**TLM8**	
	CYCLE-2					
9.	Interfacing of A/D and D/A converter	3	13-02-2024		**TLM8**	
10.	Interfacing of LEDs and Switches, Interfacing of LCD	3	20-02-2024		**TLM8**	
11.	Interfacing of Stepper Motor	3	27-02-2024		**TLM8**	
12.	Interfacing of traffic Light controller	3	05-03-2024		**TLM8**	
13.	Interfacing of Real Time Clock	3	12-03-2024		**TLM8**	
14.	Data loggers –Roll over display	3	19-03-2024		**TLM8**	
15.	Internal Lab Exam	3	26-03-2024		**TLM8**	
No. of classes required to complete:		45	No. of classes conducted:			

PART-C

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: 2023 – 24 (VI Semester)

B. Tech VI Semester - 2021 Admitted Batch			
Class work Commence From	**21-02-2022**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**04-12-2023**	27-01-2024	8 Weeks
I Mid Examinations	**29-01-2024**	**03-02-2024**	1 Week
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Preparation & Practicals	08-04-2024	13-04-2024	1 Week
Semester End Examinations	**15-04-2024**	**24-04-2024**	2 Weeks
Internship	29-04-2024	22-06-2024	8 Weeks

EVALUATIONPROCESS:

Evaluation Task	**COs**	**Marks**
Day to Day work	1,2,3,4	A=10
Internal Lab Examination	1,2,3,4	B=5
Total Internal Marks (A+B)		**C=15**
Semester End Examinations	1,2,3,4	**D=35**
Total Marks : C+D	1,2,3,4	**50**

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.
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PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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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.

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.
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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. P. LACHI REDDY]	[Mr. K.SASI BHUSHAN]	[Dr. P. LACHI REDDY]	[Dr. Y. AMAR BABU]

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Phone: 08659-222933, Fax: 08659-222931

Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. P. Venkat Rao
Course Name & Code : SATELLITE COMMUNICATIONS, 20EC19
L-T-P Structure :3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech/VI/C **A.Y.:** 2023-2024

PREREQUISITE: Analog Communications & Digital Communications

COURSE EDUCATIONAL OBJECTIVES (CEOs): 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, student will be able to

CO1	**Understand** the orbital mechanics, concepts of satellite communication and its applications **(Understand – L2)**
CO2	**Summarize** the concepts of satellite space segment, earth segment and satellite services **(Understand – L2)**
CO3	**Examine** the satellite link budget calculations and orbital dynamics **(Apply – L3)**
CO4	**Apply** the multiple-access techniques and mobile services for satellite Communications **(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
CO1	1	-	-	-	-	3	3	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	3	1	-	-	-	-	1	2	-	-
CO3	1	-	1	2	-	-	-	-	-	-	-	-	2	-	-
CO4	1	1	1	-	-	3	3	-	-	-	-	-	2	-	-
1 - Low						**2 –**Medium						**3 -** High			

TEXT BOOKS:

T1. Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003..

T2. Dennis Roddy , "Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

REFERENCE BOOKS:

R1	D.C Agarwal , "Satellite communications", Khanna Publications, 5th Edition,2006.
R2	M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Satellite Communication

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, COs	1	04-12-23			
2.	Need of satellite communication	1	05-12-23			
3.	Definition of a satellite and orbit	1	07-12-23			
4.	Different types of satellite orbits	1	11-12-23			
5.	Frequency allocations for satellite communication	1	12-12-23			
6.	General structure of satellite communication system	1	12-12-23			
7.	Merits and demerits of satellite communication	1	14-12-23			
8.	types of launch vehicles: ELV &RLV.	1	18-12-23			
9.	Applications of satellite communication	1	19-12-23			
10.	Satellite sub systems	1	19-12-23			
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: Orbital Dynamics and Satellite Launching

