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

COURSE HANDOUT

PART: A

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section –A
Academic Year : 2025-26
Course Name & Code : **Analog & Digital IC Applications**– 23EC08
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr.Poornaiah Billa

Course Objectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

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

CO 1	Apply the operational principles and characteristics of op-amps to design and analyze analog circuits such as amplifiers and active filters.(**Apply-L3**)	L3
CO 2	Design waveform generators and comparator circuits using op-amps for signal processing applications.(**Apply-L3**)	L3
CO 3	Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications. (**Apply-L3**)	L3
CO 4	Construct combinational logic circuits using digital ICs.(**Apply-L3**)	L3
CO 5	Develop sequential circuits using flip-flops, counters, and shift registers, and analyse their use in digital memory systems, including ROM, RAM, and their variants. (**Analyse-L4**)	L4

Course Articulation Matrix-Correlation between COs, Pos & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	1	2	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO 5	2	3	2							-	1	2		2	

CorrelationLevels:**1**-Slight(Low),**2**-Moderate(Medium),**3**-Substantial(High)andNocorrelation:**'-'**

Textbooks(T)andReferences(R):

TEXTBOOKS:

1. RamakanthA.Gayakwad-Op-Amps&LinearICs,PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,PearsonEducation,2005.

REFERENCEBOOKS:

1. D.Roy Chowdhury–Linear Integrated Circuits, New Age International(p) Ltd,2nd Ed.,2003.
2. John.F.Wakerly–Digital Design Principles and Practices, 3rd Ed.,Pearson,2009.
3. Salivahana-Linear Integrated Circuits and Applications,TMH,2008.
4. William D. Stanley-Operational Amplifiers with Linear Integrated Circuits,4th Ed. Pearson Education India, 2009

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I:Operational Amplifiers

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Ideal and Practical Op-Amp	1	01-07-25		TLM2	
2.	Op-Amp Characteristics	1	04-07-25		TLM2	
3.	DCCharacteristics	1	05-07-25		TLM1	
4.	AC Characteristics	1	05-07-25		TLM1	
5.	Features of 741 Op-Amp	1	08-07-25		TLM1	
6.	Modes of Operation-Inverting, Non-Inverting, Differential	1	11-07-25		TLM1	
7.	Instrumentation Amplifier, AC Amplifier	1	15-07-25		TLM1	
8.	Differentiators and Integrators	1	18-07-25		TLM1	
9.	Comparators	1	18-07-25		TLM1	
10.	Schmitt Trigger	1	22-07-25		TLM1	
11.	Introduction to Voltage Regulators	1	25-07-25		TLM1	
12.	Features of 723 Regulator	1	29-07-25		TLM1	
13.	Three Terminal Voltage Regulators	1	01-08-25		TLM1	
No.of classes required to complete UNIT-I :13			**No. ofclassestaken:**			

UNIT-II:Op-Amps, IC-555 & IC565 Applications

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 Active Filters	1	02-08-25		TLM1	
2.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	02-08-25		TLM1	
3.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	05-08-25		TLM1	
4.	Characteristics of Band pass, Band reject and All Pass Filters	1	08-08-25		TLM1	
5.	Characteristics of Band pass, Band reject and All Pass Filters	1	09-08-25		TLM1	
6.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	09-08-25		TLM1	
7.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	12-08-25		TLM1	
8.	IC555 Timer-Functional	1	19-08-25		TLM1	
9.	Monostable and Astable Operations	1	22-08-25		TLM1	
10.	Monostable and Astable Applications	1	23-08-25		TLM1	
11.	IC565 PLL- principle and Applications	1	23-08-25		TLM1	
No.of classes required to complete UNIT-II:11			**No. of classes taken:**			

UNIT-III:Data Converters

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Data Converters: Introduction, Basic DAC techniques, Different types of DACs	1	02-09-25		TLM2	
2.	Weighted resistor DAC	1	05-09-25		TLM2	
3.	R-2R ladder DAC and Inverted R-2R DAC	1	06-09-25		TLM2	
4.	Different Types of ADCs	1	06-09-25		TLM2	
5.	Parallel Comparator Type ADC	1	09-09-25		TLM2	
6.	Counter Type ADC	1	12-09-25		TLM2	
7.	Successive Approximation ADC	1	13-09-25		TLM2	
8	Dual Slope ADC	1	13-09-25		TLM2	
9.	DAC and ADC Specifications	1	16-09-25		TLM2	
No.of classes required to complete UNIT-III:9			**No. ofclassestaken:**			

UNIT-IV:Combinational Logic ICs

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**Combinational Logic ICs:** Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs	1	19-09-25		TLM2	
2.	Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs	1	20-09-25		TLM2	
3.	Code Converters	1	20-09-25		TLM2	
4.	Decoders, LED & LCD Decoders with Drivers	1	23-09-25		TLM2	
5.	Encoders, Priority Encoders	1	26-09-25		TLM2	
6.	Multiplexers, De-multiplexers	1	27-09-25		TLM2	
7.	Priority Generators/Checkers	1	27-09-25		TLM2	
8.	Parallel Binary Adder/Subtractor	1	07-10-25		TLM2	
9.	Magnitude Comparators	1	10-10-25		TLM2	
No.of classes required to complete UNIT-IV: 09			**No. ofclassestaken:**			

UNIT-V: Sequential Logic IC's and Memories

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Sequential Logic IC's and Memories:	1	11-10-25		TLM2	
2.	Familiarity with commonly available 74XX & CMOS40XX Series ICs	1	11-10-25		TLM2	
3.	All Types of Flip-flops	1	14-10-25		TLM2	
4.	Synchronous Counters	1	17-10-25		TLM2	
5.	Decade Counters	1	18-10-25		TLM2	
6.	Shift Registers.	1	18-10-25		TLM2	
7.	Memories:	1	24-10-25		TLM2	
8.	ROM Architecture	1	25-10-25		TLM2	
9.	Types of ROMS & Applications	1	25-10-25		TLM2	
10.	RAM Architecture	1	28-10-25		TLM2	
11.	Static & Dynamic RAMs	1	31-10-25		TLM2	
12	Assignment-2	1	01-11-25		TLM2	
No.of classes required to complete UNIT-V:14			**No. ofclassestaken:**			

Content 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.	Introduction to VLSI	1	01-11-25			

TeachingLearningMethods

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

PART-C: EVALUATION PROCESS:

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

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

Program Specific Outcomes (PSOs):

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

Date:01-07-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. Poornaiah Billa	Dr. B.Y.V.N.R.Swamy	Dr.B.V.N.R. Siva kumar	Dr.G.Srinivasulu

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section – A
Academic Year : 2025-26
Course Name & Code : **Digital Communications– 23EC09**
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr. K. Ravi Kumar

Course Objectives:

1	To get basic knowledge on different digital modulation techniques.
2	To know the different concepts on information theory, block codes and convolution codes.
3	To Learn the complete information regarding the design of optimum receivers for digital communication systems and their performance analysis.

