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 Name & Code : Microprocessors and Microcontrollers – 20EC15
L-T-P Structure : 3-0-0
Credits : 3
Program : B.Tech.,
A.Y : 2022 – 23

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)**

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 [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**
1.	Architecture	1	27-12-2022			
2.	Pin diagram	1	28-12-2022			
3.	Register organization	1	29-12-2022			
4.	Minimum mode and Maximum mode, timing diagrams	1	30-12-2022			
5.	Addressing modes	1	03-01-2023			
6.	Instruction set	1	04-01-2023			
7.	Interrupt vector table	1	05-01-2023			
8.	Assembly language programming - data transfer, arithmetic operations	1	06-01-2023			
9.	Assembly language programming - logical and decision making operations	1	10-01-2023			
10.	**Tutorial,/Assignment**	1	11-01-2023			

UNIT- II: 8051 MICROCONTROLLER [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**
11.	Architecture	1	18-01-2023			
12.	Input/output Ports	1	19-01-2023			
13.	Registers, Counter and Timers	1	20-01-2023			
14.	Serial port, Interrupts	1	24-01-2023			
15.	Addressing modes	1	25-01-2023			
16.	Instruction set	1	27-01-2023			
17.	Programming - data transfer, arithmetic operations	1	31-01-2023			
18.	Programming - logical and decision making operations	1	01-02-2023			
19.	**Tutorial,/Assignment**	1	02-02-2023			

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [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**
20.	History & Architecture	1	03-02-2023			
21.	ARM design philosophy	1	07-02-2023			
22.	Registers, Program status register	1	08-02-2023			
23.	Instruction pipeline, Interrupts and vector table	1	09-02-2023			
24.	ARM processor families	1	**10-02-2023**			
25.	Instruction set: Data processing instructions	1	28-02-2023			
26.	Addressing modes	1	01-03-2023			
27.	Branch, Load-Store instructions	1	02-03-2023			
28.	PSR instructions, and Conditional instructions	1	03-03-2023			
29.	**Tutorial,/Assignment**	1	07-03-2023			

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**
30.	Assembly programming,	1	08-03-2023			
31.	General structure of assembly language,	1	09-03-2023			
32.	Writing programs,	1	10-03-2023			
33.	Branch instructions	1	14-03-2023			
34.	Loading constrains	1	15-03-2023			
35.	load and store instructions	1	16-03-2023			
36.	Read only and read/write Memory	1	17-03-2023			
37.	Multiple Register Load and Store	1	21-03-2023			
38.	**Tutorial,/Assignment**	1	22-03-2023			

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**
39.	Interfacing - A/D converter	1	23-03-2023			
40.	Interfacing - D/A converter	1	24-03-2023			
41.	Interfacing - LEDs & Switches	1	28-03-2023			
42.	Interfacing – Relays & LCD	1	29-03-2023			
43.	Interfacing - Stepper Motors	1	30-03-2023			
44.	Interfacing - Real Time Clock	1	31-03-2023			
45.	Interfacing - Serial Communication	1	04-04-2023			
46.	Interfacing - GSM and GPS	1	05-04-2023			
47.	**Tutorial,/Assignment**	1	06-04-2023			

BEYOND THE SYLLABUS & REVISION [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**
48.	**MSP430** Instruction Set	1	11-04-2023			
49.	**MSP430** Digital in-outs	1	13-04-2023			
50.	**MSP430** Timer, Communication	1	14-04-2023			

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**

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 : 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 : 2022-23

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	PO1 0	PO1 1	PO1 2	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	26.12.2022			
2.	Oxidation, epitaxy	1	27.12.2022			
3.	Lithography, ion implantation	1	28.12.2022			
4.	Diffusion, ,silicon gate process	1	28.12.2022			
5.	NMOS and CMOS fabrication	1	29.12.2022			
6.	BiCMOS technology	1	02.01.2023			
7.	Comparison between CMOS and bipolar technologies	1	03.01.2023			
8.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	04.01.2023			
9.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	04.01.2023			
10.	Ids –Vds relationships	1	05.01.2023			
11.	MOS transistor threshold Voltage	1	09.01.2023			
12.	MOS transistor gm, gds	1	10.01.2023			
13.	Pass transistor	1	11.01.2023			
14.	NMOS Inverter	1	11.01.2023			
15.	Various pull up	1	12.01.2023			
16.	CMOS Inverter analysis and design	1	18.01.2023			
17.	BiCMOS Inverters	1	18.01.2023			
18.	Assignment	1	19.01.2023			
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
19.	VLSI Circuit Design Processes: VLSI design flow	1	23.01.2023			
20.	MOS Layers	1	24.01.2023			
21.	Stick Diagrams	1	25.01.2023			
22.	Design Rules and Layout, 5µm CMOS	1	25.01.2023			
23.	Design rules for wires	1	30.01.2023			
24.	Design rules for Contacts	1	31.01.2023			
25.	Design rules for Transistor	1	01.02.2023			
26.	Layout Diagrams for NMOS, CMOS Inverters and Gates,	1	01.02.2023			
27.	Scaling of MOS circuits	1	02.02.2023			
28.	Limitations of Scaling	1	06.02.2023			
29.	Basic Circuit Concepts: Sheet Resistance	1	07.02.2023			
30.	Area Capacitance calculations	1	08.02.2023			
31.	Inverter Delays	1	08.02.2023			
32.	Assignment	1	09.02.2023			
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
33.	Digital IC Building Blocks: Logic gates: combinational logic functions	1	13.02.2023			
34.	Static complementary gates	1	14.02.2023			

35.	Switch logic	1	15.02.2023			
36.	Standard cell based layout	1	15.02.2023			
37.	Logic and interconnect design	1	16.02.2023			
38.	power optimization	1	27.02.2023			
39.	Realization of Latches and Flip-Flops using switch logic	1	28.03.2023			
40.	Sub system design flow	1	01.03.2023			
41.	4x4 array multiplier	1	01.03.2023			
42.	Design of 4bit ALU using adder	1	02.03.2023			
43.	Synchronous up/down counters	1	06.03.2023			
44.	Registers	1	07.03.2023			
45.	Assignment	1	08.03.2023			
No. of classes required to complete UNIT-III		13	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
46.	Introduction	1	08.03.2023			
47.	Analog IC Building Blocks: MOS Diode/Active resistor	1	09.03.2023			
48.	Simple current sinks	1	13.03.2023			
49.	Basic current mirrors	1	14.03.2023			
50.	Advanced current mirrors	1	15.03.2023			
51.	Current and Voltage references	1	15.03.2023			
52.	Band-gap references	1	16.03.2023			
53.	Op-Amp, One Stage OP-Amp.	1	20.03.2023			
54.	Two Stage OP-Amp	1	21.03.2023			
55.	Gain boosting	1	22.03.2023			
56.	Common Mode Feedback	1	22.03.2023			

57.	Noise in Op Amps	1	23.03.2023			
58.	Assignment	1	27.03.2023			
No. of classes required to complete UNIT-IV		13		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
59.	Introduction	1	27.03.2023			
60.	Test and Testability : System Partitioning	2	29.03.2023			
61.	Layout and Testability	1	29.03.2023			
62.	Reset/Initialization	1	30.03.2023			
63.	Design for Testability (DFT)	1	03.04.2023			
64.	Design for Testability (DFT)	2	05.04.2023			
65.	Testing Combinational Logic	1	05.04.2023			
66.	Testing Sequential Logic	1	06.04.2023			
67.	Practical Design for Test Guidelines	1	10.04.2023			
68.	Scan Design Techniques	2	12.04.2023			
69.	Built-In-Self-Test (BIST)	2	17.04.2023			
70.	Future Trends	1	18.04.2023			
71.	Assignment	1	19.04.2023			
72.	Revision	2	20.04.2023			
No. of classes required to complete UNIT-V:		19		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
73.	Low power vlsi introduction	1	20.04.2023			

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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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 : 2022 – 23

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	26-12-2022			
2.	Advantages and Applications of Microwaves	1	28-12-2022			
3.	Rectangular Waveguides: Impossibility of TEM waves in waveguides	1	30-12-2022			
4.	Transverse Magnetic and Transverse Electric Waves in Rectangular Waveguides	1	31-12-2022			
5.	Field Expressions, characteristics of TE and TM Waves-Cutoff frequency	1	02-01-2023			
6.	Dominant mode in Rectangular Waveguides, phase velocity, group velocity	1	04-01-2023			
7.	relation between cutoff, guided and free space wavelengths	1	06-01-2023			
8.	Wave impedances for TE and TM cases.	1	07-01-2023			
9.	Circular Waveguides: TM and TE waves in circular guides	1	09-01-2023			
10.	Field Expressions, Dominant mode in circular waveguide.	1	11-01-2023			
11.	**Tutorial,/Assignment**	1	18-01-2023			

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	18-01-2023			
13.	Circular cavity resonators	1	19-01-2023			
14.	Field Expressions, Re-entrant Cavities	1	20-01-2023			
15.	Microwave Tubes: Limitations of conventional tubes at microwave frequencies	1	24-01-2023			
16.	Klystron Tubes: Two Cavity Klystrons – Structure	1	25-01-2023			
17.	Microwave tubes – O type and M type classifications	1	27-01-2023			
18.	Velocity Modulation Process and Applegate Diagram,	1	31-01-2023			
19.	Reflex Klystrons – Structure, Applegate Diagram and Principle of working,	1	01-02-2023			

20.	Power Output, Efficiency, output Characteristics	1	03-02-2023			
21.	**Tutorial,/Assignment**	1	04-02-2023			

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	06-02-2023			
23.	Structure of TWT	1	08-02-2023			
24.	Amplification Process in TWT	1	10-02-2023			
25.	M-Type Tubes: Cross-field effects	1	11-02-2023			
26.	Magnetrons – Different Types	1	13-02-2023			
27.	8-Cavity Cylindrical Travelling Wave Magnetron	1	15-02-2023			
28.	Hull Cut-off and Hartee Conditions	1	17-02-2023			
29.	PI-Mode Operation in Magnetrons	1	27-02-2023			
30.	Strapping in Magnetrons	1	01-03-2023			
31.	**Tutorial,/Assignment**	1	03-03-2023			

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	04-03-2023			
33.	Classification, Applications	1	06-03-2023			
34.	Transferred Electron Devices: Gunn Diode Principle,	1	10-03-2023			
35.	Two Valley Model Theory	1	11-03-2023			
36.	RWH Theory, Characteristics.	1	13-03-2023			
37.	Avalanche Transit Time Devices: IMPATT diode Principle of Operation and Characteristics,	1	15-03-2023			
38.	TRAPATT Diodes Principle of Operation and Characteristics,	1	17-03-2023			
39.	IMPATT, TRAPATT Diodes expressions	1	18-03-2023			
40.	**Tutorial,/Assignment**	1	20-03-2023			

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	24-03-2023			
42.	Formulation and Properties. S Matrix	1	24-03-2023			
43.	Calculations for E plane and H plane Tees	1	25-03-2023			
44.	Calculations for Magic Tee, Directional Coupler	1	27-03-2023			
45.	Fundamentals of branch line, rat-race couplers	1	29-03-2023			
46.	microwave filters. Ferrites– Composition and Characteristics,	1	31-03-2023			
47.	Faraday Rotation; Ferrite Components – Gyrator	1	01-04-2023			
48.	Isolator, Circulator. Microwave attenuators.	1	03-04-2023			
49.	Isolator, Circulator. Microwave attenuators.	1	10-04-2023			
50.	**Microwave Measurements:** Description of Microwave Bench setup ,precautions		12-04-2023			
51.	Measurement of Attenuation, Frequency, VSWR		15-04-2023			
52.	Measurement of Impedance, Power.					
53.	**Tutorial,/Assignment**	1	17-04-2023			

BEYOND THE SYLLABUS & REVISION [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**
54.	Microwave devices in RADAR communication	1	17-04-2023			
55.	RF Microwave Passive Devices	1	19-04-2023			
56.	Microwave devices in sattelite communication	1	21-04-2023			

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (ECE, EEE, CSE, IT & MECH) Under Tier-I
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 : Mr. M K Linga Murthy

Course Name & Code : Image Processing – 20EC18

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

Program/Sem/Sec : B.Tech., ECE., VI-Sem., Section- A A.Y : 2022-23

PRE-REQUISITE: Signals and Systems, Digital Signal Processing.

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

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

CO1	Interpret the fundamental concepts of fundamentals of Digital Image Processing. **(L2)**
CO2	Apply the concepts of masking and filtering for image enhancement. **(L3)**
CO3	Summarize the image segmentation methodologies. **(L2)**
CO4	Understand the underlying concepts of image restoration and compression techniques. **(L2)**

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

T1 R. C. Gonzalez and R. E. Woods, "*Digital Image Processing*", PHI. Pvt Ltd, 2nd Edition, 2005.

T2 Anil K Jain, "*Fundamentals of Digital Image Processing*", PHI Publications.

REFERENCE BOOKS:

R1 S.Jayaraman, E.Esakkirajan, T.Veerakumar, "*Digital Image Processing*", TMH edition, 2011.

R2 S Sridhar, " *Digital Image Processing*", Oxford University Press, 2011.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to the course, Course Objective and Course outcomes	1	26.12.2022			
2.	Introduction to Digital Image	1	27.12.2022			
3.	Image Representation – Examples	1	29.12.2022			
4.	Fundamental steps in image processing	1	30.12.2022			
5.	Components of an Image processing	1	02.01.2023			
6.	Applications of Image Processing	1	03.01.2023			
7.	Image Sampling and Quantization Process	1	05.01.2023			
8.	Spatial Resolution, Intensity Resolution.	1	06.01.2023			
9.	Relationships between Pixels, Adjacency, Connectivity, Regions, Boundaries & Distance measures	1	09.01.2023			
10.	Introduction to Image Transforms - 2D-DFT, Properties, Problems	1	10.01.2023			
11.	2D – DCT Concept, Properties, Problems	1	12.01.2023			
12.	Solving Problems	1	19.01.2023			
No. of classes required to complete UNIT-I		**12**	No. of classes taken			

UNIT-II: Image Enhancement in Spatial and Frequency Domain

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 Image Enhancement, Point Processing	1	20.01.2023			
2.	Intensity Transformation functions	1	23.01.2023			
3.	Intensity Transformation functions	1	24.01.2023			
4.	Histogram Processing, Histogram Equalization – Example	1	27.01.2023			
5.	Solving Problems	1	30.01.2023			
6.	Smoothing spatial filters – Linear and order statistic filters	1	31.01.2023			
7.	Sharpening spatial filters - Gradient and Laplacian	1	02.02.2023			
8.	Introduction to Filtering in frequency domain , Image smoothing in frequency domain	1	03.02.2023			
9.	Image sharpening in frequency domain , Laplacian in the frequency domain	1	06.02.2023			
10.	Examples	1	07.02.2023			
No. of classes required to complete UNIT-I		**10**	No. of classes taken			

UNIT-III: Image Segmentation

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 Image Segmentation	1	09.02.2023			
2.	Detection of discontinuities	1	10.02.2023			
3.	Detection of discontinuities	1	13.02.2023			
4.	Edge Lining and Boundary detection – Local Processing	1	14.06.2023			
5.	Global Processing – Hough Transform	1	16.02.2023			
6.	**Global Processing via Graph theoretic techniques**	**1**	**17.02.2023**			
7.	Thresholding – Basic Global Thresholding	1	27.02.2023			
8.	OTSU method	1	28.02.2023			
9.	Region Growing	1	02.03.2023			
10.	Region splitting & merging	1	03.03.2023			
11.	Application Oriented Examples	1	06.03.2023			
12.	Examples	1	09.03.2023			
No. of classes required to complete UNIT-III			**12**	No. of classes taken		

UNIT-IV: Image Restoration and Image Compression

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, Image restoration & degradation model	1	10.03.2023			
2.	Noise Models	1	13.03.2023			
3.	Restoration in the presence of noise using spatial filtering – Mean filters	1	14.03.2023			
4.	Order statistics filters. Adaptive filters	1	16.03.2023			
5.	Inverse Filtering, MMSE filtering	1	17.03.2023			
6.	Introduction to Image compression Coding, Inter pixel Redundancy	1	20.03.2023			
7.	Psychovisual Redundancy and Fidelity Criteria	1	21.03.2023			
8.	Image compression model & Error free compression methods - Huffman coding	1	23.03.2023			
9.	Problems solving	1	24.03.2023			
10.	Loss less predictive coding	1	27.03.2023			
11.	Lossy compression – Lossy Predictive coding, Transform coding	1	28.03.2023			
12.	JPEG compression mrethod	1	31.03.2023			
No. of classes required to complete UNIT-IV			**12**	No. of classes taken		

UNIT-V: Color Image Processing & Morphological Image Processing

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.	Color fundamentals	1	03.04.2023			
2.	Color Models – RGB	1	04.04.2023			
3.	Color Models – CMY and CMYK	1	06.04.2023			
4.	Color Models – HIS, Conversions	1	10.04.2023			
5.	Introduction to morphological image processing	1	11.04.2023			
6.	Dilation and Erosion	1	13.04.2023			
7.	Opening and Closing	1	14.04.2023			
8.	Application oriented Examples	1	17.04.2023			
No. of classes required to complete UNIT-V		**08**	No. of classes taken			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to video processing	1	18.04.2023			
2.	Image Classification based on AI & ML	1	20.04.2023			
3.	Practical Applications	1	21.04.2023			

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	26.12.2022	18.02.2023	8 W
I Mid Examinations	20.02.2023	25.02.2023	1 W
II Phase of Instructions	27.02.2023	22.04.2023	8 W
II Mid Examinations	24.04.2023	29.04.2022	1 W
Preparation and Practical's	01.05.2023	06.05.2023	1 W
Semester End Examinations	08.05.2023	20.05.2023	2 W
Internship	22.05.2023	01.07.2023	6 W

PART-C

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Mr. M K Linga Murthy	Mr. M K Linga Murthy	Dr. G L N Murthy	Dr. Y. Amar Babu

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : B.Tech. - VI-Sem. - ECE – A Section
ACADEMIC YEAR : 2022-23
COURSE NAME & CODE : Operations Research Techniques – 20ME83
L-T-P STRUCTURE : 4-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : V.Sankara Rao, Sr.Assistant Professor
COURSE COORDINATOR : V.Sankara Rao, Sr.Assistant Professor
PER-REQUISITE : NIL

COURSE EDUCATIONAL OBJECTIVES:

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:

After completion 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 the 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	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	

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 Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand& Sons, Educational Publications, New Delhi, 14th Edition, 2008.