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Kepler's Laws	1	21-12-23			
12.	Definitions of Terms for Earth-Orbiting Satellites	1	26-12-23			
13.	Orbital Elements,	1	26-12-23			
14.	Apogee and Perigee Heights	1	28-12-23			
15.	Effects of non spherical earth, Atmospheric drag	1	01-01-23			
16.	Orbital perturbations-need for station keeping	1	02-01-23			
17.	Non geostationary orbits and geostationary orbits	1	02-01-23			
18.	Orbital effects: Doppler shift, Range variation	1	04-01-23			
19.	solar eclipse and sun transit outage	1	08-01-23			
20.	launching of geostationary satellites.	1	09-01-23			
21.	Look angle determination	1	11-01-23			
22.	elevation angle and azimuth angle calculation	1	16-01-23			
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: Space Segment and 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
23.	Introduction to space segment	1	16-01-23			
24.	Power supply unit	1	18-01-23			
25.	Attitude and orbital control	1	22-01-23			
26.	spinning satellite stabilization and momentum wheel stabilization	1	23-01-23			
27.	Station keeping	1	23-01-23			
28.	Thermal control	1	25-01-23			
29.	TT&C subsystem	1	05-02-23			
30.	Transponders, The wideband receiver, The input demultiplexer, The power amplifier	1	06-02-23			
31.	Antenna subsystem, Equivalent Isotropic Radiated Power, Free-space transmission	1	06-02-23			
32.	Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses	1	08-02-23			
33.	Link power budget equation, System Noise, Carrier-to-Noise Ratio	1	12-02-23			
34.	The Uplink, Saturation flux density, Input backoff, Downlink	1	13-02-23			
35.	Output back-off, Combined Uplink and Downlink C/N Ratio.	1	13-02-23			
No. of classes required to complete UNIT-III: 13				**No. of classes taken:**		

UNIT-IV: Earth segment and Satellite access

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Design requirements for the selection of earth segment	1	15-02-23			
37.	Transmit only earth station, Receive only earth station	1	19-02-23			
38.	Transmit -Receive (T/R) earth station	1	20-02-23			
39.	Single Access	1	20-02-23			
40.	Preassigned FDMA	1	22-02-23			
41.	Demand-Assigned FDMA	1	26-02-23			
42.	Spade System, TDMA	1	27-02-23			
43.	Preassigned TDMA	1	27-02-23			
44.	Demand-assigned TDMA	1	04-03-23			
45.	Satellite-Switched TDMA	1	05-03-23			
46.	CDMA	1	05-03-23			
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Satellite Services & Applications

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Different types of satellite services	1	07-03-23			
48.	Global Positioning System	1	11-03-23			
49.	architecture and location principle	1	12-03-23			
50.	Direct Broadcast Satellite	1	12-03-23			
51.	DBS/DTH	1	14-03-23			
52.	Home receiver block (Indoor & Outdoor Unit)	1	18-03-23			
53.	Satellite Mobile Services	1	19-03-23			
54.	VSAT, MSAT	1	19-03-23			
55.	RADARSAT	1	21-03-23			
56.	IRNSS constellation	1	26-03-23			
57.	Orbcomm, Iridium	1	26-03-23			
58.	Revision	1	28-03-23			
No. of classes required to complete UNIT-V: 12						

Concepts 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
59.	Case study on latest Indian satellite launching and services	1	28-03-23			

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 Regulation):

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
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	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
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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. P. Venkat Rao**	**Dr. P. Venkat rao**	**Dr. M.V Sudhakar**	**Dr. Y.Amarbabu**
Signature				

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, NTR DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

FRESHMAN ENGINEERING DEPARTMENT

COURSE HANDOUT

PART-A

Name of Course Instructor : M Anuradha
Course Name & Code : Soft Skills & 20HSS1
L-T-P Structure : 1-0-2 **Credits:** 02
Program/Sem/Sec : B. Tech- VI SEM ECE C
Academic Year : 2023-24

PREREQUISITE: NIL

Course Educational Objectives:

The Soft Skills Laboratory course equips students with required behavioral, interpersonal & Intrapersonal skills, communication skills, leadership skills etc. It aims at training undergraduate students on soft skills leading to enhanced self-confidence, esteem, and acceptability in professional circles.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	To Develop self-awareness and personality traits for professional growth.	L2
CO2	Work effectively in multi-disciplinary and heterogeneous teams through knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality.	L3
CO3	Communicate through verbal/oral communication with good listening skills and empathy.	L3
CO4	Apply skills required to qualify in recruitment tests, Interviews & other professional assignments.	L3

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.					2			3	3	3		2
CO2.		2			2			3	3	3		3
CO3.					2			3	3	3		3
CO4.					2			3	3	3		
1 = Slight (Low) 2= Moderate (Medium) 3 = Substantial (High)												

List of Activities:

1.Personality Development Skills

Role of language in Personality – How language reflects, impacts Personality – Using gender- neutral language in MNCs – being Culturally-Sensitive-Personality Traits - Grooming & Dress code

Activities: Group Discussion/Role play/Presentations (authentic materials: Newspapers, pamphlets and News Clippings)

2.Impactful Communication

Activities: Extempore / Story Telling/ Group Discussion (Case studies/Current affairs etc.)/ Elocution on Interpretation of given quotes/ Critical Appreciation and Textual Analysis/ Writing reviews on short story/videos/book/Social Media profiling/ Pronunciation Practice

3.Professional Skills:

Career Planning- job vs. career- goal setting- SWOT Analysis-Time management – self-management – stress-management.

Activities: SWOT analysis of the self/Goal Setting-Presentation/Writing Report/Listening exercises/Effective Resume-Writing and presentation/ Interview Skills: Mock interviews/Video samples.

REFERENCES:

1. Edward Holffman, "Ace the Corporate Personality", McGraw Hill,2001
2. Adrian Furnham, Personality and Intelligence at Work, Psyc 2. hology Press, 2008.
3. M.Ashraf Rizvi, "Effective Technical Communication", 1st edition, Tata C Graw Hill, 2005.
4. Ace of Soft skills Gopalaswamy Ramesh, Pearson Education India, 2018
5. Soft Skills for the Workplace, Good heart - Willcox Publisher · 2020.
6. How to Win Friends and Influence People, Dale Carnegie · 2020

Software: Walden InfoTech

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
	Activity-1: Role of language in Personality- How language reflects, impacts Personality – Using gender	1+2	07/12/2023		TLM-1,2& 6.	
	Neutral language in MNCs – Being Culturally-Sensitive-Personality Traits- Grooming & Dress code	1+2	14/12/2023		TLM-1,2 &6.	
	Role-play	1+2	21/12/2023		TLM-1, 2& 6.	
	Group Discussion	1+2	28/12/2023		TLM-1,2& 6.	
	Presentations	1+2	04/01/2024		TLM-1,2& 6.	

	Activity-2: Impactful Communication Extempore - Story Telling	1+2	11/01/2024		TLM-1,2& 6.	
	Extempore -Group Discussion	1+2	18/01/2024		TLM-1,2& 6.	
	Elocution on Interpretation of given quotes	1+2	25/01/2024		TLM-1,2& 6.	
	Critical Appreciation and Textual Analysis/ Writing	1+2	08/02/20		TLM-1, 2& 6.	
	Reviews on short story/ book/videos/ Social Media profiling/ Pronunciation Practice	1+2	15/02/2024		TLM-1,2& 6.	
	Activity-3: Professional Skills: Career Planning	1+2	22/02/2024		TLM-1,2& 6.	
	Job vs. career- goal setting	1+2	29/02/2024		TLM-1, 2& 6.	
	Critical Appreciation and Textual Analysis/ Writing	1+2	07/03/2024		TLM-1,2& 6.	
	Stress-management.	1+2	14/03/2024		TLM-1,2& 6.	
	Presentation/Writing Report /Listening exercises	1+2	21/03/2024		TLM-1,2& 6.	
	Effective Resume-Writing and presentation	1+2	28/03/2024		TLM-1,2& 6.	
	Interview Skills: Mock Interviews /Video samples.	1+2	04/04/2024		TLM-1, 2& 6.	
No. of classes required to complete Syllabus:51						

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

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.