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

CO1	**Understand** the principles and components of digital communication system, sampling, quantization, and modulation techniques.	L2
CO2	**Summarize** the concepts of baseband and passband digital modulation techniques in terms of signal representation and system design.	L2
CO3	**Evaluate** the performance of digital modulation schemes, using signal-to-noise ratio (SNR), bit error rate (BER),and probability of error, under noisy channel conditions.	L3
CO4	**Apply** error control coding methods to enhance data transmission efficiency and reliability.	L3

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

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

Correlation Levels: **1.** Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

Textbooks (T):

T1 Simon Haykin, *"Digital Communications"*,John Wiley & sons, 2nd Edition.
T2 Taub and Schilling, *"Principles of Communication Systems"*, TMH Publications, 3rd edition

Reference Books(R)

R1 J. S. Chitode, *"Digital Communications"*,Technical Publications, first edition
R2 V.Chandra Sekar**,** *"Communication Systems"*,Oxford University Press**.**
R3 Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, Pearson Education India, 2010

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - A

UNIT-I: Introduction to Digital Communication

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 Digital communication, Analog and Digital signals.	1	30-06-25			
2.	Need for Digital Communication.	1	01-07-25			
3.	Line Codes- Unipolar, Polar and Bipolar	1	02-07-25			
4.	Elements of a Digital Communication System.	1	04-07-25			
5.	Sampling, quantization, Types of quantization, Quantization noise and error	1	07-07-25			
6.	Need for non-uniform quantization, Companding- μ-law, A-law	1	08-07-25			
7.	Source encoder- decoder, Channel Encoder-decoder.	1	09-07-25			
8.	Application of TDM in Telephony, Problems related to TDM	1	11-07-25		Innovative	
9.	Bit Rate, Baud Rate, System Bandwidth, Channel Bandwidth	1	14-07-25			
10.	Characteristics of channel and types of channels.	1	15-07-25			
11.	Tutorial-I	1	16-07-25			
12.	Revision	1	18-07-25			
No. of classes required to complete UNIT-I:		**12**	**No. of classes taken:**			

UNIT-II: Pulse Digital Modulation

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Block diagram of Pulse Code Modulation,	1	21-07-25			
14.	Regenerative repeaters	1	22-07-25			
15.	Bandwidth for PCM, Quantization noise.	1	23-07-25			
16.	Output Signal to noise ratio in PCM	1	25-07-25			
17.	Delta Modulation-Transmitter	1	28-07-25			
18.	Delta Modulation-Receiver.	1	29-07-25			
19.	Bandwidth for DM, Effect of noise in DM - slope overload distortion.	1	30-07-25			
20.	Granular noise, Adaptive Delta Modulation Transmitter Block diagram	1	01-07-25			
21.	ADM -Receiver	1	04-08-25		Innovative	
22.	Comparison of PCM , DM , ADM	1	05-08-25			
23.	Tutorial-II	1	06-08-25			
24.	Revision	1	08-08-25			
No. of classes required to complete UNIT-II :12			**No. of classes taken:**			

UNIT-III: Digital Modulation Techniques

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Digital modulation types	1	11-08-25			
26.	Coherent Binary Modulation Techniques: BASK	1	12-08-25			
27.	Binary Phase Shift Keying(BPSK)	1	13-08-25			
28.	Binary Frequency Shift Keying(BFSK)	1	18-08-25			
29.	Quadrature Phase shift Keying (QPSK)	1	19-08-25			
30.	M-ary Modulation techniques	1	20-08-25			
31.	Bandwidth efficiency for M-ary PSK	1	22-08-25			
32.	Bandwidth efficiency for M-ary FSK	1	01-09-25			
33.	Non Coherent Digital modulation techniques: ASK,	1	02-09-25			
34.	Non Coherent Digital modulation techniques: FSK and QPSK	1	03-09-25			
35.	Quadrature AmplitudeModulation QAM.	1	05-09-25		Innovative	
36.	Tutorial-III	1	08-09-25			
No. of classes required to complete UNIT-III:12			**No. of classes taken:**			

UNIT-IV: Optimal Reception of Digital Signal

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Model of digital communication system	1	09-09-25			
38.	signal detection in noise,	1	10-09-25			
39.	Receiver Techniques: Correlation receiver.	1	12-09-25			
40.	Probability of error for Coherent BASK,	1	15-09-25			
41.	Probability of error for Coherent BPSK,	1	16-09-25			
42.	Probability of error for Coherent BFSK,	1	17-09-25			
43.	Probability of error for non-coherent FSK and DPSK	1	19-09-25			
44.	Bit Error Rate Vs Signal to Noise Ratio for M-ary FSK	1	22-09-25			
45.	Bit Error Rate Vs Signal to Noise Ratio for M-ary PSK	2	23-09-25 24-09-25		Innovative	
46.	Tutorial-IV	1	26-09-25			
No. of classes required to complete UNIT-IV:11			**No. of classes taken:**			

UNIT-V: Linear Block Codes

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Matrix description of Linear Block codes	1	06-10-25			
48.	Syndrome Decoding.	1	07-10-25			
49.	Hamming codes- encoding and decoding	1	08-10-25			
50.	Binary Cyclic Codes-Algebraic structure	1	10-10-25 13-10-25			
51.	Systematic and Non Systematic form, Encoding, Syndrome calculation.	1	14-10-25			
52.	**Convolution Codes:** Encoding of Convolution Codes	1	15-10-25			
53.	Time domain approach, Transform domain approach	1	17-10-25			
54.	Graphical approach- State diagram, Code tree and Trellis diagram	1	20-10-25			
55.	Decoding of Convolution Codes- Viterbi decoding algorithm.	1	22-10-25	Innovative		
56.	Tutorial-V	1	24-10-25			
57.	Problem Solving Session	1	29-10-25			
58.	Revision	1	31-10-25			
No. of classes required to complete UNIT-V:12			**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
59.	Quadrature Amplitude Modulation **256-QAM**	**1**	27-10-2025			
60.	OFDM (Orthogonal Frequency Division Multiplexing)	**1**	28-10-2025			

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

PART-C: EVALUATION PROCESS:

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

PART-D:

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PO 10:	**Communication**: Communicate effectively on complex engineering activities with the

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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	Dr. K.Ravi Kumar	Dr. K.RaniRudrama	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC with 'A' Grade and NBA (ECE,EEE,CSE,IT,ME,CIV & ASE)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, NTR Dist, Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT
PART-A

Name of Course Instructor : Dr. B. Siva Hari Prasad
Course Name & Code : Antennas and Wave Propagation & 23EC10
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., V-Sem., Section- A A.Y:2025-26

Pre-Requisites: EM Waves and Transmission Lines.