T2 Operations Research Theory and Applications, 6th Edition, J K Sharma.

BOS APPROVED REFERENCE BOOKS:

R1 Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition, 2009.

R2 A.M.Natarajan, P.Balasubramani, A. Tamilarasi, OperationsResearch, Pearson Education, 2nd edition, 2014.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION to OR, LINEAR PROGRAMMING PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**INTRODUCTION**: Introduction To Operations Research	1	27-12-22		**TLM1**	CO1	**T1**	
2.	Operations Research Models, Applications	1	29-12-22		**TLM1**	CO1	**T1**	
3.	**Linear Programming Problem (LPP)**: Formulation	1	30-12-22		**TLM1**	CO1	**T1**	
4.	Numericals	1	31-12-22		**TLM1**	CO1	**T1**	
5.	**Tutorial I, Quiz I**	1	03-01-23		**TLM3**	CO1	**T1**	
6.	Lpp: Graphical Method, Numericals	1	05-01-23		**TLM1**	CO1	**T1**	
7.	Graphical Solution For Special Cases Of LPP	1	06-01-23		**TLM1**	CO1	**T1**	
8.	Simplex Method, Numericals	1	07-01-23		**TLM1**	CO1	**T1**	
9.	Numericals	1	10-01-23		**TLM1**		**T1**	
10.	Big M Method (Artificial Variable Technique)	1	12-01-23		**TLM1**	CO1	**T1**	
11.	Numericals	1	19-01-23		**TLM1**	CO1	**T1**	
12.	Two Phase Simplex Method (Artificial Variable Technique)	1	20-01-23		**TLM1**	CO1	**T1**	
13.	**Tutorial II, Quiz II**	1	21-01-23		**TLM3**	CO1	**T1**	
14.	Numericals	1	24-01-23		**TLM1**	CO1	**T1, T2**	
15.	Duality Principle	1	27-01-23		**TLM1**	CO1	**T1**	
16.	Numericals	1	28-01-23		**TLM1**	CO1	**T1**	
17.	**Tutorial III, Quiz III**	1	31-01-23		**TLM3**	CO1	**T1, T2**	
No. of classes required to complete UNIT-I		17			No. of classes taken:			

UNIT-II: TRANSPORTATION PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
18.	Introduction To TP, Terminology, Formulation	1	02-02-23		**TLM1**	CO2	**T2**	
19.	Standard Form, Unbalanced TP, Numericals	1	03-02-23		**TLM1**	CO2	**T2**	
20.	Ibfs: NWCM,LCM,VAM Numericals	1	04-02-23		**TLM1**	CO2	**T2**	
21.	**Tutorial Iv, Quiz Iv**	1	07-02-23		**TLM3**	CO2	**T2**	
22.	Test For Optimality: Stepping Stone Method, Modified Distribution Method (MODI Method)	1	09-02-23		**TLM1**	CO2	**T2**	
23.	Numerical	1	10-02-23		**TLM1**	CO2	**T1, T2**	
24.	Degeneracy In TP, Numericals	1	11-02-23		**TLM1**	CO2	**T1, T2**	

25.	**ASSIGNMENT PROBLEM (AP)**:Introduction To AP, Terminology; **Tutorial V, Quiz V**	1	14-02-23		**TLM3**	CO2	**T2**	
26.	Variants Of Assignment Problems	1	16-02-23		**TLM1**	CO2	**T2**	
27.	Optimal Solution, Numericals	1	17-02-23		**TLM1**	CO2	**T2**	
28.	Travelling Salesmen Problem, Numericals	1	28-02-23		**TLM1**	CO2	**T2**	
No. of classes required to complete UNIT-II		11			No. of classes taken:			

UNIT-III: THEORY OF GAMES AND JOB SEQUENCING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	**Introduction to Games Theory**: Terminology	1	02-03-23		**TLM1**	CO3	**T2,R1**	
30.	Minimax or Maxmini Criterion,Optimal Strategy	1	03-03-23		**TLM1**	CO3	**T2,R1**	
31.	Solution of games with saddle point	1	04-03-23		**TLM1**	CO3	**T2,R1**	
32.	**Tutorial VI, Quiz VI**	1	07-03-23		**TLM3**	CO3	**T2,R1**	
33.	Rectangular games without saddle point, Numericals	1	09-03-23		**TLM1**	CO3	**T2,R1**	
34.	mx2, 2xn, mxn games, Dominance Principle, Numericals	1	10-03-23		**TLM1**	CO3	**T2,R1**	
35.	Graphical approach, Numericals	1	11-03-23		**TLM1**	CO3	**T2,R1**	
36.	Job Sequencing.n jobs through 2 machines,	1	14-03-23		**TLM1**	CO3	**T2**	
37.	n jobs through 3 machines,	1	16-03-23		**TLM1**	CO3	**T1, T2**	
38.	2 jobs through m machines-graphical model	1	17-03-23		**TLM3**	CO3	**T2**	
39.	**Tutorial VII, Quiz VII**	1	18-03-23		**TLM1**	CO3	**T2**	
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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
40.	**THEORY OF REPLACEMENT:** Introduction, Replacement of Equipment that Deteriorates Gradually, Numericals	1	21-03-23		**TLM1**	CO4	**T1, T2**	
41.	Replacement of Equipment that fails suddenly, Numericals	1	23-03-23		**TLM1**	CO4	**T1, T2**	
42.	Group Replacement Policy, Numericals	1	24-03-23		**TLM1**	CO4	**T1, T2**	
43.	**Tutorial VIII, Quiz VIII**	1	25-03-23		**TLM3**	CO4	**T1, T2**	
44.	**Introduction to Queuing Theory**	1	28-03-23		**TLM1**	CO4	**T1, T2**	
45.	Single Channel – Poisson	1	31-03-23		**TLM1**	CO4	**T1, T2**	

	arrivals – exponential service times – with infinite population, Derivation, Numericals							
46.	Numericals	1	01-04-23					
47.	Single Channel – Poisson arrivals – exponential service times – with finite population, Numericals	1	04-04-23		**TLM1**	CO4	**T1, T2**	
48.	**Tutorial IX, Quiz IX**	1	06-04-23		**TLM3**	CO4	**T1, T2**	
No. of classes required to complete UNIT-IV		09			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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
49.	**INVENTORY MODELS**-terminology, EOQ	1	08-04-23		**TLM1**	CO5	**T1, T2,R2**	
50.	Instantaneous Production, finite, continuous demand	1	11-04-23		**TLM1**	CO5	**T1, T2,R2**	
51.	Shortages not Allowed	1	11-04-23		**TLM1**	CO5	**T1, T2,R2**	
52.	Purchase inventory models with one price break	1	13-04-23		**TLM1**	CO5	**T1, T2,R2**	
53.	Purchase inventory models with multiple price breaks	1	13-04-23		**TLM1**	CO5	**T1, T2**	
54.	**Tutorial X, Quiz X**	1	15-04-23		**TLM1**	CO5	**T1, T2**	
55.	**DYNAMIC PROGRAMMING (DP):** Introduction To DP	1	18-04-23		**TLM1**	CO5	**T1, T2**	
56.	Bellman's Principle of Optimality, Applications of Dynamic Programming	1	18-04-23		**TLM1**	CO5	**T1, T2**	
57.	Capital Budgeting Problem, Numericals	1	20-04-23		**TLM1**	CO5	**T1, T2**	
58.	linear programming problem	1	21-04-23		**TLM1**	CO5	**T1, T2**	
59.	Shortest path problems	1	21-04-23		**TLM3**			
No. of classes required to complete UNIT-V		11			No. of classes taken:			

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:

Description	From	To	Weeks
I Phase of Instructions-1	26-12-2022	18-02-2023	8W
I Mid Examinations	20-02-2023	25-02-2023	1W
II Phase of Instructions	27-02-2023	22-04-2023	8W
II Mid Examinations	24-04-2023	29-04-2023	1W
Preparation and Practicals	01-05-2023	06-05-2023	2W
Semester End Examinations	08-05-2023	20-05-2023	2W

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment 1	1	A1=5
Assignment 2	2	A2=5
I-Mid Examination	1,2,3	B1=15
Quiz – 1	1,2,3	Q1=10
Assignment 3	3	A3=5
Assignment 4	4	A4=5
Assignment 5	5	A5=5
II-Mid Examination	3,4,5	B2=15
Quiz – 2	3,4,5	Q2=10
Evaluation of Assignment: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=15
Evaluation of Quiz Marks: Q=75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	1,2,3,4,5	Q=10
Cumulative Internal Examination: A+B+Q	**1,2,3,4,5**	**CIE=30**
Semester End Examinations	**1,2,3,4,5**	**SEE=70**
Total Marks: CIE+SEE	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.

PEO2: To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.

PEO3: To develop inquisitiveness towards good communication and lifelong learning.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

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.

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.

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.

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.

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.

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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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.

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.

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.

PSOs

1. To apply the principles of thermal sciences to design and develop various thermal systems.

2. To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.

3. To apply the basic principles of mechanical engineering design or evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Mr.V.Sankararao	Mr.V.Sankararao	Dr.M.B.S.Sreekara Reddy	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HoD

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PART-A

Program : B.Tech., VI-Sem., ECE-A Section

Academic Year :2022-23

Course Name & Code :Microprocessor & Microcontrollers Lab - 20EC59

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

Course Credits :1.5

Course Instructor : Mr. Sasi Bhushan. K / Mrs. K. Bala Vani
Mr. M. Samba Siva Reddy / Mr. N. Dharmachari

Course Coordinator :Mr.K.Sasi Bhushan

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.

CourseOutcomes: At theend ofthe course,studentwill beableto:

CO1	DemonstratetheMASM/TASMtoolfordevelopingAssemblyLanguagePrograms.
CO2	ApplytheAssemblyLanguageinstructionsofProcessorandControllerforlogicaloperations.
CO3	DeveloptheARMbasedinterfacingsystemsforRealtimeapplications.
CO4	Adapteffectivecommunication,presentationandreportwritingskills.

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

PART-B

Lab Schedule(Lesson Plan):Section-B

List of Experiments (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.	IntroductiontoLab	3	30-12-2022		**TLM2**	
2.	Display, comparison and reverse thestring	3	06-01-2023		**TLM8**	
3.	Factorial usingProcedures	3	10-01-2023		**TLM8**	
4.	Sortingthesigned andunsignednumbers	3	27-01-2023		**TLM8**	
5.	Checking the given string forPalindrome	3	31-01-2023		**TLM8**	
6.	Arithmetic operations like Addition,Subtraction,Multiplicationan dDivision	3	10-02-2023		**TLM8**	
7.	Byte checkingbyusing8051	3	10-02-2023		**TLM8**	
8.	Additionofseriesofnumbers	3	17-02-2023		**TLM8**	
9.	Checking the given numbers forOddor Even	3	17-02-2023		**TLM8**	
	CYCLE-2					
10.	Interfacing of A/D and D/Aconverter	3	03-03-2023		**TLM8**	
11.	InterfacingofLEDsandSwitches	3	10-03-2023		**TLM8**	
12.	Interfacingof LCD	3	17-03-2023		**TLM8**	
13.	InterfacingofStepperMotors	3	24-03-2023		**TLM8**	
14.	InterfacingoftrafficLightcontroller	3	31-03-2023		**TLM8**	
15.	InterfacingofRealTime Clock	3	07-04-2023		**TLM8**	
16.	Dataloggers –Rolloverdisplay	3	14-04-2023		**TLM8**	
17.	Internal Lab Exam	3	21-04-2023		**TLM8**	
No.ofclassesrequiredtocomplete:		51	No.ofclassesconducted:			

PART-C

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

Academic Calendar:

AcademicCalendar:B.Tech.,VI-Sem.,2022-23			
Description	**From**	**To**	**Weeks**
CommencementofClasswork:26.12.2022			
IPhaseofInstructions	26-12-2022	18-02-2023	8W
IMIDExaminations	20-02-2023	25-02-2023	1W
IIPhaseofInstructions	27-02-2023	22-04-2023	8W
IIMIDExaminations	24-04-2023	29-04-2023	1W
PreparationandPracticals	01-05-2023	06-05-2023	1W
SemesterEndExaminations	08-05-2023	20-05-2023	2W

Evaluation Process:

EvaluationTask	**COs**	**Marks**
DaytoDaywork	1,2,3,4	A1=10
InternalLab Examination	1,2,3,4	B=5
TotalInternalMarks(A+B)		**C=15**
SemesterEndExaminations	1,2,3,4	**D=35**
TotalMarks: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	**Moderntoolusage**:Create,select,andapplyappropriatetechniques,resources,andmodern engineeringandITtoolsincludingpredictionandmodellingtocomplexengineeringactivitieswithanunderstandingofthe limitations
PO 6	**Theengineerandsociety**:Applyreasoninginformedbythecontextualknowledgetoassess societal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttotheprofessional engineeringpractice
PO 7	**Environmentandsustainability**:Understandtheimpactoftheprofessionalengineering solutionsinsocietalandenvironmentalcontexts,anddemonstratetheknowledgeof,andneedforsustainable development.
PO 8	**Ethic**s:Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnormsof theengineeringpractice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader indiverseteams,andinmultidisciplinarysettings.
PO 10	**Communication**:Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehendandwrite effectivereportsanddesigndocumentation,makeeffectivepresentations,andgiveandreceiveclearinstructions.
PO 11	**Projectmanagementandfinance**:Demonstrateknowledgeandunderstandingofthe engineering and managementprinciplesand apply these to one's own work,as a memberandleaderinateam, tomanageprojectsandin multidisciplinaryenvironments.
PO 12	**Life- longlearning**: Recognizetheneedfor,andhavethepreparationandabilitytoengageinindependentandlife-longlearninginthebroadestcontextoftechnologicalchange.