	Course Instructor	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**M. Anuradha**	**Dr. R. Padma Venkat**	**Dr. R. Padma Venkat**	**Dr. A. Ramireddy**
Signature				

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DEPARTMENTOFELECTRONICS & COMMUNICATIONS ENGINEERING

COURSEHANDOUT

PART-A

Name of Course Instructor :Kamala Priya B, Assistant Professor
Course Name & Code :Operations Research Techniques-20ME83 **Regulation**:R20
L-T-P Structure : **4-0-0** **Credits:**03
Program/Sem/Sec : B.Tech- ECE VI Sem C/S **A.Y.:**2023-24
PREREQUISITE : **Nil**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to introduce the concepts of formulating an engineering problem into mathematical model to develop an optimal solution.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Apply linear programming approach for optimizing the objectives of industrial oriented problems. **(Applying-L3)**
CO2	Formulate and solve transportation models and assignment models**. (Applying-L3)**
CO3	Implement the strategies in competitive situations and able to sequence the jobs to be processed on machines. **(Applying-L3)**
CO4	Identify the replacement period of the equipment and analyze the waiting situations in an organization. **(Applying-L3)**
CO5	Determine the optimum inventory level and resolve the complex problem into simple problems by dynamic programming approach and apply optimum strategies. **(Applying-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
CO1	3	3	3	2	3				3			3		3	
CO2	3	3	1	2	1				3			3		3	
CO3	3	3	3	2	1				3			3		3	
CO4	3	2	3	2	3				1			3		3	
CO5	2	3	3	2	1				1			3		3	

TEXTBOOKS:

T1	S.D Sharma, ―Operation Research‖, Kedar Nath and RamNath - Meerut, 2008.
T2	Operations Research / N.V.S. Raju / SMS, 2009.

REFERENCE BOOKS:

R1	Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition, 2009.
R2	Hiller & Libermann, Introduction to O.R (TMH), 9thEDITION, 2009.
R3	Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publications, New Delhi, 14th Edition, 2008.
R4	A.M.Natarajan, P.Balasubramani, A. Tamilarasi, Operations Research, Pearson Education, 2ndedition, 2014.
R5	Taha, Introduction to O.R .PHI, 9th edition, 2010.

PART-B

COURSEDELIVERY PLAN (LESSONPLAN): Section-A

UNIT-I:INTRODUCTION &LINEAR PROGRAMMING PROBLEM

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	TeachingLearningMethods	HOD Sign Weekly
1.	**INTRODUCTION**: Introduction To ORT & CEO, COs	1	04.12.2023		TLM1/TLM2	
2.	Operations Research Models, Phases &Applications	1	04.12.2023		TLM1/TLM2	
3.	**Linear Programming Problem (LPP)**: Formulation	1	06.12.2023		TLM1	
4.	Numericals	1	08.12.2023		TLM1	
5.	Graphical Solution For Special Cases Of LPP	1	11.12.2023		TLM1	
6.	Simplex Method	1	11.12.2023		TLM1	
7.	Numericals	1	13.12.2023		TLM1	
8.	Numericals	1	15.12.2023		TLM1	
9.	Big M Method	1	18.12.2023		TLM1	
10.	Numericals	1	18.12.2023		TLM1	
11.	Two Phase Simplex Method	1	20.12.2023		TLM1	
12.	Numericals	1	22.12.2023		TLM1	
13.	Big M method	1	27.12.2023		TLM1	
14.	Numericals	1	29.12.2023		TLM1	
No. of classes required to complete UNIT-I:		**14**		**No. of classes taken:**		