Course Objectives: This course provides the knowledge on Antennas and Radiation fundamentals. The course will expose different types of Antennas and their applications. The course also gives the complete information regarding Propagation of Radio wave in atmosphere.

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

CO1	**Understand** fundamental antenna parameters and basic radiation mechanisms and characteristics of radio wave propagations **(Understand – L2)**
CO2	**Understand** the operation and characteristics of thin linear wire , loop antennas, HF, VHF and UHF Antennas **(Understand – L2)**
CO3	**Apply** principles of antenna array design to compute and interpret radiation patterns and directivity **(Apply – L3)**
CO4	**Analyze** wave propagation modes and antenna measurement setups using theoretical models and equations **(Analyze – L4)**

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

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

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

TEXT BOOK(S):

T1 Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & sons Publishers,2nd Edition

T2 John D. Kraus, "Antennas for all applications", TMH Publishers

REFERENCE BOOK(S):

R1 G.S.N Raju, "Antennas and Wave Propagation", Pearson Education Publishers.

R2 Jordan and Balmain, Electromagnetic fields and Radiating systems, Pearson Education Publishers.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: Antenna Fundamentals:

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	01-07-2025 02-07-2025		**TLM1**	
2.	Radiation mechanism-Single wire Antenna	1	05-07-2025		**TLM1**	
3.	Current Distribution on a thin wire antenna	1	05-07-2025		**TLM6**	
4.	Field Regions	1	08-07-2025		**TLM1**	
5.	Isotropic Radiators, Directional Antennas	1	09-07-2025		**TLM1**	
6.	Antenna Parameters**:** Radiation intensity, Radiation Pattern,	1	12-07-2025		**TLM2**	
7.	Total Power radiated	1	12-07-2025		**TLM1**	
8.	Gain, Directivity,	1	15-07-2025		**TLM2**	
9.	Radiation efficiency	1	16-07-2025 19-07-2025		**TLM1**	
10.	Power gain, HPBW, FNBW	1	19-07-2025		**TLM1**	
11.	Beam Efficiency, Bandwidth, Polarization	1	22-07-2025		**TLM6**	
12.	Effective aperture	1	23-07-2025 29-07-2025		**TLM1**	
13.	Effective length	1	30-07-2025		**TLM1**	
14.	Illustrated Problems	1	02-08-2025		**TLM1**	
No. of classes required to complete UNIT-I : 14			No. of classes taken :			

UNIT-II: THIN LINEAR WIRE ANTENNAS:

S. No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Retarded Potentials	1	02-08-2025		**TLM1**	
16.	Potential functions for sinusoidal oscillations	1	05-08-2025		**TLM1**	
17.	Analysis of Radiation fields of a Alternating current element	1	06-08-2025		**TLM6**	
18.	Quarter wave Monopole and half wave dipole	1	09-08-2025		**TLM1**	
19.	Power radiated by current element	1	09-08-2025		**TLM1**	
20.	Radiation resistance of current element, quarter wave Monopole and half wave dipole	1	12-08-2025		**TLM2**	
21.	End-Fire array	1	13-08-2025		**TLM1**	
22.	Method of pattern multiplication	1	19-08-2025		**TLM2**	
23.	Binomial array	1	20-08-2025		**TLM1**	
24.	Loop Antennas: Small Loops - Field		23-08-2025		**TLM1**	

	Components					
25.	Comparison of far fields of small loop and short dipole, Concept of short magnetic dipole		23-08-2025		**TLM1**	
26.	D and R_r relations for small loops	1	02-09-2025		**TLM1**	
No. of classes required to complete UNIT-II		**12**	No. of classes taken:			

UNIT-III: ANTENNA ARRAYS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	2 element arrays – different cases	1	02-09-2025 03-09-2025		**TLM1**	
28.	Principle of Pattern Multiplication	2	06-09-2025		**TLM1**	
29.	N element Uniform Linear Arrays – Broadside, End-fire Arrays	1	06-09-2025		**TLM1**	
30.	EFA with Increased Directivity, Derivation of their characteristics and comparison, Scanning Arrays	1	09-09-2025		**TLM2**	
31.	Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions,	1	10-09-2025 13-09-2025		**TLM2**	
32.	Design Relations Arrays with Parasitic Elements,	2	13-09-2025		**TLM1**	
33.	Yagi-Uda Antenna	1	16-09-2025		**TLM1**	
34.	Folded Dipoles and their characteristics	1	16-09-2025		**TLM1**	
No. of classes required to complete UNIT-III : 08				No. of classes taken:		

UNIT-IV: BROADBAND ANTENNAS & UHF AND MICROWAVE ANTENNAS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Log periodic antenna, Basic principle	2	17-09-2025		**TLM1**	
36.	Helical Antennas – Significance, Geometry, basic properties	1	20-09-2025		**TLM1**	
37.	Design considerations for monofilar helical antennas in Axial Mode and Normal Modes	2	20-09-2025		**TLM1**	
38.	Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns	2	23-09-2025 24-09-2025		**TLM1**	
39.	Paraboloidal Reflectors: Geometry, characteristics, types of feeds,	1	24-09-2025		**TLM1**	
40.	F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Case grain Feeds.	1	27-09-2025		**TLM1**	
41.	Microstrip Antennas-Introduction, Features, Advantages and Limitations	1	27-09-2025		**TLM1**	
42.	Rectangular Patch Antennas – Geometry and Parameters	1	01-10-2025		**TLM6**	
43.	Impact of different parameters on characteristics	1	04-10-2025		**TLM1**	

44.	Illustrated Problems.	1	07-10-2025		**TLM1**	
No. of classes required to complete UNIT-IV: 10			No. of classes taken:			