Programme Specific Outcomes(PSOs):

PSO 1	**Communication:**Designanddevelopmoderncommunicationtechnologiesforbuildingtheinterdisciplinaryskillstomeet currentandfutureneedsofindustry.
PSO 2	**VLSIandEmbeddedSystems:**Designand AnalyzeAnalogandDigitalElectronicCircuitsor systemsandImplementrealtimeapplicationsinthefieldofVLSIandEmbeddedSystemsusingrelevant tools
PSO 3	**SignalProcessing:**ApplytheSignalprocessingtechniquestosynthesizeandrealizetheissuesrelatedtoreal timeapplications

CourseInstructor	CourseCoordinator	ModuleCoordinator	HOD
(Mr. Sasi Bhushan. K)	(Mr.K.SasiBhushan)	(Dr.P.LachiReddy)	(Dr.Y.AmarBabu)

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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 : 2022-23

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):

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	29.12.2022			
Cycle – I							
1	Experiment – 1	CO1	3	05.01.2023			
2	Experiment – 2	CO1	3	12.01.2023			
3	Experiment – 3	CO1	3	19.01.2023			
4	Experiment – 4	CO2,CO3	3	02.01.2023			
5	Experiment – 5	CO2,CO3	3	09.02.2023			
6	Experiment – 6	CO2,CO3	3	16.02.2023			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	02.03.2023			
8	Experiment – 8	CO2,CO3	3	09.03.2023			
9	Experiment – 9	CO2,CO3	3	16.03.2023			
10	Experiment – 10	CO2,CO3	3	23.03.2023			
11	Experiment – 11	CO2,CO3	3	06.04.2023			
12	Experiment beyond syllabus	CO2,CO3	3	13.03.2023			
13	Internal Examination	--	3	20.04.2023			

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	26.12.2022			
Cycle – I							
1	Experiment – 1	CO1	3	02.01.2023			
2	Experiment – 2	CO1	3	09.01.2023			
3	Experiment – 3	CO1	3	23.01.2023			
4	Experiment – 4	CO2,CO3	3	30.01.2023			
5	Experiment – 5	CO2,CO3	3	06.02.2023			
6	Experiment – 6	CO2,CO3	3	13.02.2023			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	27.02.2023			
8	Experiment – 8	CO2,CO3	3	06.03.2023			
9	Experiment – 9	CO2,CO3	3	13.03.2023			
10	Experiment – 10	CO2,CO3	3	20.03.2023			
11	Experiment – 11	CO2,CO3	3	27.03.2023			
12	Experiment beyond syllabus	CO2,CO3	3	03.04.2023			
--	Revision		3	10.04.2023			
	Internal Examination	--	3	17.04.2023			

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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COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Microwave Engineering Lab– 20EC61

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Mrs.K.RANI RUDRAMA / Dr. Y.V.N.R. SWAMY

COURSE COORDINATOR : Mrs.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	26.12.2022		-	TLM1	
2	Experiment-1	3	02.01.2023		COs 1,3,4	TLM4	
3	Experiment-2	3	09.01.2023		COs 1,3,4	TLM4	
4	Experiment -3	3	23.01.2023		COs1,3,4	TLM4	
5	Experiment-4	3	30.01.2023		COs 1,3,4	TLM4	
6	Experiment-9	3	06.02.2023		COs 2,4	TLM4	
7	Experiment-10	3	13.02.2023		COs2,4	TLM4	
8	Experiment-5	3	27.02.2023		COs1,3,4	TLM4	
9	Experiment-6	3	06.03.2023		COs 1,3,4	TLM4	
10	Experiment-7	3	13.03.2023		COs 1,3,,4	TLM4	
11	Experiment-8	3	20.03.2023		COs 1,3,4	TLM4	
12	Experiment-11	3	27.03.2023		COs 2,4	TLM4	
13	Experiment-12	3	03.04.2023		COs 2,4	TLM4	
14	Revision	3	10.04.2023				
15	Internal exam	3	17.04.2023				

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	29.12.2022		COs 1,4	TLM1	
2.	Experiments-1	3	05.01.2023		COs 1,4	TLM4	
3.	Experiment-2	3	19.01.2023		COs 1,4	TLM4	
4.	Experiment-3,4	3	02.02.2023		COs 3,4	TLM4	
5.	Experiment-9	3	09.02.2023		COs2,4	TLM4	
6.	Experiment-10	3	16.02.2023		COs 2,4	TLM4	
7.	Experiment-5	3	02.03.2023		COs 2,4	TLM4	
8.	Experiment-6	3	09.03.2023		COs 1,3,4	TLM4	
9.	Experiment-7	3	16.03.2023		COs 1,3,4	TLM4	
10.	Experiment-8	3	23.03.2023		COs 1,3,4	TLM4	
11.	Experiment-11,12	3	06.04.2023		COs 2,4	TLM4	
12.	Revision		13.04.2023				
13.	Internal exam		20.04.2023				

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.
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.
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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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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

Name of Course Instructor : **Dr. Sujith Kumar Rath& Mr. B Sagar**
Course Name & Code : **Soft skills & soft skills Laboratory (20HSS1)**
L-T-P Structure : **0-0-1+2** **Credit : 2**
Program/Sem/Sec : **B.Tech.ECE-A , VI-Sem.,** **A.Y: 2022-23**

Course Description & Objectives:

The Soft Skills Laboratory course equips students with required behavioural, 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	**Infer** the self awareness and personality **(Understand – L2)**
CO2	Work effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.**(Apply – L3)**
CO3	Communicate through verbal/oral communication and improve the listening skills**(Apply – L3)**
CO4	**Relate** thecritical & lateral thinking while dealing with personal/social/professional issues. **(Apply – L3)**

Course Content:

Personality Development Skills

Role of language in Personality – How language reflects, impactsPersonality – Using gender-neutral language in MNCs – being culturally-sensitive-Personality Traits- Grooming & Dress code

Activities: Group Discussion/Role play/Presentations (authentic materials: News papers, pamphlets and news clippings)

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

ProfessionalSkills:

Career Planning- job vs. career- goal setting- SWOT analysis-Timemanagement – 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.

REFERENCEBOOKS:

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

ECE-A

S.No.	No. of Lecture Hours	Date	Planned Topics	Actual Date	HOD Sign Weekly
1	1	04-01-23	Role of language in personality		
2	2	04-01-23	Extempore		
3	1	11-01-23	How language reflects, impacts Personality		
4	2	11-01-23	Story Telling		
5	1	18-01-23	Using gender-neutral language in MNCs		
6	2	18-01-23	Case Studies		
7	1	25-01-23	Being culturally-sensitive-Personality Traits- Grooming & Dress code		
8	2	25-01-23	Using authentic materials: News papers, pamphlets and news clippings		
9	1	01-02-23	Career Planning		
10	2	01-02-23	Public Speaking		
11	1	08-02-23	Job vs. career- goal setting		
12	2	08-02-23	Critical Appreciation and Textual Analysis		
13	1	15-03-23	SWOT analysis		
14	2	15-03-23	Writing a review on a given short story/videos/book		
15	1	01-03-23	Time management		
16	2	01-03-23	Empathetic speaking		
17	1	15-03-23	Self-management		
18	2	15-03-23	Telephonic conversation		
19	1	29-03-23	Stress-management		
20	2	29-03-23	Situation based dialogues		
21	1	12-04-23	Effective Resume-Writing and presentation		
22	2	12-04-23	Listening to dialogues and analyzing		
23	1	19-04-23	Interview Skills		
24	2	19-04-23	Mock Interviews		

Signature of Faculty Signature of HOD

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Name & Code	:	Microprocessors and Microcontrollers – 20EC15
L-T-P Structure	:	3-0-0
Credits	:	3
Program	:	B.Tech.,
A.Y	:	2022 – 23
Course Instructor	:	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)**

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, B Section

UNIT-I: 8086 MICROPROCESSOR [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**
1.	Architecture	1	27-12-2022			
2.	Pin diagram	1	28-12-2022			
3.	Register organization	1	29-12-2022			
4.	Minimum mode and Maximum mode, timing diagrams	1	30-12-2022			
5.	Addressing modes	1	03-01-2023			
6.	Instruction set	1	04-01-2023			
7.	Interrupt vector table	1	05-01-2023			
8.	Assembly language programming - data transfer, arithmetic operations	1	06-01-2023			
9.	Assembly language programming - logical and decision making operations	1	10-01-2023			
10.	**Tutorial,/Assignment**	1	11-01-2023			

UNIT- II: 8051 MICROCONTROLLER [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**
11.	Architecture	1	18-01-2023			
12.	Input/output Ports	1	19-01-2023			
13.	Registers, Counter and Timers	1	20-01-2023			
14.	Serial port, Interrupts	1	24-01-2023			
15.	Addressing modes	1	25-01-2023			
16.	Instruction set	1	27-01-2023			
17.	Programming - data transfer, arithmetic operations	1	31-01-2023			
18.	Programming - logical and decision making operations	1	01-02-2023			
19.	**Tutorial,/Assignment**	1	02-02-2023			

UNIT – III: ARM ARCHITECTURE & PROGRAMMING MODEL [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**
20.	History & Architecture	1	03-02-2023			
21.	ARM design philosophy	1	07-02-2023			
22.	Registers, Program status register	1	08-02-2023			
23.	Instruction pipeline, Interrupts and vector table	1	09-02-2023			
24.	ARM processor families	1	**10-02-2023**			
25.	Instruction set: Data processing instructions	1	28-02-2023			
26.	Addressing modes	1	01-03-2023			
27.	Branch, Load-Store instructions	1	02-03-2023			
28.	PSR instructions, and Conditional instructions	1	03-03-2023			
29.	**Tutorial,/Assignment**	1	07-03-2023			

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**
30.	Assembly programming,	1	08-03-2023			
31.	General structure of assembly language,	1	09-03-2023			
32.	Writing programs,	1	10-03-2023			
33.	Branch instructions	1	14-03-2023			
34.	Loading constrains	1	15-03-2023			
35.	load and store instructions	1	16-03-2023			
36.	Read only and read/write Memory	1	17-03-2023			
37.	Multiple Register Load and Store	1	21-03-2023			
38.	**Tutorial,/Assignment**	1	22-03-2023			

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**
39.	Interfacing - A/D converter	1	23-03-2023			
40.	Interfacing - D/A converter	1	24-03-2023			
41.	Interfacing - LEDs & Switches	1	28-03-2023			
42.	Interfacing – Relays & LCD	1	29-03-2023			
43.	Interfacing - Stepper Motors	1	30-03-2023			
44.	Interfacing - Real Time Clock	1	31-03-2023			
45.	Interfacing - Serial Communication	1	04-04-2023			
46.	Interfacing - GSM and GPS	1	05-04-2023			
47.	**Tutorial,/Assignment**	1	06-04-2023			

BEYOND THE SYLLABUS & REVISION [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**
48.	**MSP430** Instruction Set	1	11-04-2023			
49.	**MSP430** Digital in-outs	1	13-04-2023			
50.	**MSP430** Timer, Communication	1	14-04-2023			

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**

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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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- B A.Y : 2022-23

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	PO1 0	PO1 1	PO1 2	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	26.12.2022			
2.	Oxidation, epitaxy	1	27.12.2022			
3.	Lithography, ion implantation	1	28.12.2022			
4.	Diffusion, ,silicon gate process	1	29.12.2022			
5.	NMOS and CMOS fabrication	1	31.12.2022			
6.	BiCMOS technology	1	02.01.2023			
7.	Comparison between CMOS and bipolar technologies	1	03.01.2023			
8.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	04.01.2023			
9.	Basic Electrical Properties of MOS and BiCMOS Circuits	1	05.01.2023			
10.	Ids –Vds relationships	1	07.01.2023			
11.	MOS transistor threshold Voltage	1	09.01.2023			
12.	MOS transistor gm, gds	1	10.01.2023			
13.	Pass transistor	1	11.01.2023			
14.	NMOS Inverter	1	12.01.2023			
15.	Various pull up	1	17.01.2023			
16.	CMOS Inverter analysis and design	1	18.01.2023			
17.	BiCMOS Inverters	1	19.01.2023			
18.	Assignment	1	21.01.2023			
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
19.	VLSI Circuit Design Processes: VLSI design flow	1	23.01.2023			
20.	MOS Layers	1	24.01.2023			
21.	Stick Diagrams	1	25.01.2023			
22.	Design Rules and Layout, 5µm CMOS	1	28.01.2023			
23.	Design rules for wires	1	30.01.2023			
24.	Design rules for Contacts	1	31.01.2023			
25.	Design rules for Transistor	1	01.02.2023			
26.	Layout Diagrams for NMOS, CMOS Inverters and Gates,	1	02.02.2023			
27.	Scaling of MOS circuits	1	04.02.2023			
28.	Limitations of Scaling	1	06.02.2023			
29.	Basic Circuit Concepts: Sheet Resistance	1	07.02.2023			
30.	Area Capacitance calculations	1	08.02.2023			
31.	Inverter Delays	1	09.02.2023			
32.	Assignment	1	11.02.2023			
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
33.	Digital IC Building Blocks: Logic gates: combinational logic functions	1	13.02.2023			

34.	Static complementary gates	1	14.02.2023			
35.	Switch logic	1	15.02.2023			
36.	Standard cell based layout	1	16.02.2023			
37.	Logic and interconnect design	1	27.02.2023			
38.	power optimization	1	28.02.2023			
39.	Realization of Latches and Flip-Flops using switch logic	1	01.03.2023			
40.	Sub system design flow	1	02.03.2023			
41.	4x4 array multiplier	1	04.03.2023			
42.	Design of 4bit ALU using adder	1	06.03.2023			
43.	Synchronous up/down counters	1	07.03.2023			
44.	Registers	1	09.03.2023			
45.	Assignment	1	11.03.2023			
No. of classes required to complete UNIT-III		13	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
46.	Introduction	1	13.03.2023			
47.	Analog IC Building Blocks: MOS Diode/Active resistor	1	14.03.2023			
48.	Simple current sinks	1	15.03.2023			
49.	Basic current mirrors	1	16.03.2023			
50.	Advanced current mirrors	1	18.03.2023			
51.	Current and Voltage references	1	20.03.2023			
52.	Band-gap references	1	21.03.2023			
53.	Op-Amp, One Stage OP-Amp.	1	23.03.2023			
54.	Two Stage OP-Amp	1	25.03.2023			
55.	Gain boosting	1	27.03.2023			

56.	Common Mode Feedback	1	28.03.2023			
57.	Noise in Op Amps	1	29.03.2023			
58.	Assignment	1	01.04.2023			
No. of classes required to complete UNIT-IV		13		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	03.04.2023			
48.	Test and Testability : System Partitioning	1	04.04.2023			
49.	Layout and Testability	1	06.04.2023			
50.	Reset/Initialization	1	08.04.2023			
51.	Design for Testability (DFT)	1	10.04.2023			
52.	Design for Testability (DFT)	1	11.04.2023			
53.	Testing Combinational Logic	1	12.04.2023			
54.	Testing Sequential Logic	1	13.04.2023			
55.	Practical Design for Test Guidelines	1	15.04.2023			
56.	Scan Design Techniques	1	17.04.2023			
57.	Built-In-Self-Test (BIST)	1	18.04.2023			
58.	Future Trends	1	19.04.2023			
59.	Assignment	1	20.04.2023			
No. of classes required to complete UNIT-V:		13		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 Low Power VLSI	1	20.04.2023			

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	**Project management and finance**: Demonstrate knowledge and understanding of the

11	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. V.Ravi Sekhara Reddy, Sr.Asst. 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 : 2022 – 23

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:[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	26-12-2022			
2.	Advantages and Applications of Microwaves	1	27-12-2022			
3.	Rectangular Waveguides: Impossibility of TEM waves in waveguides	1	28-12-2022			
4.	Transverse Magnetic and Transverse Electric Waves in Rectangular Waveguides	1	30-12-2022			
5.	Field Expressions, characteristics of TE and TM Waves-Cutoff frequency	1	02-01-2023			
6.	Dominant mode in Rectangular Waveguides, phase velocity, group velocity	1	03-01-2023			
7.	relation between cutoff, guided and free space wavelengths	1	04-01-2023			
8.	Wave impedances for TE and TM cases.	1	06-01-2023			
9.	Circular Waveguides: TM and TE waves in circular guides	1	09-01-2023			
10.	Field Expressions, Dominant mode in circular waveguide.	1	10-01-2023			
11.	**Tutorial,/Assignment**	1	11-01-2023			

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	18-01-2023			
13.	Circular cavity resonators	1	20-01-2023			
14.	Field Expressions, Re-entrant Cavities	1	23-01-2023			
15.	Microwave Tubes: Limitations of conventional tubes at microwave frequencies	1	24-01-2023			
16.	Klystron Tubes: Two Cavity Klystrons – Structure	1	25-01-2023			
17.	Microwave tubes – O type and M type classifications	1	27-01-2023			
18.	Velocity Modulation Process and Applegate Diagram,	1	31-01-2023			
19.	Reflex Klystrons – Structure, Applegate Diagram and Principle of working,	1	01-02-2023			