UNIT-II:TRANSPORTATION & ASSIGNMENT PROBLEMS

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction To TP, Terminology, Formulation	1	03.01.2024		TLM1/TLM2	
16.	Standard Form, Unbalanced TP	1	05.01.2024		TLM1	
17.	Numericals	1	08.01.2024		TLM1	
18.	IBFS:NWCM, LCM, VAM	1	08.01.2024		TLM1	
19.	Numericals	1	10.01.2024		TLM1	
20.	Test For Optimality: Stepping Stone Method, Modified Distribution Method (MODI Method)	1	12.01.2024		TLM1	

21.	Numericals	1	17.01.2024		TLM1	
22.	Degeneracy in TP, Numericals	1	19.01.2024		TLM1	
23.	Introduction to Assignment Problem	1	22.01.2024		TLM1	
24.	Variants of Assignment Problems	1	22.01.2024		TLM1	
25.	Optimal Solution, Numericals	1	24.01.2024		TLM1	
26.	Travelling Salesmen Problem	1	26.01.2024		TLM1	
27.	Numericals	1	05.02.2024		TLM1	
No. of classes required to complete UNIT-II		13		**No. of classes taken:**		

UNIT-III:GAME THEORY AND JOB SEQUENCING

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	**Introduction to Games Theory**: Terminology	1	05.02.2024		TLM1/TLM2	
29.	Minimax or Maxmini Criterion,Optimal Strategy	1	07.02.2024		TLM1	
30.	Solution of games with saddle point	1	09.02.2024		TLM1	
31.	Rectangular games without saddle point, Numericals	1	12.02.2024		TLM1	
32.	2x2 games	1	12.02.2024		TLM1	
33.	mx2, 2xn, mxn games, Dominance Principle,	1	14.02.2024		TLM1	
34.	Graphical approach, Numericals	1	16.02.2024		TLM1	
35.	**Job Sequencing:**n jobs through 2 machines,	1	19.02.2024		TLM1	
36.	n jobs through 3 machines,	1	19.02.2024		TLM1	
37.	2 jobs through m machines	1	21.02.2024		TLM1	
38.	Numericals	1	23.02.2024		TLM1	
39.	Graphical model	1	26.02.2024		TLM1	
No. of classes required to complete UNIT-III		12		**No. of classes taken:**		

UNIT-IV: THEORY OF REPLACEMENT AND WAITING LINES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	**THEORY OF REPLACEMENT:** Introduction, Replacement of Equipment that Deteriorates Gradually	1	26.02.2024		TLM1/TLM2	
41.	Numericals	1	28.02.2024		TLM1	
42.	Replacement of Equipment that fails suddenly, Numericals	1	01.03.2024		TLM1	
43.	Numericals	1	04.03.2024		TLM1	
44.	Group Replacement Policy	1	04.03.2024		TLM1/TLM2	
45.	**Introduction to Queuing Theory**	1	06.03.2024		TLM1/TLM2	
46.	Single Channel – Poisson arrivals – exponential service times – with	1	08.03.2024		TLM1	

	infinite population, Derivation					
47.	Single Channel – Poisson arrivals – exponential service times – with finite population, Numericals	1	11.03.2024		TLM1/TLM2	
No. of classes required to complete UNIT-IV		08		**No. of classes taken:**		