UNIT-V: ANTENNA MEASUREMENTS, WAVE PROPAGATION :

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	FRIIS Transmission Equation, Patterns Required	1	08-10-2025		**TLM1**	
46.	Set Up, Distance Criterion, Directivity	1	11-10-2025		**TLM1**	
47.	Gain Measurements (Comparison, Absolute and 3-Antenna Methods)	1	11-10-2025		**TLM1**	
48.	TYPES of propagations	1	14-10-2025		**TLM1**	
49.	Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics	1	15-10-2025		**TLM1**	
50.	Mechanism of Reflection and Refraction	1	18-10-2025		**TLM1**	
51.	Critical Frequency, MUF and Skip Distance	1	18-10-2025		**TLM1**	
52.	Space Wave Propagation – Mechanism	1	22-10-2025		**TLM1**	
53.	Fundamental Equation for free space Propagation	1	25-10-2025		**TLM1**	
54.	LOS and Radio Horizon	1	25-10-2025		**TLM2**	
55.	Field strength equation,	1	28-10-2025		**TLM1**	
No. of classes required to complete UNIT-V :11			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.	Design of microstrip patch Antennas	1	29-10-2023 01-11-2025		TLM2	

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

PART-C

EVALUATION PROCESS:

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

Semester End Examination (SEE) (Unit-I, Unit – II, Unit –III, Unit-IV and Unit-V)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

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(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
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NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt. T. Kalpana

Course Name & Code : Digital System Design Through HDL & 23EC12

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

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

Pre-Requisites: Digital logic circuits.

Course Objectives: This course provides the language constructs of Verilog HDL. It also provides exposure on Design and synthesis of combinational and sequential logic circuits and analyzing using test benches.

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

CO1	Understand the language constructs and programming fundamentals of Verilog HDL (**Understand-L2**).
CO2	Construct Combinational and sequential circuits in different modeling styles using Verilog HDL (**Apply-L3**).
CO3	Design and synthesize combinational and sequential logic circuits (**Apply-L3**).
CO4	Analyze and verify the functionality of digital circuits/systems using test benches.**(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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	1		-	-	-	-	-	-	1	-	1	-
CO2	3	2	2	2		-	-	-	-	-	-	2	-	3	-
CO3	1	2	3	2	2	-	-	-	-	-	-	2	-	3	-
CO4	1	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 BOOK(S):

T1 Samir Palnitkar, "Verilog HDL A Guide to Digital and Synthesis",2nd Edition, Pearson Education,2006.

T2 Michael, D. Ciletti, "Advanced digital design with the Verilog HDL", Pearson Education India,2005.

REFERENCE BOOK(S):

R1 Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016

R2 S. Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rdEdision 2014.

R3 J. Bhasker, "A Verilog HDL Primer" 2nd edition, BS Publications, 2001.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I: Introduction to Verilog HDL and Gate Level Modelling

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 subject & Course Outcomes discussion,	1	30.06.25			
2.	Verilog as HDL, Levels of Design Description	1	03.07.25			
3.	Basics of Concepts of Verilog	1	04.07.25			
4.	Data Types, System Task	1	05.07.25			
5.	Compiler directives, modules and ports.	1	07.07.25			
6.	AND Gate Primitive, Module Structure, Other Gate Primitives	1	10.07.25			
7.	Illustrative Examples	1	11.07.25		Innovative	
8.	Tri-State Gates	1	12.07.25			
9.	Array of Instances of Primitives,	1	14.07.25			
10.	Additional Examples	1	17.07.25			
11.	Design of Flip-flops with Gate Primitives,	1	18.07.25			
12.	Delay	1	19.07.25			
13.	Tutorial-1	1	21.07.25			
No. of classes required to complete UNIT-I		13	No. of classes taken			

UNIT-II: Behavioural Modelling

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	Introduction	1	24.07.25			
15.	structured processors	1	25.07.25			
16.	procedural assignments	1	26.07.25			
17.	Timing controls	1	28.07.25			
18.	conditional statements	1	31.07.25			
19.	multi-way branching, loops	1	01.08.25			
20.	sequential and parallel blocks	1	02.08.25			
21.	generate blocks	1	04.08.25			

22.	Design of Decoders in Behavioral model	1	07.08.25		Innovative	
23.	Design of Multiplexers, Flip-flops in Behavioral model	1	08.08.25			
24.	Design of Registers in Behavioral model	1	09.08.25			
25.	Design of Counters in Behavioral model	1	11.08.25			
26.	Tutorial-2	1	14.08.25			
No. of classes required to complete UNIT-II		13	No. of classes taken			

UNIT-III: Modelling at Data flow Level:& **Switch Level Modelling:**

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Introduction	1	16.08.25			
28.	Continuous Assignment Structures,	1	18.08.25			
29.	Delays and Continuous Assignments	1	21.08.25			
30.	Assignment to Vectors, Operators	1	22.08.25			
31.	Design of Decoders, Multiplexers	1	23.08.25		Innovative	
32.	Design of Flip-flops	1	01.09.25			
33.	Design of Registers & Counters in dataflow model,	1	04.09.25			
34.	Switch Level Modelling: Introduction	1	06.09.25			
35.	Basic Transistor Switches	1	08.09.25			
36.	CMOS Switch	1	11.09.25			
37.	Bi-directional Gates	1	12.09.25			
38.	Time Delays with Switch Primitive delays.	1	13.09.25			
39.	Tutorial-3	1	15.09.25			
No. of classes required to complete UNIT-III			**13**	No. of classes taken		

UNIT-IV: FSM Design:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Functions, Tasks	1	18.09.25			
41.	User-defined	1	19.09.25			
42.	Primitives: Introduction	1	20.09.25			
43.	Function, Tasks	1	22.09.25			

44.	User-Defined Primitives (UDP),	1	25.09.25			
45.	FSM Design (Moore and Mealy Machines),	1	26.09.25			
46.	Encoding Style: From Binary to One Hot.	1	27.09.25			
47.	Introduction to Synthesis	1	29.09.25			
48.	Synthesis of combinational logic	1	03.10.25			
49.	Synthesis of sequential logic with latches	1	04.10.25			
50.	Synthesis of sequential logic with flip-flops,	1	06.10.25			
51.	Synthesis of Explicit and Implicit State Machines	1	09.10.25		Innovative	
52.	Synthesis of Explicit and Implicit State Machines	1	10.10.25			
53.	Tutorial-4	1	11.10.25			
No. of classes required to complete UNIT-IV			.14	No. of classes taken		