20.	Power Output, Efficiency, output Characteristics	1	03-02-2023			
21.	**Tutorial,/Assignment**	1	06-02-2023			

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	06-02-2023			
23.	Structure of TWT	1	07-02-2023			
24.	Amplification Process in TWT	1	08-02-2023			
25.	M-Type Tubes: Cross-field effects	1	10-02-2023			
26.	Magnetrons – Different Types	1	13-02-2023			
27.	8-Cavity Cylindrical Travelling Wave Magnetron	1	14-02-2023			
28.	Hull Cut-off and Hartee Conditions	1	15-02-2023			
29.	PI-Mode Operation in Magnetrons	1	27-02-2023			
30.	Strapping in Magnetrons	1	28-02-2023			
31.	**Tutorial,/Assignment**	1	03-03-2023			

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	04-03-2023			
33.	Classification, Applications	1	06-03-2023			
34.	Transferred Electron Devices: Gunn Diode Principle,	1	07-03-2023			
35.	Two Valley Model Theory	1	10-03-2023			
36.	RWH Theory, Characteristics.	1	13-03-2023			
37.	Avalanche Transit Time Devices: IMPATT diode Principle of Operation and Characteristics,	1	14-03-2023			
38.	TRAPATT Diodes Principle of Operation and Characteristics,	1	15-03-2023			
39.	IMPATT, TRAPATT Diodes expressions	1	17-03-2023			
40.	**Tutorial,/Assignment**	1	20-03-2023			

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	21-03-2023			
42.	Formulation and Properties. S Matrix	1	24-03-2023			
43.	Calculations for E plane and H plane Tees	1	27-03-2023			
44.	Calculations for Magic Tee, Directional Coupler	1	28-03-2023			
45.	Fundamentals of branch line, rat-race couplers	1	29-03-2023			
46.	microwave filters. Ferrites– Composition and Characteristics,	1	31-03-2023			
47.	Faraday Rotation; Ferrite Components – Gyrator	1	03-04-2023			
48.	Isolator, Circulator. Microwave attenuators.	1	04-04-2023			
49.	Isolator, Circulator. Microwave attenuators.	1	10-04-2023			
50.	**Microwave Measurements:** Description of Microwave Bench setup ,precautions	1	11-04-2023			
51.	Measurement of Attenuation, Frequency, VSWR	1	12-04-2023			
52.	Measurement of Impedance, Power.	1	17-04-2023			
53.	**Tutorial,/Assignment**	1	19-04-2023			

BEYOND THE SYLLABUS & REVISION [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**
54.	Microwave devices in RADAR communication	1	19-04-2023			
55.	RF Microwave Passive Devices	1	21-04-2023			
56.	Microwave devices in sattelite communication	1	21-04-2023			

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
[Dr. V.RAVISEKHARA REDDY]	[Dr. V.RAVISEKHARA REDDY]	[Dr. B.Y.V.N.R.SWAMY]	[Dr. Y. AMAR BABU]

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& 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., ECE., VI-Sem., Section- B A.Y : 2022-23

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	26-12-2022		TLM1	
2.	Need of satellite communication	1	27-12-2022		TLM1	
3.	Definition of a satellite and orbit	1	28-12-2022		TLM1	
4.	Frequency allocations for satellite services	1	29-12-2022		TLM1	
5.	General structure of satellite communication system	1	02-01-2023		TLM1	
6.	Merits and demerits of satellite communication	1	03-01-2023		TLM1	
7.	Types of launch vehicles: ELV &RLV	1	04-01-2023		TLM1	
8.	Types of launch vehicles: ELV &RLV	1	05-01-2023		TLM1	
9.	Problems	1	09-01-2023		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	10-01-2023		TLM1	
11.	Kepler's Laws	1	11-01-2023		TLM1	
12.	Definitions of Terms for EarthOrbiting Satellites	1	12-01-2023		TLM1	
13.	Orbital Elements, Apogee and Perigee Heights	1	18-01-2023		TLM1	
14.	Effects of non spherical earth, Atmospheric drag	1	19-01-2023		TLM1	
15.	Orbital perturbations-need for station keeping	1	23-01-2023		TLM3	
16.	Non geostationary orbits and geostationary orbits	1	24-01-2023		TLM1	
17.	Orbital effects; Doppler shift, Range variation	1	25-01-2023		TLM1	
18.	solar eclipse and sun transit outage	1	30-01-2023		TLM1	
19.	Look angle determination: elevation angle and azimuth angle calculation,	1	31-01-2023		TLM1	
20.	launching of geostationary satellites.	1	01-02-2023		TLM1	
21.	Problems	1	02-02-2023		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	06-02-2023		TLM1	
23.	Power supply, Attitude and orbital control: spinning satellite stabilization and momentum wheel stabilization	1	07-02-2023		TLM1	
24.	Station keeping, Thermal control	1	08-02-2023		TLM1	
25.	TT&C subsystem, Transponders,	1	09-02-2023		TLM1	
26.	The wideband receiver, The input demultiplexer	1	13-02-2023		TLM1	
27.	The power amplifier, Antenna subsystem	1	14-02-2023		TLM1	
28.	Equivalent Isotropic Radiated Power, Free-space transmission, Feeder losses	1	15-02-2023		TLM1	
29.	Antenna misalignment losses, Fixed atmospheric and ionospheric losses	1	27-02-2023		TLM1	
30.	Link power budget equation, System Noise	1	28-02-2023		TLM1	
31.	Carrier-to-Noise Ratio, The Uplink	1	01-03-2023		TLM1	
32.	Saturation flux density, Input backoff	1	02-03-2023		TLM1	
33.	Downlink, Output back-off	1	06-03-2023		TLM1	
34.	Combined Uplink and Downlink C/N Ratio	1	07-03-2023		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	09-03-2023		TLM1	
36.	Design requirements for the selection of earth segment	1	13-03-2023		TLM1	
37.	Transmit only earth station	1	14-03-2023		TLM1	

38.	Receive only earth station	1	15-03-2023		TLM1	
39.	Transmit -Receive (T/R) earth station.	1	16-03-2023		TLM1	
40.	Single Access, Preassigned FDMA	1	20-03-2023		TLM1	
41.	Demand-Assigned FDMA	1	21-03-2023		TLM1	
42.	Spade System, TDMA	1	23-03-2023		TLM1	
43.	Preassigned TDMA	1	27-03-2023		TLM1	
44.	Demand-assigned TDMA,	1	28-03-2023		TLM1	
45.	Satellite-Switched TDMA, CDMA.	1	29-03-2023		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	03-04-2023		TLM1	
47.	Global Positioning System	1	04-04-2023		TLM1	
48.	architecture and location principle	1	06-04-2023		TLM1	
49.	Direct Broadcast Satellite (DBS/DTH)-Home receiver block (Indoor & Outdoor Unit)	1	10-04-2023		TLM1	
50.	Satellite Mobile Services	1	11-04-2023		TLM1	
51.	VSAT	1	12-04-2023		TLM1	
52.	MSAT	1	13-04-2023		TLM1	
53.	RADARSAT	1	17-04-2023		TLM1	
54.	IRNSS constellation	1	18-04-2023		TLM1	
55.	Orbcomm, Iridium	1	19-04-2023		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	20-04-2023		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	26-12-2022	18-02-2023	8W
I Mid Examinations	20-02-2023	25-02-2023	1 W
II Phase of Instructions	27-02-2023	22-04-2023	8 W
II Mid Examinations	24-04-2023	29-04-2023	1 W
Preparation and Practical's	01-05-2023	06-05-2023	1 W
Semester End Examinations	08-05-2023	20-05-2023	2 W

PART-C

EVALUATION PROCESS:

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

PART-D

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.M.V.Sudhakar	Dr.M.V.Sudhakar	Dr.M.V.Sudhakar	Dr.Y.Amar Babu

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : **B.Tech. - VI-Sem. - ECE – C Section**
ACADEMIC YEAR : 2022-23
COURSE NAME & CODE : **OPERATIONS RESEARCH TECHNIQUES – 20ME83**
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : **Mallikarjuna Rao Dandu, Sr. Assistant Professor**
COURSE COORDINATOR : **V. Sankara Rao, Sr. Assistant Professor**
PER-REQUISITE : **NIL**

COURSE EDUCATIONAL OBJECTIVES:

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:

After completion 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 the 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	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	

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 Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand& Sons, Educational Publications, New Delhi, 14th Edition, 2008.

T2 Operations Research Theory and Applications,6th Edition, J K Sharma.

BOS APPROVED REFERENCE BOOKS:

R1 Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley- Interscience Publication, 4th edition,2009..

R2 A.M.Natarajan, P.Balasubramani, A. Tamilarasi, OperationsResearch, Pearson Education, 2nd edition, 2014.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: INTRODUCTION to OR, LINEAR PROGRAMMING PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**INTRODUCTION**: Introduction To Operations Research	1	28-12-2022		**TLM1**	CO1	**T1**	
2.	Operations Research Models, Applications	1	29-12-2022		**TLM1**	CO1	**T1**	
3.	**Linear Programming Problem (Lpp)**: Linear Programming Problem Formulation	1	30-12-2022		**TLM1**	CO1	**T1**	
4.	Numerical	1	31-12-2022		**TLM1**	CO1	**T1**	
5.	**Tutorial I, Quiz I**	1	04-01-2023		**TLM3**	CO1	**T1**	
6.	Lpp: Graphical Method, Numerical	1	05-01-2023		**TLM1**	CO1	**T1**	
7.	Graphical Solution For Special Cases Of LPP	1	06-01-2023		**TLM1**	CO1	**T1**	
8.	Simplex Method, Numerical	1	07-01-2023		**TLM1**	CO1	**T1**	
9.	Big M Method (Artificial Variable Technique)	1	11-01-2023		**TLM1**	CO1	**T1**	
10.	Numerical	1	12-01-2023		**TLM1**	CO1	**T1**	
11.	Two Phase Simplex Method (Artificial Variable Technique)	1	18-01-2023		**TLM1**	CO1	**T1**	
12.	**Tutorial II, Quiz II**	1	19-01-2023		**TLM3**	CO1	**T1**	
13.	Numerical	1	20-01-2023		**TLM1**	CO1	**T1, T2**	
14.	Duality Principle	1	21-01-2023		**TLM1**	CO1	**T1**	
15.	**Tutorial III, Quiz III**	1	25-01-2023		**TLM3**	CO1	**T1, T2**	
No. of classes required to complete UNIT-I		15	No. of classes taken:					

UNIT-II: TRANSPORTATION PROBLEM

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Introduction To TP, Terminology, Formulation	1	27-01-2023		**TLM1**	CO2	**T2**	
17.	Standard Form, Unbalanced TP, Numerical	1	28-01-2023		**TLM1**	CO2	**T2**	
18.	Ibfs: NWCM,LCM,VAM Numerical	1	30-01-2023		**TLM1**	CO2	**T2**	
19.	**Tutorial Iv, Quiz Iv**	1	30-01-2023		**TLM3**	CO2	**T2**	
20.	Test For Optimality: Stepping Stone Method, Modified Distribution Method (MODI Method)	1	01-02-2023		**TLM1**	CO2	**T2**	
21.	Numerical	1	01-02-2023		**TLM1**	CO2	**T1, T2**	
22.	Degeneracy In TP, Numerical	1	02-02-2023		**TLM1**	CO2	**T1, T2**	

23.	**ASSIGNMENT PROBLEM (AP)**:Introduction To AP, Terminology; **Tutorial V, Quiz V**	1	03-02-2023		**TLM3**	CO2	**T2**	
24.	Variants Of Assignment Problems	1	06-02-2023		**TLM1**	CO2	**T2**	
25.	Optimal Solution, Numerical	1	08-02-2023		**TLM1**	CO2	**T2**	
26.	Travelling Salesmen Problem, Numerical	1	09-02-2023		**TLM1**	CO2	**T2**	
No. of classes required to complete UNIT-II		11	No. of classes taken:					

UNIT-III: THEORY OF GAMES AND JOB SEQUENCING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
27.	**Introduction to Games Theory**: Terminology	1	10-02-2023		**TLM1**	CO3	**T2,R1**	
28.	Minimax or Maxmini Criterion,Optimal Strategy	1	13-02-2023		**TLM1**	CO3	**T2,R1**	
29.	Solution of games with saddle point	1	15-02-2023		**TLM1**	CO3	**T2,R1**	
30.	**Tutorial VI, Quiz VI**	1	16-02-2023		**TLM3**	CO3	**T2,R1**	
31.	Rectangular games without saddle point, Numerical	1	17-02-2023		**TLM1**	CO3	**T2,R1**	
32.	mx2, 2xn, mxn games, Dominance Principle, Numerical	1	27-02-2023		**TLM1**	CO3	**T2,R1**	
33.	Graphical approach, Numerical	1	01-03-2023		**TLM1**	CO3	**T2,R1**	
34.	Job Sequencing.n jobs through 2 machines,	1	02-03-2023		**TLM1**	CO3	**T2**	
35.	n jobs through 3 machines,	1	03-03-2023		**TLM1**	CO3	**T1, T2**	
36.	2 jobs through m machines-graphical model	1	06-03-2023		**TLM3**	CO3	**T2**	
37.	**Tutorial VII, Quiz VII**	1	09-03-2023		**TLM1**	CO3	**T2**	
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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
38.	**THEORY OF REPLACEMENT:** Introduction, Replacement of Equipment that Deteriorates Gradually, Numerical	1	10-03-2023		**TLM1**	CO4	**T1, T2**	
39.	Replacement of Equipment that fails suddenly, Numerical	1	13-03-2023		**TLM1**	CO4	**T1, T2**	
40.	Group Replacement Policy, Numerical	1	15-03-2023		**TLM1**	CO4	**T1, T2**	
41.	**Tutorial VIII, Quiz VIII**	1	16-03-2023		**TLM3**	CO4	**T1, T2**	

42.	**Introduction to Queuing Theory**	1	17-03-2023		**TLM1**	CO4	**T1, T2**	
43.	Single Channel – Poisson arrivals – exponential service times – with infinite population, Derivation, Numerical	1	20-03-2023		**TLM1**	CO4	**T1, T2**	
44.	Numerical	1	23-03-2023					
45.	Single Channel – Poisson arrivals – exponential service times – with finite population, Numerical	1	24-03-2023		**TLM1**	CO4	**T1, T2**	
46.	**Tutorial IX, Quiz IX**	1	27-03-2023		**TLM3**	CO4	**T1, T2**	
No. of classes required to complete UNIT-IV		09			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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
47.	**INVENTORY MODELS**-terminology, EOQ	1	29-03-2023		**TLM1**	CO5	**T1, T2,R2**	
48.	Instantaneous Production, finite, continuous demand	1	31-03-2023		**TLM1**	CO5	**T1, T2,R2**	
49.	Shortages not Allowed	1	03-04-2023		**TLM1**	CO5	**T1, T2,R2**	
50.	Purchase inventory models with one price break	1	06-04-2023		**TLM1**	CO5	**T1, T2,R2**	
51.	Purchase inventory models with multiple price breaks	1	10-04-2023		**TLM1**	CO5	**T1, T2**	
52.	**Tutorial X, Quiz X**	1	12-04-2023		**TLM1**	CO5	**T1, T2**	
53.	**DYNAMIC PROGRAMMING (DP):** Introduction To DP	1	13-04-2023		**TLM1**	CO5	**T1, T2**	
54.	Bellman's Principle of Optimality, Applications of Dynamic Programming	1	17-04-2023		**TLM1**	CO5	**T1, T2**	
55.	Capital Budgeting Problem, Numerical	1	19-04-2023		**TLM1**	CO5	**T1, T2**	
56.	linear programming problem	1	20-04-2023		**TLM1**	CO5	**T1, T2**	
57.	Shortest path problems	1	21-04-2023		**TLM3**			
No. of classes required to complete UNIT-V		11			No. of classes taken:			

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:

Description	From	To	Weeks
I Phase of Instructions-1	26-12-2022	18-2-2023	8W
I Mid Examinations	**20-2-2023**	**25-2-2023**	1W
II Phase of Instructions	27-2-2023	22-4-2023	8W
II Mid Examinations	**24-4-2023**	**29-4-2023**	1W
Preparation and Practicals	1-5-2023	6-5-2023	2W
Semester End Examinations	**8-5-2023**	**20-5-2023**	2W

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment 1	1	A1=5
Assignment 2	2	A2=5
I-Mid Examination	1,2,3	B1=15
Quiz – 1	1,2,3	Q1=10
Assignment 3	3	A3=5
Assignment 4	4	A4=5
Assignment 5	5	A5=5
II-Mid Examination	3,4,5	B2=15
Quiz – 2	3,4,5	Q2=10
Evaluation of Assignment: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=15
Evaluation of Quiz Marks: Q=75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	1,2,3,4,5	Q=10
Cumulative Internal Examination: A+B+Q	**1,2,3,4,5**	**CIE=30**
Semester End Examinations	**1,2,3,4,5**	**SEE=70**
Total Marks: CIE+SEE	**1,2,3,4,5**	**100**
Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=5
Assignment/Quiz – 2	2	A2=5
I-Mid Examination	1,2	B1=20
Assignment/Quiz – 3	3	A3=5
Assignment/Quiz – 4	4	A4=5
Assignment/Quiz – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Cumulative Internal Examination : A+B	**1,2,3,4,5**	**A+B=25**
Semester End Examinations	**1,2,3,4,5**	**C=75**
Total Marks: A+B+C	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.