UNIT-V: INVENTORY MODELS AND DYNAMIC PROGRAMMING

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
48.	**INVENTORY MODELS**-terminology, EOQ	1	11.03.2024		TLM1/TLM2	
49.	Instantaneous Production, finite, continuous demand	1	13.03.2024		TLM1/TLM2	
50.	Shortages not Allowed	1	15.03.2024		TLM1	
51.	Purchase inventory models with one price break	1	18.03.2024		TLM1	
52.	Purchase inventory models with multiple price breaks	1	20.03.2024		TLM1	
53.	**DYNAMIC PROGRAMMING (DP):** Introduction To DP	1	22.03.2024		TLM1/TLM2	
54.	Bellman's Principle of Optimality, Applications of Dynamic Programming	1	25.03.2024		TLM1/TLM2	
55.	Capital Budgeting Problem, Numericals	1	25.03.2024		TLM1	
56.	linear programming problem	1	27.03.2024		TLM1	
57.	Shortest path problems	1	29.03.2024		TLM1	
No. of classes required to complete UNIT-V		10		**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

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Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	04-12-2023	27-01-2024	8
I MID Examinations	29-01-2024	03-02-2024	1
II Phase of Instructions	05-02-2024	30-03-2024	8
II MID Examinations	01-04-2024	06-04-2024	1
Preparation and Practicals	08-04-2024	13-04-2024	1
Semester End Examinations	15-04-2024	27-04-2024	2

PART-C

EVALUATION PROCESS (R20Regulation):

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-QuizExamination(Units-I,II&UNIT-III(HalfoftheSyllabus))	Q1=10
Assignment-II(Unit-III(RemainingHalfoftheSyllabus),IV&V)	A2=5
II-DescriptiveExamination(UNIT-III(RemainingHalfoftheSyllabus),IV&V)	M2=15
II-QuizExamination(UNIT-III(RemainingHalfoftheSyllabus),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

PROGRAMME 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):

PO1	**Engineeringknowledge**:Applythe knowledge ofmathematics,science,engineeringfundamentals,andanengineering specializationtothesolution of complex engineering problems.
PO2	**Problemanalysis**:Identify, formulate, reviewresearchliterature,andanalysecomplexengineeringproblemsreachingsubstantiatedconclusions using first principles of mathematics, natural sciences, and engineering sciences.
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, andthe cultural, societal, and environmental considerations.
PO4	**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.
PO5	**Moderntoolusage**: 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.
PO6	**Theengineerandsociety**: 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.
PO7	**Environmentandsustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individualandteamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the ring 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.
PO12	**Life-longlearning**: 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	Design and develop modern communication technologies for building the interdisciplinary skills to meet current and future needs of industry.
PSO 2	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	Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

Title	**CourseInstructor**	**CourseCoordinator**	**ModuleCoordinator**	**Head of theDepartment**
Name of the Faculty	Kamala Priya B	Mr.V.Sankararao	Dr.M.B.S.Sreekara Reddy	Dr.M.B.S.Sreekara Reddy
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
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

Name of Course Instructor : N Dharmachari

Course Name & Code : VLSI Design Automation – 20ECH3
L-T-P Structure : 3-1-0 Credits : 4

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Honors A.Y : 2023-24

PRE-REQUISITE: VLSI Design

COURSE EDUCATIONAL OBJECTIVES (CEOs):
In this course student will learn about the design cycles, various techniques on Partitioning, Placement and Routing and addressing their problems

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

CO 1	Understand need for VLSI physical design automation. **(Understand – L2)**
CO 2	Analyze VLSI automation algorithms for partitioning **(Apply – L3)**
CO 3	Formulate placement, floor planning and pin assignment problems and simulate. **(Apply – L3)**
CO 4	Resolve routing issues using various algorithms **(Analyze – L4)**
CO 5	Illustrate physical design cycle for FPGAs **(Analyze – L4)**

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

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

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

TEXT BOOK:

1. Naveed Shervani, **"Algorithms for VLSI Physical Design Automation"**, Springer Publisher, Third edition

REFERENCE BOOKS:

1. ChristophnMeinel& Thorsten Theobold, **"Algorithm and Data Structures for VLSI Design"**, KAP, 2002.
2. Rolf Drechsheler :**"Evolutionary Algorithm for VLSI"**, Second edition.
3. Trimburger, **"Introduction to CAD for VLSI",** Kluwer Academic publisher, 2002