UNIT-V: Components Test and Verification:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
54.	Introduction	1	13.10.25			
55.	Test Bench – Combinational Circuits Testing	1	16.10.25			
56.	Test Bench – Combinational Circuits Testing	1	17.10.25			
57.	Test Bench – Sequential Circuits Testing	1	18.10.25			
58.	Test Bench –Sequential Circuits Testing	1	23.10.25			
59.	Test Bench Techniques	1	24.10.25		Innovative	
60.	Design Verification	1	25.10.25			
61.	Assertion Verification	1	27.10.25			
62.	Tutorial-5	1	30.10.25			
63.	Revision	1	31.10.25			
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.	ASIC design flow, FPGA Architecture, CPLD Architecture	1	01.11.25			

Teaching Learning Methods

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

PART-C

EVALUATION PROCESS:

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

PART-D

Program Educational Objectives (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

PO 2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO 6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: **Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: **Communication:** Design and develop modern communication technologies for building interdisciplinary skills to meet the 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	Smt. T. Kalpana	Smt. T. Kalpana	Dr. P. Lachi Reddy	Dr. G. Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. Johnwesily Chappidi
Course Name & Code : Python Programming for AI & ML (23AM81)
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech. ECE/III/A-Sec. A.Y.: 2025-26

Pre Requisite: Python Programming, Familiarity with mathematics

COURSE EDUCATIONAL OBJECTIVE (CEO):

- Learn Python programming fundamentals and libraries.
- To learn the basics of AI and apply various search algorithms to solve problems effectively.
- To understand and apply data handling and preprocessing techniques using NumPy and Pandas for effective data analysis and machine learning.
- To Understand data handling, visualization, and preprocessing in Python.
- To understand and apply basic ML algorithms using Python.

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

CO1:	Learn how to use Python to work with lists, sets, tuples, and dictionaries, and apply loops and conditions to solve basic problems.	Understand –Level 2
CO2:	Apply the basics of Artificial Intelligence, AI agents, and apply different search algorithms like BFS, DFS, Uniform Cost Search, Greedy Search, and A* to solve problems.	Apply – Level 3
CO3:	Apply Python libraries such as NumPy and Pandas for efficient data manipulation and preprocessing.	Apply – Level 3
CO4:	Understand the Visualize and explore data using tools like Matplotlib and Seaborn for effective data analysis and interpretation	Apply – Level 3
CO5:	Apply the basics of Machine Learning, its types and uses, and understand how supervised, unsupervised, and reinforcement learning methods work.	Apply – Level 3

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**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	-
CO3	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO4	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO5	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**1**	-	-
1 – Low								**2** – Medium					**3** – High		

TEXTBOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2019 **(Unit-I)**
2. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig (for AI concepts) **(Unit-II)**
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024 Python Machine Learning – Sebastian Raschka **(Unit-III to V)**

REFERENCE BOOKS:

1. **Allen B. Downey**, *Think Python: How to Think Like a Computer Scientist*, 2nd Ed., O'Reilly Media.
2. Stefanie Molin, Hands-On Data Analysis with Pandas, Packt Publishing, 2021.
3. **Stuart Russell & Peter Norvig**, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson, 2020.
4. **"Machine Learning",** TomM. Mitchell, McGraw-HillPublication, 2017
5. **Aurélien Géron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (3rd Ed.), O'Reilly Media, 2022.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT – I: Python Basic Data Structures

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	Discussion of CO's and PO's, brief introduction about Python	1	30-06-2025		TLM1	
2	Python programming introduction, Basics	1	02-07-2025		TLM2	
3	Creating Lists, Accessing and Manipulating Lists	1	05-07-2025		TLM1	
4	Sets	1	07-07-2025		TLM2	
5	Tuples	1	09-07-2025		TLM1	
6	Dictionaries	1	12-07-2025		TLM2	
7	Understanding the differences among them	1	14-07-2025		TLM1	
8	Applications of the Data Structures	1	16-07-2025		TLM2	
9	Using Branching and Control loops with Data structures	2	19-07-2025		TLM2	
No. of classes required to complete UNIT – I: 9				**No. of classes taken:**		

UNIT – II: Python for AI Concepts

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.	Introduction to Artificial Intelligence	1	21-07-2025		TLM2	
12.	AI agents	1	23-07-2025		TLM2	
13.	AI agents	1	26-07-2025		TLM1	
14.	Problem Solving	1	28-07-2025		TLM1	
15.	Search Algorithms: Informed searching strategies: BFS (Breadth-First Search)	1	30-07-2025		TLM2	
16.	DFS (Depth-First Search)	1	02-08-2025		TLM1	
17.	Uniformed cost search	1	04-08-2025		TLM1	
18.	Uninformed searching strategies: Best first Search	1	06-08-2025		TLM1	
19.	Greedy best first search	1	09-08-2025		TLM1	
20.	A* algorithm	1	11-08-2025		TLM1	
No. of classes required to complete UNIT – II: 10				**No. of classes taken:**		

UNIT – III: NumPy, Pandas & Data Preprocessing

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.	Introduction to Numpy: Arrays	1	13-08-2025		TLM2	
22.	Indexing, Operations	1	16-08-2025		TLM1	
23.	Introduction to Pandas: Data Frames, Series	1	18-08-2025		TLM2	
24.	Data Cleaning: Handling Missing Values	1	20-08-2025		TLM1	
25.	Outliers	1	23-08-2025		TLM2	
26.	Feature Encoding: Label Encoding	1	01-09-2025		TLM2	
27.	One-Hot Encoding	1	03-09-2025		TLM2	
28.	Feature Scaling: MinMax	1	06-09-2025		TLM2	
29.	Standard Scaler	1	08-09-2025		TLM1	
30.	Data Splitting: Train-Test Split	1	10-09-2025		TLM2	
No. of classes required to complete UNIT – III: 10				**No. of classes taken:**		

UNIT – IV: Data Visualization and Exploratory Data Analysis (EDA)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Introduction to Matplotlib	1	13-09-2025		TLM2	
32.	Seaborn, Plotting Line	1	15-09-2025		TLM1	
33.	Bar, Histogram	1	17-09-2025		TLM2	
34.	Box, and Heatmaps	1	20-09-2025		TLM2	
35.	Pair plots, Correlation Matrix	1	22-09-2025		TLM2	
36.	Visualizing Categorical	1	24-09-2025		TLM2	
37.	Numerical Data	1	27-09-2025			
38.	Understanding Data Distributions	1	29-09-2025		TLM1	
39.	Patterns	1	01-10-2025		TLM2	
No. of classes required to complete UNIT – IV: 08				**No. of classes taken:**		