PEO2: To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.

PEO3: To develop inquisitiveness towards good communication and lifelong learning.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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.
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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

PSOs

1. To apply the principles of thermal sciences to design and develop various thermal systems.
2. To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
3. To apply the basic principles of mechanical engineering design or evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

MALLIKARJUNA RAO DANDU	V.SANKARA RAO	K.MURAHARI	Dr.S.PICHI REDDY
Course Instructor	Course Coordinator	Module Coordinator	HoD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

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

COURSE HANDOUT

PART-A

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

ACADEMIC YEAR : 2022 - 23

COURSE NAME & CODE : Microprocessor & Microcontrollers Lab - 20EC59

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : **Mr. M. Samba Siva Reddy**

COURSE COORDINATOR : **Mr. K. Sasi Bhushan**

COURSE 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: 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 (LESSON PLAN): Section-B

LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

S.No.	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	CYCLE-1					
1.	Introduction to Lab	3	26-12-2022		**TLM2**	
2.	Display, comparison and reverse the string	3	02-01-2023		**TLM8**	
3.	Factorial using Procedures	3	09-01-2023		**TLM8**	
4.	Sorting the signed and unsigned numbers	3	23-01-2023		**TLM8**	
5.	Checking the given string for Palindrome	3	30-01-2023		**TLM8**	
6.	Arithmetic operations like Addition, Subtraction, Multiplication and Division	3	06-02-2023		**TLM8**	
7.	Byte checking by using 8051	3	13-02-2023		**TLM8**	
8.	Addition of series of numbers	3	27-02-2023		**TLM8**	
9.	Checking the given numbers for Odd or Even	3	27-02-2023		**TLM8**	
	CYCLE-2					
10.	Interfacing of A/D and D/A converter	3	06-03-2023		**TLM8**	
11.	Interfacing of LEDs and Switches	3	13-03-2023		**TLM8**	
12.	Interfacing of LCD	3	20-03-2023		**TLM8**	
13.	Interfacing of Stepper Motors	3	27-03-2023		**TLM8**	
14.	Interfacing of traffic Light controller	3	03-04-2023		**TLM8**	
15.	Interfacing of Real Time Clock	3	10-04-2023		**TLM8**	
16.	Data loggers – Rollover display	3	10-04-2023		**TLM8**	
17.	Internal Lab Exam	3	17-04-2023		**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:

Academic Calendar: B.Tech., VI-Sem., 2022-23			
Description	**From**	**To**	**Weeks**
Commencement of Class work: 26.12.2022			
I Phase of Instructions	26-12-2022	18-02-2023	8W
I MID Examinations	20-02-2023	25-02-2023	1W
II Phase of Instructions	27-02-2023	22-04-2023	8W
II MID Examinations	24-04-2023	29-04-2023	1W
Preparation and Practicals	01-05-2023	06-05-2023	1W
Semester End Examinations	08-05-2023	20-05-2023	2W

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Day to Day work	1,2,3,4	A1=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 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
(M.Sambasiva Reddy)	(Mr.K.Sasi Bhushan)	(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 : Mrs.T.Kalpana, 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- B A.Y : 2022-23

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(20761A0465 to 20761A0499) Friday– 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	30.12.2022			
Cycle – I							
1	Experiment – 1	CO1	3	06.01.2023			
2	Experiment – 2	CO1	3	13.01.2023			
3	Experiment – 3	CO1	3	20.01.2023			
4	Experiment – 4	CO2,CO3	3	27.01.2023			
5	Experiment – 5	CO2,CO3	3	03.02.2023			
6	Experiment – 6	CO2,CO3	3	10.02.2023			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	17.02.2023			
8	Experiment – 8	CO2,CO3	3	03.03.2023			
9	Experiment – 9	CO2,CO3	3	10.03.2023			
10	Experiment – 10	CO2,CO3	3	17.03.2023			
11	Experiment – 11	CO2,CO3	3	24.03.2023			
12	Experiment beyond syllabus	CO2,CO3	3	31.03.2023			
13	Internal Examination	--	3	21.04.2023			

Batch-2 (20761A04A0 to 20761A04C8 & 21765A0407 to 21765A0412) Tuesday – 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	27.12.2022			
Cycle – I							
1	Experiment – 1	CO1	3	03.01.2023			
2	Experiment – 2	CO1	3	10.01.2023			
3	Experiment – 3	CO1	3	17.01.2023			
4	Experiment – 4	CO2,CO3	3	24.01.2023			
5	Experiment – 5	CO2,CO3	3	31.01.2023			
6	Experiment – 6	CO2,CO3	3	07.02.2023			
Cycle – II							
7	Experiment – 7	CO2,CO3	3	14.02.2023			
8	Experiment – 8	CO2,CO3	3	28.02.2023			
9	Experiment – 9	CO2,CO3	3	07.03.2023			
10	Experiment – 10	CO2,CO3	3	14.03.2023			
11	Experiment – 11	CO2,CO3	3	21.03.2023			
12	Experiment beyond syllabus	CO2,CO3	3	28.03.2023			
--	Revision	--	3	04.04.2023			
--	Revision	--	3	11.04.2023			
--	Internal Examination	--	3	18.04.2023			

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
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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 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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COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2022-23

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

COURSE COORDINATOR : Mrs. 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	27.12.2022		-	TLM1	
2	Experiment-1	3	03.01.2023		COs 1,3,4	TLM4	
3	Experiment-2	3	10.01.2023		COs 1,3,4	TLM4	
4	Experiment -3	3	24.01.2023		COs1,3,4	TLM4	
5	Experiment-4	3	31.01.2023		COs 1,3,4	TLM4	
6	Experiment-9	3	07.01.2023		COs 2,4	TLM4	
7	Experiment-10	3	14.02.2023		COs2,4	TLM4	
8	Experiment-5	3	21.02.2023		COs1,3,4	TLM4	
9	Experiment-6	3	28.02.2023		COs 1,3,4	TLM4	
10	Experiment-7	3	07.03.2023		COs 1,3,,4	TLM4	
11	Experiment-8	3	14.03.2023		COs 1,3,4	TLM4	
12	Experiment-11	3	21.03.2023		COs 2,4	TLM4	
13	Experiment-12	3	28.03.2023		COs 2,4	TLM4	
13	Revision	3	04.04.2023				
14	Revision	3	11.04.2023				
15	Internal exam	3	18.04.2023				

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	30.12.2022		COs 1,4	TLM1	
2.	Experiments-1	3	06.01.2023		COs 1,4	TLM4	
3.	Experiment-2	3	20.01.2023		COs 1,4	TLM4	
4.	Experiment-3,4	3	27.01.2023		COs 3,4	TLM4	
5.	Experiment-9	3	03.02.2023		COs2,4	TLM4	
6.	Experiment-10	3	10.02.2023		COs 2,4	TLM4	
7.	Experiment-5	3	17.03.2023		COs 2,4	TLM4	
8.	Experiment-6	3	24.02.2023		COs 1,3,4	TLM4	
9.	Experiment-7	3	03.03.2023		COs 1,3,4	TLM4	
10.	Experiment-8	3	10.03.2023		COs 1,3,4	TLM4	
11.	Experiment-11	3	17.03.2023		COs 2,4	TLM4	
12.	Experiment-12		24.03.2023		COs 2,4	TLM4	
13.	Revision	3	31.03.2023				
14.	Internal exam	3	21.04.2023				

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]	[Mrs. K.RANI RUDRAMA]	[Dr. B.Y.V.N.R.SWAMY]	[Dr. Y. AMAR BABU]

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

Name of Course Instructor : **Dr. Sujith Kumar Rath& Mr. B Sagar**
Course Name & Code : **Soft skills & soft skills Laboratory (20HSS1)**
L-T-P Structure : **0-0-1+2** **Credit : 2**
Program/Sem/Sec : **B.Tech.ECE-B , VI-Sem.,** **A.Y: 2022-23**

Course Description & Objectives:

The Soft Skills Laboratory course equips students with required behavioural, 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	**Infer** the self awareness and personality **(Understand – L2)**
CO2	Work effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.**(Apply – L3)**
CO3	Communicate through verbal/oral communication and improve the listening skills**(Apply – L3)**
CO4	**Relate** thecritical & lateral thinking while dealing with personal/social/professional issues. **(Apply – L3)**

Course Content:

Personality Development Skills

Role of language in Personality – How language reflects, impactsPersonality – Using gender-neutral language in MNCs – being culturally-sensitive-Personality Traits- Grooming & Dress code

Activities: Group Discussion/Role play/Presentations (authentic materials: News papers, pamphlets and news clippings)

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

ProfessionalSkills:

Career Planning- job vs. career- goal setting- SWOT analysis-Timemanagement – 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.

REFERENCEBOOKS:

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

ECE-B

S.No.	No. of Lecture Hours	Date	Planned Topics	Actual Date	HOD Sign Weekly
1	1	06-01-23	Role of language in personality		
2	2	05-01-23	Extempore		
3	1	20-01-23	How language reflects, impacts Personality		
4	2	19-01-23	Story Telling		
5	1	27-01-23	Using gender-neutral language in MNCs		
6	2	02-02-23	Case Studies		
7	1	03-02-23	Being culturally-sensitive-Personality Traits- Grooming & Dress code		
8	2	09-02-23	Using authentic materials: News papers, pamphlets and news clippings		
9	1	10-02-23	Career Planning		
10	2	16-02-23	Public Speaking		
11	1	17-02-23	Job vs. career- goal setting		
12	2	23-02-23	Critical Appreciation and Textual Analysis		
13	1	03-03-23	SWOT analysis		
14	2	02-03-23	Writing a review on a given short story/videos/book		
15	1	10-03-23	Time management		
16	2	09-03-23	Empathetic speaking		
17	1	17-03-23	Self-management		
18	2	16-03-23	Telephonic conversation		
19	1	24-03-23	Stress-management		
20	2	23-03-23	Situation based dialogues		
21	1	31-03-23	Effective Resume-Writing and presentation		
22	2	13-04-23	Listening to dialogues and analyzing		
23	1	21-04-23	Interview Skills		
24	2	20-04-23	Mock Interviews		

Signature of Faculty Signature of HOD

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. T. Satyanarayana
Course Name & Code : Universal Human Values 2: Understanding Harmony – 20HS01
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section-C A.Y : 2022-23

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES (CEOs): To become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

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

CO 1	Apply the value inputs in life and profession **(Apply – L3)**
CO 2	Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body **(Understand – L2)**
CO 3	Understand the role of a human being in ensuring harmony in society **(Understand – L2)**
CO 4	Understand the role of a human being in ensuring harmony in the nature and existence. **(Understand – L2)**
CO 5	Distinguish between ethical and unethical practices (**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	3		2		3			
CO2							1	1		1		2			
CO3							2	3		2		3			
CO4							2	3		2		3			
CO5							2	3		2		3			

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

TEXT BOOKS:

T1 Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS:

R1 Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
R2 Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
R3 The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - B

UNIT-I: Need, Basic Guidelines, Content and Process for Value Education:

S. No.	Topics	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course objective and Course Outcomes	1	07-03-22		**TLM1**	
2.	Need, Basic Guidelines, Content and Process for Value Education	1	08-03-22		**TLM1**	
3.	Natural Acceptance' and Experiential Validation- as the process for self-exploration	1	11-03-22		**TLM1**	
4.	Continuous Happiness and Prosperity	1	14-03-22		**TLM1**	
5.	Basic Human Aspirations	1	15-03-22		**TLM1**	
6.	Right understanding	1	21-03-22		**TLM1**	
7.	Relationship and Physical Facility	1	22-03-22		**TLM1**	
8.	Understanding Happiness and Prosperity	1	25-03-22		**TLM1**	
No. of classes required to complete UNIT-I:		**08**	No. of classes taken:			

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself:

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 Understanding Harmony in the Human Being - Harmony in Myself	1	28-03-22		**TLM2**	
2.	Understanding human being as a co-existence of the sentient 'I' and the material 'Body'	1	29-03-22		**TLM2**	
3.	Understanding the needs of Self ('I') and 'Body' - happiness and physical facility	1	01-04-22		**TLM2**	
4.	Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)	1	04-04-22		**TLM2**	
5.	Understanding the characteristics and activities of 'I' and harmony in 'I	1	08-04-22		**TLM2**	
6.	Understanding the harmony of I with the Body: Sanyam and Health	1	11-04-22		**TLM2**	
7.	Correct appraisal of Physical needs, meaning of Prosperity in detail	1	12-04-22		**TLM2**	
No. of classes required to complete UNIT-II:		**07**	No. of classes taken:			

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:

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.	Understanding values in human-human relationship	1	18-04-22		**TLM2**	
2.	Meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness	1	19-04-22		**TLM2**	
3.	Trust and Respect as the foundational values of relationship	1	22-04-22		**TLM2**	
4.	Understanding the harmony in the	1	02-05-22			

	society: Resolution, Prosperity					
5.	Understanding the harmony in the society: fearlessness and co-existence as comprehensive Human Goals	1	06-05-22		**TLM2**	
6.	Visualizing a universal harmonious order in society- Undivided Society	1	09-05-22		**TLM2**	
7.	Universal Order- from family to world family, Gratitude as a universal value in relationships	1	10-05-22		**TLM2**	
8.	**Revision**	1	13-05-22			
No. of classes required to complete UNIT-III:		**08**	No. of classes taken:			

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:

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.	Understanding the harmony in the Nature	1	16-05-22		**TLM2**	
2.	Inter connectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature	1	17-05-22		**TLM2**	
3.	Understanding Existence as Co-existence of mutually interacting units in all-pervasive space	1	20-05-22		**TLM2**	
4.	Holistic perception of harmony at all levels of existence	1	23-05-22		**TLM2**	
5.	**Revision**	1	24-05-22		**TLM2**	
6.	**Revision**	1	27-05-22			
No. of classes required to complete UNIT-IV:		**06**	No. of classes taken:			

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics:

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.	Natural acceptance of human values; Definitiveness of Ethical Human Conduct	1	30-05-22		**TLM2**	
2.	Basis for Humanistic Education	1	31-05-22		**TLM2**	
3.	Humanistic Constitution and Humanistic Universal Order	1	03-06-22		**TLM2**	
4.	Competence in professional ethics	1	06-06-22		**TLM2**	
5.	Strategy for transition from the present state to Universal Human Order	1	07-06-22		**TLM2**	
6.	Revision	1	10-06-22		**TLM2**	
7.	**Revision**	1	13-06-22		**TLM2**	
8.	Overall review	1	14-06-22			
No. of classes required to complete UNIT-V:		**08**	No. of classes taken:			

Contents beyond the Syllabus

S. No.	Topics	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.		18-06-22				

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 (R20 Regulations):

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

PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Date: 31-01-2023

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Dr. T. Satyanarayana	Dr. B. Srinivasa Rao	Dr. B. Srinivasa Rao	Dr. Y. Amar Babu
Professor, ECE	Prof. & HoD, IT	Prof. & HoD, IT	Prof. & HoD, ECE

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ECE

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.K.Ravi Kumar, Assoc. Professor

Course Name & Code	**:** Control Systems-20EE09	**Regulation**: R20
L-T-P Structure	**:** 2-1-0	**Credits:** 03
Program/Sem/Sec	: B. Tech. IV-Sem., ECE-C Sec	**A.Y.:** 2021-22

PRE REQUISITE: Electrical Circuit Analysis and Applied Physics.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals withthe different aspects of stability analysis of systems in frequency domain and time domain.