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: VLSI Physical Design Automation

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	General Interaction & Introduction to the course	1	05-12-2023		-	
2.	Course Objective and Outcomes, POs, PSOs and Mapping with COs	1	07-12-2023		-	
3.	Introduction	1	12-12-2023		TLM1	
4.	VLSI Design cycle	1	14-12-2023		TLM2	
5.	New trends in VLSI design cycle	2	16-12-2023		TLM2	
6.	New trends in Physical design cycle	1	19-12-2023		TLM2	
7.	Design styles	1	21-12-2023		TLM2	
8.	Full custom Basic terminology	2	23-12-2023		TLM2	
9.	Complex issues	1	26-12-2023		TLM2	
10.	Basic algorithms	1	28-12-2023		TLM2	
11.	Basic data structures, and algorithms	2	30-12-2023		TLM2	
No. of classes required to complete UNIT-I		**14**	**No. of classes taken**			

UNIT-II: VLSI Automation Algorithms

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Partitioning: problem formulation	1	02-01-2024		TLM2	
2.	Classification of partitioning algorithms	1	04-01-2024		TLM2	
3.	Group migration algorithms	3	06-01-2024 09-01-2024		TLM2	
4.	Simulated annealing & evolution.	2	11-01-2024 16-01-2024		TLM2	
5.	Other partitioning algorithms	3	18-01-2024 20-01-2024		TLM2	
No. of classes required to complete UNIT-II		**10**	**No. of classes taken**			

UNIT-III: Placement, Floor Planning & Pin Assignment

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Problem formulation	1	23-01-2024		TLM2	
2.	Simulation base placement algorithms	1	25-01-2024		TLM2	
3.	Other placement algorithms	2	27-01-2024		TLM2	
4.	Constraint based floor planning	2	06-02-2024 08-02-2024		TLM2	

5.	floor planning algorithms for mixed block & cell design	1	13-02-2024		TLM2	
6.	General & channel pin assignment	1	15-02-2024		TLM2	
No. of classes required to complete UNIT-III		**08**	**No. of classes taken**			

UNIT-IV: Global Routing, Detailed Routing and Over The Cell Routing & Via Minimization

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Problem formulation	2	17-02-2024		TLM2	
2.	Classification of global routing algorithms	1	20-02-2024		TLM2	
3.	Problem formulation, Classification of Detailed routing algorithms	1	22-02-2024		TLM2	
4.	Maze routing algorithm, line probe algorithm	2	24-02-2024		TLM2	
5.	Steiner Tree based algorithms, ILP based approaches	1	27-02-2024		TLM2	
6.	Single layer routing algorithms	1	29-02-2024		TLM2	
7.	Two layer channel routing algorithms	2	02-03-2024		TLM2	
8.	Three layer channel routing algorithms, Switchbox routing algorithms	1	05-03-2024		TLM2	
9.	Two layers over the cell routers	1	07-03-2024		TLM2	
10.	Constrained & unconstrained via minimization	1	12-03-2024		TLM2	
No. of classes required to complete UNIT-IV		**13**	**No. of classes taken**			

UNIT-V: Physical design Automation of FPGAs

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	14-03-2024		TLM2	
2.	FPGA Technologies	2	16-03-2024		TLM2	
3.	Physical design cycle for FPGAs, Partitioning	1	19-03-2024		TLM2	
4.	Routing	1	21-03-2024		TLM2	
5.	Routing algorithms for the non-segmented model	2	23-03-2024		TLM2	
6.	Routing algorithms for segmented model	1	26-03-2024		TLM2	
7.	routing algorithms for staggered model	1	28-03-2024		TLM2	
No. of classes required to complete UNIT-V		**09**	**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
1.	Semi-custom IC design flow	**2**	30-03-2024		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

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.
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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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. N.Dharmachari	Mr. N.Dharmachari	Dr. P.Lachi Reddy	Dr. Y. Amar Babu