UNIT – V: Introduction to Machine Learning

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.	Introduction of Machine Learning	1			TLM2	
41.	Types of ML, Applications of ML	1	04-10-2025		TLM2	
42.	Supervised Learning: Linear Regression	1	06-10-2025		TLM2	
43.	Logistic Regression	1	08-10-2025		TLM1	
44.	K-Nearest Neighbours	1	11-10-2025		TLM1	
45.	Support Vector Machine	1	13-10-2025		TLM1	
46.	Introduction to Unsupervised	1	15-10-2025		TLM1	

	Learning					
47.	Intro. to Reinforcement Learning.	1	18-10-2025		TLM1	

No. of classes required to complete UNIT – V: 08	**No. of classes taken:**

Content Beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
48.	Reinforcement Learning, Types of Data	1	20-10-2025		TLM2	
49.	Introduction to Deep Learning	1	01-11-2025		TLM2	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: 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 engaging independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1	The ability to apply Software Engineering practices and strategies in software project development using open-source programming environment for the success of organization.
PSO2	The ability to design and develop computer programs in networking, web applications and IoT asper the society needs.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Johnwesily chappidi	Dr. Shaik Jameer	Dr. Shaik Jameer	Dr. S Jayaprada
Signature				

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSEHANDOUT

PART-A:

Program :B.Tech.V-Sem.,ECE.,Section–A
AcademicYear : 2025-26
CourseName&Code : **Analog & Digital IC Applications Lab** – 23EC56
L-T-P-Cr : 0-0-3-1.5
CourseInstructors : Dr. Poornaiah Billa & Mrs. T. Kalpana

CourseObjectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

CourseOutcomes (COs): Attheendofthe course,students willbe ableto

CO 1	Demonstrate the characteristics and applications of Op-Amp, Timer, VCO and PLL.	L2
CO 2	Design Active filters, arithmetic circuits, waveform generators and data converters using Op-Amp	L3
CO 3	Analyze operation of combinational and sequential circuits using digital ICs.	L4
CO 4	Adapt effective Communication, presentation and report writing skills.	L3

CourseArticulationMatrix-CorrelationbetweenCOs,POs&PSOs

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

CorrelationLevels:**1**-Slight(Low),**2**-Moderate(Medium),**3**-Substantial(High)andNocorrelation:**'-'**

PART-B:COURSEDELIVERYPLAN(LESSONPLAN): BATCH-I (23761A0401-436)(Monday)

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	30-06-2025		TLM4	
2.	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	07-07-2025		TLM4	
3.	Integrator and Differentiator Circuits using IC 741.	3	14-07-2025		TLM4	
4.	Active Filter Applications – LPF, HPF (first order)	3	21-07-2025		TLM4	
5.	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	28-07-2025		TLM4	
6.	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	04-08-2025		TLM4	
7.	Function Generator using OP AMPs.	3	11-08-2025		TLM4	
8.	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	18-08-2025		TLM4	
9.	4 bit DAC using OP AMP.	3	01-09-2025		TLM4	
10.	Realization of Logic Gates	3	08-09-2025		TLM4	
11.	3 to 8 Decoder- 74138	3	15-09-2025		TLM4	
12.	D Flip-Flop- 7474	3	22-09-2025		TLM4	
13.	Decade Counter- 7490	3	06-10-2025		TLM4	
14.	Revision		13-10-2025			
15.	Lab Internal Examination	3	20-10-2025			
No. of classes required:42				**No. of classes taken:**		

PART-B:COURSEDELIVERYPLAN(LESSONPLAN):BATCH-II (23761A0437-466)& Le401-406(Thursday)

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	03-07-2025		TLM4	
2	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	10-07-2025		TLM4	
3	Integrator and Differentiator Circuits using IC 741.	3	17-07-2025		TLM4	
4	Active Filter Applications – LPF, HPF (first order)	3	24-07-2025		TLM4	
5	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	31-07-2025		TLM4	
6	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	07-08-2025		TLM4	
7	Function Generator using OP AMPs.	3	14-08-2025		TLM4	
8	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	21-08-2025		TLM4	
9	4 bit DAC using OP AMP.	3	04-09-2025		TLM4	
10	Realization of Logic Gates	3	11-09-2025		TLM4	
11	3 to 8 Decoder- 74138	3	18-09-2025		TLM4	
12	D Flip-Flop- 7474	3	25-09-2025		TLM4	
13	Decade Counter- 7490	3	09-10-2025		TLM4	
14	Revision	3	16-10-2025			
15	Lab Internal Examination	3	23-10-2025			
No. of classes required:45				**No. of classes taken:**		

Teaching Learning Methods

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

Program Educational Objectives (PEOs):

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

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.

Program Specific Outcomes (PSOs):

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

Course Instructors	Course Coordinator	Module Coordinator	HOD
Dr.B.Poornaiah/ Mrs.T.Kalpana	Dr.B.Poornaiah	Dr.B.V.N.R. Siva Kumar	Dr.G. Srinivasulu

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - A
Course Instructor : Dr. K. Ravi Kumar / Dr.P.Venkat Rao
Course Name & Code : Analog & Digital Communications Lab – 23EC54
L-T-P-Cr Structure : 0-0-3-1.5
Academic Year : 2025-26

Course Objectives:

1	To provide practical exposure on different aspects of analog and digital communications.
2	To demonstrate the importance of different modulation techniques in analog and digital communication systems.