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

CO1	Develop mathematical models of systems in terms of transfer function and state-space. **(Apply-L3)**
CO2	Analyze control systems in time domain **(Apply-L3)**
CO3	Analyze control systems in frequency domain**(Apply-L3)**
CO4	Understand the concepts of controllers and compensators. **(Understand-L2)**

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

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

TEXTBOOKS:

T1 B. C. Kuo , "Automatic Control Systems" John Wiley and Sons ,9th edition,2014.

T2 I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P)Limited Publishers,6th edition,2018

REFERENCE BOOKS:

R1 Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 5thedition,2009

PART-B

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: MATHEMATICAL MODELLING OF CONTROL SYSTEMS

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 and COs	1	07-03-2022			
2.	Concept of Control systems, Open loop and Closed loop control systems	1	08-03-2022			
3.	Modeling of Electrical systems	1	10-03-2022			
4.	Modeling of Mechanical systems	1	11-03-2022			
5.	Electrical analogy of Mechanical systems	1	14-03-2022			
6.	**Tutorial-1**	1	15-03-2022			
7.	Block Diagrams Reduction rules	1	17-03-2022			
8.	Signal Flow Graph Terminology	1	21-03-2022			
9.	**Tutorial-2**	1	22-03-2022			
10.	SFG Reduction using Masons Gain Formula	1	24-03-2022			
11.	Feedback Control System Characteristics	1	25-03-2022			
No. of classes required to complete UNIT-I: 11				**No. of classes taken:**		

UNIT-II: TIME RESPONSE ANALYSIS-I

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.	Standard test signals	1	28-03-2022			
13.	Time response of first order systems	1	29-03-2022			
14.	Response of second order system	1	31-03-2022			
15.	Response of second order for different damping values	1	01-04-2022			
16.	Time domain specifications	1	04-04-2022			
17.	**Tutorial-3**	1	07-04-2022			
18.	Steady state errors	1	08-04-2022			

	and error constants.					
19.	Introduction to PI, PD and PID Controllers	1	11-04-2022			
20.	**Tutorial-4**	1	12-04-2022			
No. of classes required to complete UNIT-II: 09				**No. of classes taken:**		

UNIT-III: **TIME RESPONSE ANALYSIS-II**

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Concepts of stability	1	18-04-2022			
22.	Necessary conditions for Stability	1	19-04-2022			
23.	Routh stability criterion	1	21-04-2022			
24.	Relativestability analysis	1	22-04-2022			
25.	**Tutorial-5**	1	02-05-2022			
26.	Root Locus Technique	1	05-05-2022			
27.	Construction of root loci	1	06-05-2022			
28.	Effects of adding poles and zeros to G(s) H(s) on the root loci.	1	09-05-2022			
29.	**Tutorial-6**	1	10-05-2022			
No. of classes required to complete UNIT-III: 09				**No. of classes taken:**		

UNIT-IV: FREQUENCY RESPONSE ANALYSIS

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.	Frequency domain specifications	1	12-05-2022			
31.	Frequency response of standard second order system	1	13-05-2022			
32.	Bode Plot - Frequency domain specifications	1	16-05-2022			
33.	**Tutorial-7**	1	17-05-2022			
34.	Transfer function from the Bode Plot	1	19-05-2022			
35.	Polar Plot	1	20-05-2022			
36.	Nyquist plot- Nyquist Stability criteria	2	23-05-2022 24-05-2022			
37.	**Tutorial-8**	1	26-05-2022			
38.	Introduction to Lag, Lead Compensators	1	27-05-2022			
39.	Lead-Lag Compensator	1	30-05-2022			
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: STATE SPACE ANALYSIS

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.	Concept of state variables	1	31-05-2022			
41.	State models for linear and time invariant Systems	1	02-06-2022			
42.	The Transfer Function from the State Equation	1	03-06-2022			
43.	Solution of state equation	1	06-06-2022			
44.	**Tutorial-9**	1	07-06-2022			
45.	State transition matrix and it's properties	1	09-06-2022			
46.	Computation of state transition matrix using Laplace transformation method	1	10-06-2022			
47.	Concepts of controllability and observability	1	13-06-2022			
48.	**Tutorial-10**	1	14-06-2022			
49.	Revision	1	16-06-2022			
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
52.	Root Locus Construction using MatLab	1	17-06-2022		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

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):

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	Design and develop modern communication technologies for building the inter disciplinary 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

Date:

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr.K.Ravi Kumar**	**Dr.K.Ravi Kumar**	**Dr. G. L N Murthy**	**Dr. Y. Amar Babu**
Signature				

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. V.V.Rama Krishna
Course Name & Code : Digital Signal Processing – 20EC06

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

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section- C A.Y : 2022-23

Pre-Requisites: Signals and Systems.

Course Objectives:

This course introduces discrete time signals and systems and operations performed on them. It introduces Discrete time Fourier Transform, Discrete Fourier transform and Z transform meant for spectral analysis of discrete time signals and systems. Fast Fourier Transform that is an efficient way of implementing DFT is also introduced. It also provides the basic knowledge about the design of both IIR and FIR filters.

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

CO1	Interpret the basics of discrete time signal processing techniques.**(Understand – L2)**
CO2	Examine Discrete Time Signals in time and frequency domain using DTFT, DFT, FFTand Z-transforms **(Apply – L3)**
CO3	Apply DFT, FFT and Z-Transform techniques to solve and realize discrete systems **(Apply – L3)**
CO4	Construct the IIR Filters using Butterworth, Chebyshev Approximation techniques andFIR Filters using Fourier series method and windowing Techniques **(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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	3	3	1	1	-	-	-	-	-	-	-	2	-	-	2
CO4	3	3	2	1	-	-	-	-	-	-	-	3	-	-	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 BOOK(S):

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

T2 Alan V Openheim, Ronald W. Schafer, ***"Digital Signal Processing"***, PHI learning, 1st edition, 2010.

REFERENCE BOOK(S):

R1 P.RameshBabu, ***"Digital Signal Processing"***, Scitech Publications, 4th edition, 2012Pvt Ltd.

R2 A.NagoorKani, ***"Digital Signal Processing"***, RBA Publications,1st edition, 2005.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I: Discrete Time Signals, Discrete Time Systems & DTFT

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Course, CEO, COs, POs and PSOs	1	30-01-2023		TLM1	
2.	Introduction - Block diagram of DSP System, Advantages , Limitations and Applications of DSP	1	01-02-2023		TLM1	
3.	Elementary Discrete Time Signals, Representation of Discrete Time Signals	1	02-02-2023		TLM1	
4.	Operations on Discrete Time Signals	1	03-02-2023		TLM1	
5.	Properties or classifications of Discrete Time Signals	1	06-02-2023		TLM1	
6.	Properties or classifications of Discrete Time Systems	1	08-02-2023		TLM1	
7.	Analysis of LTI Systems through LCCDE	1	09-02-2023		TLM1	
8.	Analysis of LTI Systems through LCCDE	1	10-02-2023		TLM1	
9.	Linear Convolution	1	13-02-2023		TLM1	
10.	Linear Convolution	1	15-02-2023		TLM1	
11.	DTFT of a Sequence and System	1	16-02-2023		TLM1	
12.	DTFT of a Sequence and System	1	17-02-2023		TLM1	
13.	Properties of DTFT	1	20-02-2023		TLM1	
No. of classes required to complete UNIT-I		**13**	No. of classes taken			

UNIT-II: Z-Transforms

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Z-Transform of a sequence and ROC – its properties	1	22-02-2023		TLM1	
2.	Properties of Z-Transforms	1	23-02-2023		TLM1	
3.	Properties of Z-Transforms	1	24-02-2023		TLM1	
4.	Inverse Z-Transform	1	27-02-2023		TLM1	
5.	Problems on Z-Transforms		01-03-2023		TLM1	
6.	Problems on Inverse Z-Transforms		02-03-2023		TLM1	
7.	Analysis of LTI system using Z-transforms	1	03-03-2023		TLM1	
8.	Analysis of LTI system using Z-transforms	1	06-03-2023		TLM1	
9.	Direct Form-I, Direct Form-II,	1	09-03-2023		TLM1	
10.	Cascade Form and Parallel Form for IIR systems	1	10-03-2023		TLM1	
11.	Direct Form, Cascade Form and Parallel Form, Linear Phase	1	13-03-2023		TLM1	

	Realization for FIR systems					
No. of classes required to complete UNIT-II		**11**	No. of classes taken			

UNIT-III: Discrete Fourier Transform (DFT) and Fast Fourier Transforms

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction - DFT, Computation of DFT, IDFT, Relation between DTFT and DFT, Twiddle factor – Properties, Problems	1	15-03-2023		**TLM1**	
2.	Properties of DFT	1	16-03-2023		**TLM1**	
3.	Properties of DFT, Problems	1	17-03-2023		**TLM1**	
4.	Linear Convolution and Circular Convolution	1	20-03-2023		**TLM1**	
5.	Linear Convolution through Circular Convolution	1	23-03-2023		**TLM1**	
6.	Circular Convolution through DFT & IDFT, Linear Convolution through DFT & IDFT	1	24-03-2023		**TLM1**	
7.	Need for FFT	1	03-04-2023		**TLM1**	
8.	Radix – 2 DIT-FFT Algorithm for DFT computation	1	06-04-2023		**TLM1**	
9.	Radix – 2 DIT-FFT Algorithm for DFT computation	1	10-04-2023		**TLM1**	
10.	Radix – 2 DIF-FFT Algorithm for DFT computation	1	12-04-2023		**TLM1**	
11.	Radix – 2 DIF-FFT Algorithm for DFT computation	1	13-04-2023		**TLM1**	
12.	Radix – 2 DIT-FFT Algorithm for IDFT computation.	1	03-04-2023		**TLM1**	
13.	Radix – 2 DIF-FFT Algorithm for IDFT computation	1	17-04-2023		**TLM1**	
14.	Revision	1	19-04-2023		**TLM1**	
No. of classes required to complete UNIT-III			**14**	No. of classes taken		

UNIT-IV: IIR Filter Design

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction - Characteristics and Classification of Filters	1	20-04-2023			
2.	Design of IIR Digital Filter – Impulse Invariant Transformation – Aliasing effect	1	21-04-2023		**TLM1**	
3.	Design of IIR Digital Filter – Bilinear Transformation – Frequency warping	1	24-04-2023		**TLM1**	
4.	Problems on Impulse Invariance and Bilinear Transformation	1	26-04-2023		**TLM1**	
5.	Specifications of Low pass filters , Design of IIR Analog filter using Butterworth Approximations	1	27-04-2023		**TLM1**	
6.	Problems on Butterworth Filter	1	28-04-2023		**TLM1**	

7.	Design of IIR Analog filter using Chebyshev Approximations	1	01-05-2023		**TLM1**	
8.	Problems on Chebyshev Filetr	1	03-05-2023		**TLM1**	
9.	Analog Frequency Transformation	1	04-05-2023		**TLM1**	
10.	Problems on Frequency Transformations	1	05-05-2023		**TLM1**	
11.	Revision	1	08-05-2023		**TLM1**	
No. of classes required to complete UNIT-IV			**11**	No. of classes taken		

UNIT-V: FIR filters Design

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Comparisons between IIR and FIR filters, Characteristics of FIR filters with linear phase.	1	10-05-2023		**TLM1**	
2.	Frequency Response Linear Phase FIR filters	1	11-05-2023		**TLM1**	
3.	Frequency Response Linear Phase FIR filters		12-05-2023		**TLM1**	
4.	Design of FIR filters using Fourier series method	1	15-05-2023		**TLM1**	
5.	Problems	1	17-05-2023		**TLM1**	
6.	Design of FIR filters using window method and various window(s) characteristics	1	18-05-2023		**TLM1**	
7.	Design of FIR filters using window method and various window(s) characteristics	1	19-05-2023		**TLM1**	
8.	Design of FIR filters using window method and various window(s) characteristics	1	22-05-2023		**TLM1**	
9.	Problems	1	24-05-2023		**TLM1**	
10.	Revision		25-05-2023		**TLM1**	
No. of classes required to complete UNIT-V		**10**	No. of classes taken			

Contents beyond the Syllabus

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Multirate Signal Processing	**1**	26-05-2023		**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

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

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. V V Rama Krishna	Dr.E.V.KrishnaRao	Dr. G L N Murthy	Dr. Y. Amar Babu

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt. M V L Bhavani
Course Name & Code : Analog Communications&20EC07
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section- C A.Y : 2022-23

PRE-REQUISITE: Signals & Systems

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on various analog modulation techniques in both time and frequency domains. The course will give an idea about generation and demodulation methods of various analog modulation techniques. It also gives complete information regarding the transmitters and receivers types and performance evaluation of continuous wave modulation.

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

CO1:	Understand the fundamental concepts of various analog modulation schemes with relevant time and frequency domain representations. (Understand – L2)
CO2:	Interpret the generation, detection of continuous wave and pulse analog modulation techniques. (Understand – L2)
CO3:	Apply the concepts of analog modulation and demodulation techniques for calculating communication system related parameters .(Apply – L3)
CO4:	Analyze the performance of continuous wave modulation schemes in the presence of channel noise. (Analyze – L4)

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

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

BOS APPROVED TEXT BOOKS:

T1 Simon Haykin, *"Communication Systems"*, John Wiley & Sons, 2nd Edition, 1983

T2 George Kennedy ,Davis, *"Electronic Communication Systems"*, Tata McGraw Hill Education, 4th edition, 1999.

BOS APPROVED REFERENCE BOOKS:

R1 G.K.Mithal, "*Radio Engineering*", Khanna Publishers,20th Edition,2000

R2 Sanjay Sharma, *"Analog Communication Systems"*,S.K.Katariya& Sons,2nd Edition, 2007

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Communication System, Amplitude modulation, Double Side band Suppressed Carrier Modulation

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.	General Interaction	1	30.01.2023		TLM1	
2.	Introduction to Course. Course Outcomes	1	01.02.2023		TLM1	
3.	Elements of a communication system, Need for modulation, Classification of Modulation	1	02.02.2023		TLM1	
4.	Amplitude Modulation: Definition, Time and Frequency Domain Representation	1	03.02.2023		TLM1	
5.	Power relations in AM wave, Generation of AM waves using square law modulator, Switching modulator.	1	06.02.2023		TLM1	
6.	Demodulation of AM waves using square law Demodulator, Envelop Detector,	1	08.02.2023		TLM1	
7.	Tutorial -1	1	09.02.2023		TLM3	
8.	Introduction to DSBSC -AM, Time and Frequency domain Representation	1	10.02.2023		TLM1	
9.	Generation of DSBSC wave using Balanced Modulator	1	13.02.2023		TLM1	
10.	Generation of DSBSC using Ring Modulator	1	15.02.2023		TLM1	
11.	Coherent Detection of DSBSC wave	1	16.02.2023		TLM1	
12.	Effect of Phase and frequency Errors	1	17.02.2023		TLM1	
13.	Costas Loop	1	20.02.2023		TLM1	
14.	Tutorial -2	1	22.2.2023		TLM3	
No. of classes required to complete UNIT-I :		14	No. of classes taken:			

UNIT-II : Single Side band Modulation & Vestigial Side band Modulation

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.	Single Side band Modulation: Definition, Time and Frequency domain representation	1	23.02.2023		TLM1	
16.	Generation of SSB wave: Filter Method,	1	24.02.2023		TLM1	
17.	Phase Discrimination method	1	27.02.2023		TLM1	
18.	Coherent detection of SSB wave	1	01.03.2023		TLM1	
19.	Effect of Phase and Frequency Error in the detection	1	02.03.2023		TLM1	
20.	Tutorial-3	1	03.03.2023		TLM3	
21.	Vestigial Side band Modulation: Definition, Time and frequency domain representation	1	06.03.2023		TLM1	
22.	Generation of VSB wave	1	08.03.2023		TLM1	
23.	Envelope detection of VSB wave plus carrier	1	09.03.2023		TLM1	
24.	Comparisons of amplitude modulation techniques, Applications of different AM systems	1	10.03.2023		TLM1	
25.	Tutorial-4	1	13.3.2023		TLM3	
No. of classes required to complete UNIT-II		11	No. of classes taken:			