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

CO1	**Demonstrate** basic analog communication techniques such as amplitude and frequency modulation/demodulation and understand their characteristics. **(Understand-L2)**	L2
CO2	**Apply** Sampling Theorem and implement pulse modulation techniques including PAM, PWM and PPm using suitable hardware and simulation tools. **(Apply-L3)**	L3
CO3	**Design** and implement digital communication methods like PCM, DM, FSK, PSK and DPSK using simulation hardware or simulation tools**. (Apply-L3)**	L3
CO4	**Design** and test basic multiplexing and channel coding techniques including TDM, linear block codes and Cyclic codes **(Analyze-L4)**	L3
CO5	**Adopt** effective communication, presentation and report writing skills **(Apply-L3)**	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	2	2	2	2	-	-	-	2	2	-	2	2	-	-
CO2	3	2	3	2	3	-	-	-	2	2	-	2	3	-	-
CO3	3	3	2	3	3	-	-	-	2	1	-	2	3	-	-
CO4	3	3	2	2	3	-	-	-	2	1	-	2	3	-	-
CO5	1	-	-	-	1	-	-	2	3	3	-	2	1	-	-

Correlation Levels: **1.**Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

TEXT BOOKS:

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers - Rudra Pratap, Oxford University Press

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - A

Batch A (23761A0436 to 23761A0436)

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, COs, POs, Matlab	3	30-06-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	07-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	14-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	21-07-25			
5.	Verification of Sampling Theorem	3	28-07-25			
6.	Pluse Amplitude Modulation & Demodulation	3	04-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	04-08-25			
8.	Time division multiplexing	3	11-08-25			
9.	Pluse code Modulation	3	18-08-25			
10.	Delta modulation	3	01-09-25			
11.	Frequency shift keying	3	08-09-25			
12.	Phase shift keying	3	15-09-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	06-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	13-10-25			
15.	Internal Exam	3	27-10-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

Batch B (23761A0437 to 23761A0466)

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, COs,POs, MATLAB	3	03-07-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	10-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	17-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	24-07-25			
5.	Verification of Sampling Theorem	3	31-07-25			

6.	Pluse Amplitude Modulation & Demodulation	3	07-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	14-08-25			
8.	Time division multiplexing	3	21-08-25			
9.	Pluse code modulation	3	04-09-25			
10.	Delta modulation	3	11-09-25			
11.	Frequency shift keying	3	18-09-25			
12.	Phase shift keying	3	09-10-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	16-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	23-10-25			
15.	Internal Exam	3	30-10-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	**Experiment Nos.**	**Marks**
Day to Day work	1,2,3,4,5,6,7,8,9,10	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10	30
Total Marks = CIE + SEE		100

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

Program Specific Outcomes (PSOs):

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

Date	Dr. K. Ravi Kumar	Dr. K. Ravi Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
29.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - A
Course Instructor : Dr. B.Siva Hari Prasad, Associate Professor of ECE
Course Name & Code : Design and Simulation of Antennas Lab – 23EC58
L-T-P-Cr Structure : 0-0-2-1
Academic Year : 2025-26

Course Objectives:

To equip students with practical knowledge and simulation skills in antenna design, electromagnetic wave analysis, impedance matching, and development of modern antennas for wireless applications.

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

CO1	Analyze EM wave characteristics and perform impedance matching using Smith Chart for efficient antenna performance **(Analyze – L4)**	L2
CO2	Design and simulate various antennas including dipole, monopole, and microstrip types **(Apply – L3)**	L3
CO3	Interpret radiation patterns and assess antenna suitability for wireless applications like Bluetooth, Wi-Fi, and WiMAX **(Apply – L3)**	L3
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**	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	2	2	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	1	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	2	2	3		1	-	-	-

Correlation Levels: **1.**Slight (Low),**2-**Moderate(Medium), **3-**Substantial (High).

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - A

UNIT-I: Amplitude Modulation

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 the course	2	02.07.2025			
2.	Generation of EM-Wave	2	09.07.2025			
3.	Impedance Matching using Smith Chart	2	16.07.2025			
4.	Calculation of phase and group velocity	2	23.07.2025			
5.	Introduction to HFSS	2	30.07.2025			
6.	Design of Microstrip Patch Antenna with Strip Line Feed	2	06.08.2025			
7.	Design and Analysis of Rectangular Microstrip Patch Antenna	2	13.08.2025			
8.	Design of Patch Antenna for Bluetooth Applications	2	20.08.2025			
9.	Design of Patch Antenna for Wi-Fi Applications	2	03.09.2025			
10.	Design of Patch Antenna for WiMAX Applications	2	10.09.2025			
11.	Design and Simulation of Circular Microstrip Patch Antenna	2	17.09.2025			
12.	Design and Simulation of Hexagonal Microstrip Patch Antenna	2	24.09.2025			
13.	Design of Dual Band Patch Antennas	2	08.10.2025			
14.	Design of Wideband Patch Antennas	2	15.10.2025			
15.	Content beyond syllabus – Design reconfigurable antennas	2	22.10.2025			
16.	Internal Exam	2	29.10.2025			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	Experiment Nos.	Marks
Day to Day work	1,2,3,4,5,6,7,8,9,10,11,12	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10,11,12	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10,11,12	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10,11,12	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10,11,12	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10,11,12	30
Total Marks = CIE + SEE		100

PART-D:

Program Educational Objectives (PEOs):

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Program Outcomes(POs):

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PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
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	leader in diverse teams, and in multidisciplinary settings.
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PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
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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	Dr. B.Siva Hari Prasad	Dr. P.Rakesh Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : M.Sambasiva Reddy/Mr.V.V. Rama Krishna/Mrs.B.Rajeswari
Course Name & Code : Idea Implementation Lab & 23ECS2
L-T-P Structure : 0-1-2 Credits : 2
Program/Sem/Sec : B.Tech., ECE., V-Sem., Sections- A A.Y :2025-26

Pre-Requisites: Python Programming

Course Objectives: In this course, student will learn about idea implementation and procedure to develop prototypes for engineering applications.

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

CO1	Understand the programming concepts of IOT. (**Understand – L2)**
CO2	Develop real time applications using Internet of Things. (**Apply – L3)**
CO3	Demonstrate the integration of sensors with IOT. (**Understand – L2)**
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**

TEXTBOOKS:

1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017.
2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition.

REFERENCES:

1. ArshdeepBahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, University Press, 2015
2. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford Press.