UNIT-III :Angle Modulation, Demodulation of FM Wave

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	Types of Angle Modulation Frequency Modulation: Time domain representation,	1	15.03.2023		TLM1	
27.	Single tone Frequency Modulation	1	16.03.2023		TLM1	

28.	Narrow Band Frequency Modulation: Time and Frequency domain representation	1	17.03.2023		TLM1	
29.	Wide band Frequency Modulation Time and Frequency Domain representation	1	20.03.2023		TLM1	
30.	Transmission power and Band width of FM wave	1	23.03.2023		TLM1	
31.	Tutorial-5	1	24.03.2023		TLM3	
32.	Generation of FM wave: Direct method	1	03.04.2023		TLM1	
33.	Generation of FM wave: Indirect method	1	05.04.2023		TLM1	
34.	Demodulation of FM – frequency Discrimination methods: simple slope detector, Balanced slope detector	1	06.04.2023		TLM1	
35.	Phase Discrimination methods: Foster Seeley Discrimination method	1	07.04.2023		TLM1	
36.	Ratio Detector, PLL	1	10.04.2023		TLM1	
37.	Tutorial -6	1	12.04.2023		TLM3	
No. of classes required to complete UNIT-III		12	No. of classes taken:			

UNIT-IV :: Radio Transmitters and Receivers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
38.	Radio transmitter introduction and classification AM transmitters-low level and high level	1	13.04.2023		TLM1	
39.	FM Transmitter: Reactance tube method	1	14.04.2023		TLM1	
40.	FM Transmitter: Armstrong method	1	17.04.2023		TLM1	
41.	Tutorial-7		19.04.2023		TLM3	
42.	Radio Receiver introduction and classification	1	20.04.2023		TLM1	
43.	Tuned Radio Frequency receiver and its limitations	1	21.04.2023		TLM1	
44.	Need of heterodyning AM Super heterodyne Receiver,	1	24.04.2023		TLM1	
45.	Frequency Changing and Tracking, Concept of IF		26.04.2023		TLM1	

46.	Significance of AGC in AM Radio Receivers, Simple AGC,	1	27.04.2023		TLM1	
47.	Delayed AGC		28.04.2023		TLM1	
48.	FM receiver	1	01.05.2023		TLM1	
49.	Tutorial-8	1	03.05.2023		TLM3	
No. of classes required to complete UNIT-IV		12	No. of classes taken:			

UNIT-V Noise in Analog Communication Systems, Analog Pulse modulation & Multiplexing

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
50.	Definition of Noise in communication system Signal to Noise ratio calculations in AM	1	0.05.2023		TLM1	
51.	Signal to Noise ratio calculations in DSBSC, and SSBSC receivers	1	05.05.2023		TLM1	
52.	Signal to Noise ratio calculations in FM receivers		08.05.2023		TLM1	
53.	Threshold Effect, Pre-Emphasis and De Emphasis circuits	1	10.05.2023		TLM1	
54.	Introduction to Carrier to Noise Ratio Signal to Interference plus Noise Ratio	1	11.05.2023		TLM1	
55.	Tutorial-9	1	12.05.2023		TLM3	
56.	Analog Pulse Modulation: Need for Pulse Modulation Types of Pulse analog Modulation,	1	15.05.2023		TLM1	
57.	Pulse Amplitude Modulation Generation and Demodulation	1	17.05.2023		TLM2	
58.	Pulse Amplitude Demodulation.		18.05.2023		TLM1	
59.	Pulse Width, Pulse Position Modulation	1	18.05.2023		TLM2	
60.	Generation and Demodulation	1	19.05.2023		TLM2	
61.	**Multiplexing:** Frequency Division Multiplexing, Time Division Multiplexing	2	22.05.2023 24.05.2023		TLM1	
62.	Tutorial-10	1	25.05.2023		TLM3	
No. of classes required to complete UNIT-V:		13	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
63.	Recent Trends and application areas in Communication	1	26.05.2023		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

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
Mrs.M.V.L.Bhavani	Mrs.M.V.L.Bhavani	Dr.M.V.Sudhakar	Dr.Y.Amar Babu

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

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. B Siva Hari Prasad

Course Name & Code : Electromagnetic Waves & Transmission Lines - 20EC08

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

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section- C A.Y : 2022-23

Pre-Requisites: Vector Algebra, Coordinate Systems, Vector Calculus.

Course Objectives: This course is useful to impart knowledge on electric and magnetic fields in both static and dynamic domains. The course will introduce the application of Maxwell's equations. The course gives the complete information regarding the Electromagnetic wave propagation in different mediums. This course will help in the analysis of transmission line using circuit theory and use the Smith chart to find reflection coefficient, VSWR, impedance in easy way.

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

CO1	Define the basic laws of Electrostatic and Magnetostatic Fields (Remember Level – L1).
CO2	Understand the basic concepts of Electromagnetic fields in static and time varying conditions (Understand Level – L2).
CO3	Apply the Electromagnetic concepts to solve real time problems (Apply Level – L3).
CO4	Analyze the characteristics of EM wave propagation in different mediums (Analyze Level – L4).

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

TEXT BOOK(S):

T1 Matthew N. O. Sadiku, "Elements of Engineering Electromagnetics", Oxford University Press, 4th Edition.

T2 William Hayt, J A Buck, M JallelAkhtar "Engineering Electromagnetics", TMH Publishers, 8th Edition.

REFERENCE BOOK(S):

R1 Jordan and Balmain, "Electromagnetic fields and Radiating systems", Pearson education.

R2 K.Shevgaonkar, "Electromagnetic waves" TMH Publishers.

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

UNIT-I: Electrostatics

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Course and COs	1	30-1-2023			
2.	Introduction to Unit-I	1	31-1-2023			
3.	Vector Algebra, Coordinate System	1	01-2-2023			
4.	Vector Calculus	1	02-2-2023			
5.	Coulombs Law & Electric Field Intensity	1	06-2-2023			
6.	Electric Field due to continuous charge distributions	1	07-2-2023			
7.	Electric Flux & Electric Flux Density	1	08-2-2023			
8.	Gauss's Law and Applications	1	09-2-2023			
9.	Electric Potential and Potential Gradient	1	13-2-2023			
10.	Maxwell's two equations for Electrostatic Fields	1	14-2-2023			
11.	Electric Dipole and Dipole Moment	1	15-2-2023			
12.	Electrostatic Energy and Energy Density	1	16-2-2023			
13.	Poisson's and Laplace's Equations	1	20-2-2023			
14.	Capacitance and Different Capacitors	1	21-2-2023			
15.	Problem Solving	1	22-2-2023			
16.	Problem Solving	1	23-2-2023			
No. of classes required to complete UNIT-I		16	No. of classes taken			

UNIT-II: Magnetostatics

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Magnetic Field Intensity & Biot-Savart's Law	1	27-2-2023			
18.	Ampere's Circuit Law & Applications	1	28-2-2023			
19.	Magnetic Flux & Magnetic Flux Density	1	01-3-2023			
20.	Maxwell's two equations for Magnetostatic Fields	1	02-3-2023			
21.	Magnetic Scalar & Vector Potentials	1	06-3-2023			
22.	Force Due to Magnetic Field	1	07-3-2023			
23.	Magnetic Energy and Energy Density	1	09-3-2023			
24.	Concept of Inductance	1	13-3-2023			
25.	Problem Solving	1	14-3-2023			
26.	Problem Solving	1	15-3-2023			
No. of classes required to complete UNIT-II		10	No. of classes taken			

UNIT-III (First Half Unit): Maxwell's Equations

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Time varying Fields, Faradays Law, Continuity Equation	1	16-3-2023			
28.	Inconsistency of Ampere's Law, Displacement Current Density	1	20-3-2023			
29.	Time Varying Four Maxwell's Equations	1	21-3-2023			
30.	Boundary Conditions	1	23-3-2023			
No. of classes required to complete UNIT-III(First Half - 50%)		4	No. of classes taken			

UNIT-III (Second Half Unit): Electromagnetic Waves-I

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Introduction to EM Waves-Scalar, Vector Form, Solution of EM Wave Equations	1	03-4-2023			
32.	Intrinsic Impedance, Attenuation and Phase Constants, Loss Tangent, Velocity and Wavelength of EM Wave	1	04-4-2023			
33.	Wave Propagation in Lossy Dielectrics	1	06-4-2023			
34.	Wave Propagation in Lossless Dielectrics	1	10-4-2023			
35.	Wave Propagation in Free Space	1	11-4-2023			
36.	Wave Propagation in Good Conductors	1	12-4-2023			
37.	Polarization-Linear, Circular & Elliptical	1	13-4-2023			
38.	Problem Solving	1	17-4-2023			
39.	Problem Solving	1	18-4-2023			
40.	Problem Solving	1	19-4-2023			
No. of classes required to complete UNIT-III. (Second Half - 50%)		10	No. of classes taken			

UNIT-IV: Electromagnetic Waves-II

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41.	Poynting Vector-Time Average Power, Power Loss in a Plane Conductor	1	20-4-2023			
42.	Poynting Theorem	1	24-4-2023			
43.	Reflection of a Plane Wave at Normal Incidence – Dielectric-Dielectric	1	25-4-2023			
44.	Reflection of a Plane Wave at Normal Incidence – Dielectric-Conductor	1	26-4-2023			
45.	Reflection of a Plane Wave at Oblique Incidence– Parallel Polarization	1	27-4-2023			
46.	Reflection of a Plane Wave at Oblique Incidence–Perpendicular Polarization	1	01-5-2023			
47.	Brewster Angle, Critical Angle and Total Internal reflection, Surface Impedance	1	02-5-2023			
48.	Problem Solving	1	03-5-2023			
49.	Problem Solving	1	04-5-2023			
50.	Problem Solving	1	08-5-2023			
No. of classes required to complete UNIT-IV		10	No. of classes taken			

UNIT-V: Transmission Lines

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51.	Types of Transmission Lines, Transmission Lines Equations	1	09-5-2023			
52.	Primary and Secondary Constants of a Transmission Line	1	10-5-2023			
53.	Lossless, Distortion less, Low loss Transmission lines, Concept of Loading	1	11-5-2023			
54.	Input Impedance of a Transmission Line, Reflection Coefficient, VSWR	1	15-5-2023			
55.	Short Circuit, Open Circuit and Matched Lines	1	16-5-2023			
56.	Smith Chart and Applications	1	17-5-2023			
57.	Problem Solving	1	18-5-2023			
58.	Problem Solving	1	22-5-2023			
59.	Problem Solving	1	23-5-2023			
No. of classes required to complete UNIT-V		**9**	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
60.	Antenna and Wave Propagation	1	24-5-2023			
61.	Microwaves	1	25-5-2023			

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.

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

PO 10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. B. Siva Hari Prasad	Dr. B. Siva Hari Prasad	Dr. B. Y.V.N.R.Swamy	Dr.Y.Amar Babu

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ELECTRONIC AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. Shaheda Niloufer
Course Name & Code : Environmental Science & 20MC03
L-T-P Structure : 2-0-0 Credits : 0
Program/Sem/Sec : B.Tech., ECE-C., IV-Sem., SEC-C A.Y : 2022-23

PRE-REQUISITE:

COURSE EDUCATIONAL OBJECTIVES (CEOs): The purpose of this course is to provide a general background on developing an understanding of systems and cycles on the earth and how individual organisms live together in complex communities and how human activities influence our air, water and soil. It also helps in developing an understanding about our use of fossil fuels and effect on climate and sustainable management of natural resources.

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

CO 1	Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions.
CO 2	Evaluate local, regional and global environmental issues related to resources and their sustainable management.
CO 3	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO 4	Acknowledge and prevent the problems related to pollution of air, water and soil.
CO5	Identify the significance of implementing environmental laws and abatement devices for environmental management.

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	3	3	-	-	-	3	-	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	3	-	-	-
CO3	3	-	3	-	-	-	2	-	-	-	-	2	-	-	-
CO4	3	-	-	-	-	2	3	2	-	-	-	3	-	-	-
CO5	3	3	3	3	-	3	3	3	-	-	-	3	-	-	-

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

TEXT BOOKS:

T1 Anubha Kaushik, C.P.Kaushik, "Perspectives in Environmental Studies", New age international publishers, 5th Edition, Delhi, 2016.

T2 Mahua Basu, S. Xavier, "Fundamentals of Environmental Studies", Cambridge University Press, 1st Edition, Delhi, 2016.

REFERENCE BOOKS:

R1 S. Deswal, A. Deswal, "A Basic course in Environmental Studies", Educational & Technical Publishers, 2nd Edition, Delhi, 2014.

R2 R. Rajagopalan, "*Environmental Studies (From Crisis to Cure)*", Oxford University Press, 2nd Edition, New Delhi, 2012.
R3 De, A.K, "Environmental Chemistry", New Age International (P) Limited, 5th Edition, New Delhi, 2003.
R4 Dr.K.V.S.G. Murali Krishna, "Environmental Studies", VGS Techno Series, 1st Edition, Vijayawada, 2010.
R5 G. Tyler Miller, Scott Spoolman, "Introduction to Environmental Studies", Cengage Learning, 13th Edition, New Delhi, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: NATURE AND SCOPE OF ENVIRONMENTAL 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
1.	Introduction of course and course objectives. Introduction of components of Environment	1	30-01-2023		2	
2.	Population explosion and variations among Nations.	1	01-02-2023		2	
3.	Resettlement and Rehabilitation - Issues and possible solutions	1	06-02-2023		2	
4.	Environmental Hazards	1	08-02-2023		2	
5.	Role of Information Technology in environmental management and human health.	1	13-02-2023		2	
No. of classes required to complete UNIT-I: 5				No. of classes taken:		

UNIT-II: NATURAL RESOURCES AND CONSERVATION

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 and classification of Natural resources, Forest Resources,	1	15-02-2023		2	
2.	Water Resources	1	20-02-2023		2	
3.	Mineral Resources	1	22-02-2023		2	
4.	Food Resources	1	27-02-2023		2	
5.	Food Resources	1	01-03-2023		2	
6.	Food Resources	1	06-03-2023		2	
7.	Energy Resources	1	08-03-2023		2	
No. of classes required to complete UNIT-II: 6				No. of classes taken:		

UNIT-III: ECOLOGY AND BIODIVERSITY

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.	Definition, structure and functions of an ecosystem	1	13-03-2023		2	
2.	Food chains and Food webs, Ecological succession, Ecological pyramids,	1	15-03-2023		2	
3.	Major Types of Ecosystems – Forest, Grassland, Desert Land & aquatic Ecosystem, Ecological Niche and Keystone Species, Bio-	1	20-03-2023		2	

	geographical classification of India. India as a mega diversity nation					
4.	Bio-geo-chemical cycles	1	22-03-2023			
5.	**I MID EXAMINATION**	1	27-03-2023			
6.	**I MID EXAMINATION**	1	29-03-2023			
7.	Values of biodiversity- Direct and Indirect values. Threats to biodiversity; Assignment in Unit II	1	03-04-2023		2	
8.	Man and wild life conflicts. Endangered and endemic species of India	1	05-04-2023		2,3	
9.	Conservation of biodiversity: In-situ and Ex-situ conservation methods	1	10-04-2023		2	
No. of classes required to complete UNIT-III: 7				No. of classes taken:		

UNIT-IV : ENVIRONMENTAL POLLUTION

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.	Air Pollution	1	12-04-2023		2	
2.	Causes, effects and control measures of: Water Pollution	1	17-04-2023		2	
3.	Causes, effects and control measures of: Soil Pollution,	1	19-04-2023			
4.	Noise Pollution		24-04-2023			
5.	Solid Waste Management	1	26-04-2023		2,3	
6.	Disaster Management- Floods, Cyclones, Earthquakes, Landslides and Tsunamis.	1	01-05-2023		2	
No. of classes required to complete UNIT-IV: 6				No. of classes taken:		

UNIT-V : ENVIRONMENTAL MANAGEMENT

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.	Sustainable Development	1	03-05-2023		2	
2.	Climate disruption-Greenhouse effect, ozone layer depletion and acid rain.	1	08-05-2023		2,3	
3.	Stockholm conference	1	10-05-2023		2	
4.	Environmental Impact Assessment (EIA)		15-05-2023		2	
5.	Green building	1	17-05-2023		2	
6.	Environmental Law	1	22-05-2023		2	
7.	Revision	1	24-05-2023		2,3	
8.	II MID EXAMINATIONS	1	05-06-2023			
9.	II MID EXAMINATIONS	1	07-06-2023			
No. of classes required to complete UNIT-V: 07				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)

TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (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 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.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr. Shaheda Niloufer	Dr. Shaheda Niloufer	Dr. Shaheda Niloufer	Dr. A. Rami Reddy
Signature				

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ECE

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.P.Lachi Reddy / Dr.K.Ravi kumar
Mr.P.Venkateswara Rao /Ms.G.Asha

Course Name & Code : Programming using Python Lab-20AD53 **Regulation**: R20
L-T-P Structure : 1-0-2 **Credits:** 02
Program/Sem/Sec : B. Tech. IV-Sem., ECE-C Sec **A.Y.:** 2022-23

PRE REQUISITE: Programming Languages like C Language.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of python course is to lead the students from the basics of writing and running python scripts in problem solving and also to design and implement the modules and understands the working of classes and objects in python.

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

CO1	**Identify** various programming constructs available in Python and **apply** them in solving computational problems **(Apply- L3)**
CO2	**Demonstrate** data structures available in Python and **apply** them in solving computational problems **(Apply- L3)**
CO3	**Implement** modular programming, string manipulations and Python Libraries **(Apply- L3)**
CO4	**Improve** individual / teamwork skills, communication & report writing skills with ethical values

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

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

TEXTBOOKS:

T1 Reema Thareja,"Python Programming Using Problem Solving Approach ", Oxford Publications

T2 Python for Everybody: Exploring Data In Python 3by Dr. Charles Russell Severance, Sue Blumenberg

REFERENCE BOOKS:

R1 Gowri Shankar, Sand Veena,"Introduction to Python Programming", CRC Press, Taylor, and Francis Group– Achapman & Hallbook.

PART-B

THEORY

S.No	Topics to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	CO's, Introduction, Language basics	1	31-01-2023		TLM1	
2.	Variables, Operators, data types, Constructs	2	31-01-2023		TLM1	
3.	Language Basics and Example programs on data types usage	2	07-02-2023		TLM1	
4.	Language Basics and Example programs on loops	1	07-02-2023		TLM1	
5.	Lists in python- introduction, methods and built in functions	1	21-02-2023		TLM1	
6.	Tuples in python- introduction, methods, examples	1	28-02-2023		TLM1	
7.	Sets in python- union, intersection, difference, comparisons, examples	1	07-03-2023		TLM1	
8.	Dictionaries in python- sorting, keys, concatenation, mapping, examples	1	14-03-2023		TLM1	
9.	Functions & Recursions- defining functions in python, examples	1	21-03-2023		TLM1	
10.	Strings in python- different string operations, string length comparisons, examples	2	04-04-2023 11-04-2023		TLM1	
11.	Regular expressions in python- checking the validity of string/password, examples	2	18-04-2023 25-04-2023		TLM1	
12.	Matplotlib Library in python- line, plot, multiple plots, bar chart, examples,pie chart, scatter plot, examples	1	02-05-2023		TLM1	
Number of classes required:		16	No. of classes conducted:			

LAB

COURSE DELIVERY PLAN (LESSON PLAN)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction: Language Basics and Example Problems	3	14-02-2023		TLM1	
2.	Introduction: Language Basics and Example Problems	2	21-02-2023		TLM4	
3.	Module 1: Exercise Programs on Lists	2	28-02-2023		TLM4	
4.	Module 2: Exercise Programs on Tuples	2	07-03-2023		TLM4	
5.	Module 3: Exercise Programs on Sets	2	14-03-2023		TLM4	
6.	Module 4: Exercise Programs on Dictionaries	2	21-03-2023		TLM4	
7.	Module 5: Exercise Programs on Functions and Recursion	4	04-04-2023 11-04-2023		TLM4	
8.	Module 6: Exercise Programs on Strings	4	18-04-2023 25-04-2023		TLM4	
9.	Module 7: Exercise Programs on Regular Expressions	2	02-05-2023		TLM4	
10.	Module 8: Exercise Programs on Matplot Library	3	09-05-2023		TLM4	
11.	Internal Lab Exam	3	23-05-2023		-	
No. of classes required to complete - 29				**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
12.	Signal processing application using python	3	16-05-2023		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	Exp 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 EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and

	responsibilities and norms of the engineering practice
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Design and develop modern communication technologies for building the inter disciplinary 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

Date:

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr.P.Lachi Reddy**	**Dr.K.Ravi Kumar**	**Dr. B.Poornaiah**	**Dr. Y. Amar Babu**
Signature				

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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. M V Sudhakar / Mr. M K Linga Murthy / Mrs. B Rajeswari Mr. M Siva Sankara Rao / Prof. B Ramesh Reddy

Course Name & Code : Digital Signal Processing Lab – 20EC55

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

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section- C **A.Y :** 2022-23

Pre-Requisites: C – Programming, Basic Definitions of signals and systems.

Course Objectives: This course provides generation of basic signals and operations on signals. This course also provides design of IIR filters using Butterworth and Chebyshev approximation techniques and FIR filters using windowing techniques. This course also gives the knowledge about DSP Processors.

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

CO 1	**Understand** the generation and operations of signals using MATLAB. **(Understand – L2)**
CO 2	**Analyze** the signals in time and frequency domains using MATLAB and Code Composer Studio.**(Analyze – L4)**
CO 3	**Design** IIR and FIR Filters and obtain their frequency response using MATLAB.**(Apply – L3)**
CO 4	**Adapt** effective communication, presentation skills and report writing.**(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	2	3	-	-	1	-	-	-	-	-	-	2	-	-	2
CO3	2	2	3	1	2	-	-	-	-	-	-	2	-	-	2
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).

TEXT BOOK(S):

T1 Rudra Pratap, "*MATLAB Getting Started with MATLAB 7*", oxford university press,
T2 Tarun Kumar Rawat, "Digital Signal Processing", oxford university press,2015

DSP LAB SCHEDULE (LESSON PLAN): Section-A
Wednesday – 21761A04D0 to 21761A04J4 & 22765A0416 to 22765A0423

PART-B

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 DSP Lab experiments, COs, Pos and PSOs	--	3	04.02.2023			
Cycle – I – MATLAB Software							
1	Generation of Discrete Time (DT) signals and Operations on DT signals	CO1	3	18.02.2023			
2, 3	Linear Convolution and Circular Convolution	CO2	3	25.02.2023			
4	Computation of N-Point DFT and IDFT.	CO2	3	04.03.2023			
5,6	Linear and Circular Convolution Using DFT & IDFT, Power Spectral Density for sinusoidal signal.	CO2	3	18.03.2023			
7	Design of Digital IIR butter worth filter using Bi-linear Transformation.	CO3	3	25.03.2023			
8	Design of Digital IIR Chebyshev filter using Bi-linear Transformation	CO3	3	15.04.2023			
9	Design of FIR filters using window techniques	CO3	3	29.04.2023			
Cycle – II - Code Composer Studio Simulation Software and DSPProcessors							
10, 11	Linear Convolution and Circular Convolution	CO2	3	06.05.2023			
12	Computation DFT & Content Beyond the Experiment	CO2	3	20.05.2023			
--	Internal Lab Examination	--	3	27.05.2023			
No. of classes required to complete Lab			**33**	No. of classes conducted:			

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 (Viva =2M & Experiment Conduction =3M) = **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 interdisciplinary skills to meet current and future needs of industry.

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

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

Date: 01.02.2023

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. M V Sudhakar	Mr. M Siva Sankara Rao	Dr. G L N Murthy	Dr. Y Amar Babu

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

Part-A

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Analog Communications Lab – 20EC56

L-T-P STRUCTURE : 0-0-2

COURSE CREDITS : 1

COURSE INSTRUCTOR : Mrs. M. V. L. Bhavani / Mr. Ch. Siva Rama Krishna/ Ms. G. Asha/ Dr. A. Narendra Babu

COURSE COORDINATOR : Dr. G. L. N. Murthy

COURSE OBJECTIVES: This course provides the practical exposure on analog communication schemes and gives the practical knowledge about pulse modulation techniques used in communication systems. It also gives the knowledge on implementation of continuous wave and pulse modulation schemes using MATLAB..

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

CO1 : Demonstrate the practical aspects of continuous wave modulation schemes.**(Understand – L2)**
CO2 : Construct the circuits for studying pulse modulation techniques. **(Apply – L3)**
CO3 : Apply the programming aspects of MATLAB in simulation of continuous wave and pulse modulation techniques**(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	3	3	1	-	1	-	-	-	-	-	-	-	2	-	-
CO2	2	3	1	-	1	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	-	-	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	03.02.2023		-	TLM1	
2.	Experiment-1	3	10.02.2023		COs 1,4	TLM4	
3.	Experiment-2	3	17.02.2023		COs 1,4	TLM4	
4.	Experiment-3	3	24.02.2023		COs 1,4	TLM4	
5.	Experiment -4	3	03.03.2023		COs1,2,4	TLM4	
6.	Experiment-9	3	10.03.2023		COs 3,4	TLM4	
7.	Experiment-10	3	17.03.2023		COs 3,4	TLM4	
8.	Experiment-5	3	24.03.2023		COs2,4	TLM4	
9.	Experiment-6	3	07.04.2023		COs1,4	TLM4	
10.	Experiment-7	3	14.04.2023		COs 1,4	TLM4	
11.	Experiment-8	3	21.04.2023		COs 2,4	TLM4	
12.	Experiment-11	3	28.04.2023		COs 3,4	TLM4	
13.	Experiment-12	3	05.05.2023		COs 3,4	TLM4	
14.	Revision	3	12.05.2023		-	-	
15.	Revision	3	19.05.2023		-	-	
16.	Internal exam	3	26.05.2023		-	-	

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, Experiment-1	3	04.02.2023		COs 1,4	TLM1	
2.	Experiments-2	3	25.02.2023		COs 1,4	TLM4	
3.	Experiment-3,4	3	04.03.2023		COs 1,4	TLM4	
4.	Experiment-9,10	3	18.03.2023		COs 3,4	TLM4	
5.	Experiment-5,6	3	25.03.2023		Cos 2,4	TLM4	
6.	Experiment-7	3	15.04.2023		COs 1,4	TLM4	
7.	Experiment-8	3	29.04.2023		COs 2,4	TLM4	
8.	Experiment-11,12	3	06.05.2023		COs 3,4	TLM4	
9.	Revision	3	20.05.2023		-	-	
10.	Internal exam	3	27.05.2023		-	-	

List of Experiments:

Exp. No	Experiments to be conducted	Exp. No	Experiments to be conducted
CYCLE-1			CYCLE-2
1.	Generate the Amplitude modulated (AM) signal for different modulation indices and reconstruct the original signal.	5	Estimate the cutoff frequencies for Pre emphasis and De-emphasis circuits.
2.	Demonstrate the generation of Frequency modulated signal and reconstruction of original signal.	6	Generate the Pulse Amplitude Modulated signal and reconstruct the original signal using low pass filter
3.	Use product modulator to generate double sideband suppressed carrier AM signal and demodulate the signal using Synchronous detector.	7	Construct circuits for generating the Pulse width and Pulse position modulated signals using IC555 and perform demodulation to reconstruct the message signal
4.	Apply phase shift method for generating the Single sideband modulated AM signal and demodulate using coherent detector.	8	Generation of sampled signal for different sampling rates and verify sampling theorem for efficient reconstruction.
9.	Amplitude Modulation and Demodulation (Simulation Using MATLAB)	11	Pulse Amplitude Modulation techniques (Simulation Using MATLAB)
10	Frequency Modulation and Demodulation (Simulation Using MATLAB)	12	Frequency modulation and demodulation (Simulation Using MATLAB)

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.
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

Mrs. M V L Bhavani	Dr. G L N Murthy	Dr.M.V.Sudhakar	Dr.Y.Amar Babu
Course Instructor	Course Coordinator	Module Coordinator	HOD

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 HANDOUT

PART-A

Name of Course Instructor : Dr. T. Satyanarayana

Course Name & Code : MODELING, DESIGN AND PROTOTYPING – 20ECS2

L-T-P Structure : 1-0-2 Credits : 2

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section- C A.Y : 2022-23

Pre-requisites: C-Programming, Pulse and Digital Circuits.

Course Educational Objectives: In this course, students will learn about how to build an engineering application with LabVIEW software and associated hardware.

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

CO1	Understand the programming concept of virtual instruments. (**Understand – L2**)
CO2	Develop real time applications using loops, formula nodes, array, clusters and DAQ. (**Apply – L3**)
CO3	Adopt 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	3	2	-	-	2	-	-	-	-	-	-	1	1	2	1
CO2	3	2	2	-	2	-	-	-	2	-	-	1	1	2	1
CO3	-	-	-	-	-	-	-	-	2	2	-	-	1	2	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).

TEXT BOOK(S):

T1 S. Sumathi, P.Surekha, Virtual Instrumentation with LabVIEW, ACME Learning Pvt. Ltd.,2007.

T2 Jeffrey Travis, Jimkring, LabVIEW for Everyone, Pearson Education, 2009.

REFERENCE BOOK(S):

R1 Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI Learning Pvt. Ltd., 2006.

R2 Rick Bitter, Taqi Mohiuddin, Matt Nawrocki – LabVIEW Advanced Programming Techniques, CRC Press, 2009.

Part – A: Theory (Monday)

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	06-02-2023		TLM2	
2.	VI and Data operations	1	13-02-2023		TLM2	
3.	VI front and block panel	1	20-02-2023		TLM2	
4.	Data flow programming	1	27-02-2023		TLM2	
5.	Graph programming	1	06-03-2023		TLM2	
6.	Loops, Arrays applications	1	13-03-2023		TLM2	
7.	Concepts of VI& Sub VIs	1	20-03-2023		TLM2	
8.	Applications of sequence structures	1	03-04-2023		TLM2	
9.	Waveforms and Graphs	1	10-04-2023		TLM2	
10.	Applications	1	17-04-2023		TLM2	
11.	Modules	1	24-04-2023		TLM2	
12.	NI Hardware	1	01-05-2023		TLM2	
13.	DAQ Installation and configuration	1	08-05-2023		TLM2	
14.	Applications	1	15-05-2023		TLM2	
15.	DAQ Hardware & Conclusion	1	22-05-2023		TLM2	

PART – B: Friday Batch

S.No.	Topics	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Virtual Instruments, COs, Numeric	3	03-02-2023		TLM2	
2.	Boolean and compound operations	3	10-02-2023		TLM4	
3.	For and while loops	3	17-02-2023		TLM4	
4.	Structures, Timers	3	24-02-2023		TLM4	
5.	Arrays & Clusters	3	03-03-2023		TLM4	
6.	Formula node, Sub VI	3	10-03-2023		TLM4	
7.	Files	3	17-03-2023		TLM4	
8.	DAQ – installation, Application	3	24-03-2023		TLM4	
9.	Analog applications	3	21-04-2023		TLM4	
10.	Digital applications	3	28-04-2023		TLM4	
11.	Discussion of Models & Demo	3	05-05-2023		TLM2	

12.	Discussion of Models & Demo	3	12-05-2023		TLM2	
13.	Discussion of Models & Demo	3	19-05-2023		TLM2	
14.	Discussion of Models, Conclusion & Reports	3	26-05-2023		TLM6	

PART B – Saturday Batch

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion		HOD Sign Weekly
1.	Virtual Instruments, Cos, Numeric	3	04-02-2023		TLM4	
2.	Boolean and compound operations	3	11-02-2023		TLM4	
3.	For and while loops	3	25-02-2023		TLM4	
4.	Structures, Timers	3	04-03-2023		TLM4	
5.	Arrays & Clusters	3	11-03-2023		TLM4	
6.	Formula node, Sub VI	3	18-03-2023		TLM4	
7.	Files	3	25-03-2023		TLM4	
8.	DAQ – installation, Application	3	08-04-2023		TLM4	
9.	Analog applications	3	15-04-2023		TLM4	
10.	Digital applications	3	29-04-2023		TLM2	
11.	Discussion of Models & Demo	3	06-05-2023		TLM2	
12.	Discussion of Models & Demo	3	13-05-2023		TLM2	
13.	Conclusion of Models	3	20-05-2023		TLM2	
14.	Documentation Verification & Reports	3	27-05-2023		TLM6	

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

EVALUATION PROCESS:

Report	**10**
Quality of work	10
Presentation	20
Interaction / Queries	10
Total	50

PART-D

PROGRAMME OUTCOMES (POs):

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

Date:

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Dr. T. Satyanarayana	Dr P. Rakesh Kumar	Dr B. Poornaiah	Dr Y Amar Babu