PART-B (Theory)

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**IoT Basics:** IoT, Frame work	1	01-07-2025			
2.	Architectural View	1	08-07-2025			
3.	Technology, Sources	1	15-07-2025			
4.	M2M communication	1	22-07-2025			
5.	Sensors	1	29-7-2025			
6.	Participatory sensing	1	05-08-2025			
7.	RFID	1	12-08-2025			
8.	Wireless sensor network elements	1	19-08-2025			
No. of classes required to complete UNIT-I : 08			No. of classes taken :			

UNIT-II:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	IoT Applications	1	02-09-2025			
10.	Prototyping embedded devices for M2M and IoT	1	09-09-2025			
11.	M2M and IoT case studies	1	16-09-2025			
12.	Case studies	1	23-09-2025			
13.	Case studies	1	30-09-2025			
14.	Case studies	1	07-10-2025			
15.	Case studies	1	14-10-2025			
No. of classes required to complete UNIT-II		**7**	No. of classes taken:			

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Experiment Name	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Lab	2	01-07-2025			
2.	Interfacing LED. DHT11-Temperature and, humidity sensor using Arduino	2	08-07-2025			
3.	Interfacing Ultrasonic sensor and PIR sensor using Arduino	2	15-07-2025			
4.	Design of Traffic Light Simulator using Arduino	2	22-07-2025			
5.	Design of Water flow detection using an Arduino board	2	29-7-2025			
6.	Interfacing of LED, Push button with Raspberry Pi and Python Program	2	05-08-2025			
7.	Design of Motion Sensor Alarm using PIR Sensor	2	12-08-2025			

8.	Interfacing DHT11-Temperature and Humidity Sensor with Raspberry Pi	2	19-08-2025			
9.	Interfacing DS18B20 Temperature Sensor with Raspberry Pi	2	02-09-2025			
10.	Implementation of DC Motor and Stepper Motor Control with Raspberry Pi	2	09-09-2025			
11.	Raspberry Pi based Smart Phone Controlled Home Automation	2	16-09-2025			
12.	Smart Traffic light Controller	2	23-09-2025			
13.	Smart Health Monitoring System	2	30-09-2025			
14.	Idea Implementation	2	07-10-2025			
15.	Idea Implementation	2	14-10-2025			
16.	Documentation	2	21-10-2025			
17.	Documentation	2	28-10-2025			
No. of classes required to complete Laboratory :				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Descriptive Examination	**15**
Objective Examination	**10**
Assignment	**5**
Day-to-Day	**10**
Total CIE(A)	**40**
Total SEE(B)	**70**
Total(A+B)	**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 complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO 3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1 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: 30-06-2025

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

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

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

Course Instructor : Dr. P. Lachi Reddy Professor

Mr. Sasi Bhushan. K, Associate Professor

Course Name & Code : Real Time Operating Systems – 23ECH4

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

Academic Year : 2025 – 26

Pre requisite:

COURSE EDUCATIONAL OBJECTIVES:

The course aims to equip students with knowledge of RTOS concepts, programming with various real-time kernels, case-based modeling of embedded systems, Linux-based development and image creation, and RT Linux programming, enabling them to design and implement reliable, real-time embedded applications.

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

CO1:	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems
CO2:	Apply the fault tolerance techniques, evaluation of reliability.
CO3:	Analyze the working of real time operating systems and real time database.
CO4:	Create mathematical model of the system and to develop real time algorithm for task scheduling.

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

Prescribed Syllabus:

UNIT-I: Introduction

OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device, File and IO Systems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues.

UNIT-II: RTOS Programming

Basic Functions and Types of RTOS for Embedded Systems, RTOS mCOS-II, RTOS Vx Works, Programming concepts of above RTOS with relevant Examples, Programming concepts of RTOS Windows CE, RTOS Linux 2.6.x and RTOS RT Linux.

UNIT-III: Program Modeling – Case Studies

case study of digital camera hardware and software architecture, Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car, Case Study of Embedded System for a Smart Card, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-IV: Target Image Creation & Programming in Linux

Operating System Software, Target Image Creation for Window XP Embedded, Porting RTOS on a Micro Controller based Development Board. Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming

UNIT-V: Programming in RT Linux

Overview of RT Linux, Core RT Linux API, Program to display a message periodically, semaphore management, Mutex, Management, Case Study of Appliance Control by RT Linux System

TEXT BOOKS:

1. Rajkamal: “Embedded Systems-Architecture, Programming and Design”, Tata McGraw Hill Publications, Second Edition, 2008.
2. Dr. K.V.K.K. Prasad: “Embedded/Real-Time Systems” Dream Tech Publications, 2005 Edition, Black pad book.

REFERENCES:

1. Labrosse, “Embedding system building blocks “, CMP publishers.
2. Rob Williams,” Real time Systems Development”, Butterworth Heinemann Publications.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION [10 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Introduction, Discussion of Syllabus and Course Outcomes	1	02-07-2025			
2.	OS Services: Process Management, Timer Functions, Event Functions,	1	03-07-2025			
3.	Memory Management, Device, File and IO Systems Management,	1	03-07-2025			
4.	Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls	1	09-07-2025			
5.	Real-Time Operating Systems,	1	10-07-2025			
6.	Basic Design Using an RTOS,	1	10-07-2025			
7.	RTOS Task Scheduling Models,	1	16-07-2025			
8.	Interrupt Latency and Response of the Tasks as Performance Metrics,.	1	17-07-2025			
9.	OS Security Issues	1	17-07-2025			
10.	**Revision/Tutorial,/Assignment**	1	23-07-2025			

UNIT- II: RTOS PROGRAMMING [13 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.	Basic Functions and Types of RTOS for Embedded Systems,	2	24-07-2025			
12.	RTOS mCOS-II,	1	30-07-2025			
13.	RTOS Vx Works,.	2	31-07-2025			
14.	Programming concepts of above RTOS with relevant Examples,	1	06-08-2025			
15.	Programming concepts of RTOS Windows CE,	2	07-08-2025			
16.	RTOS Linux 2.6.x	1	13-08-2025			
17.	RTOS RT Linux	2	14-08-2025			
18.	Programming - logical and decision making operations	2	20-08-2025 21-08-2025			
19.	**Revision / Tutorial,/Assignment**	1	21-08-2025			

UNIT – III: PROGRAM MODELING – CASE STUDIES [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.	case study of digital camera hardware and software architecture,	2	03-09-2025 04-09-2025			
21.	Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car,	2	04-09-2025 10-09-2025			
22.	Case Study of Embedded System for a Smart Card,	2	11-09-2025 11-09-2025			
23.	Case Study of Embedded System of Mobile Phone Software for Key Inputs.	2	17-09-2025 18-09-2025			
24.	**Revision / Tutorial,/Assignment**	1	**18-09-2025**			

UNIT – IV: TARGET IMAGE CREATION & PROGRAMMING IN LINUX [7 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
25.	Operating System Software,	1	24-09-2025			
26.	Target Image Creation for Window XP Embedded,	1	25-09-2025			
27.	Porting RTOS on a Micro Controller based Development Board.	1	25-09-2025			
28.	Overview and programming concepts of Unix/Linux Programming,	1	08-10-2025			
29.	Shell Programming,	1	09-10-2025			
30.	System Programming	1	09-10-2025			
31.	**Revision / Tutorial,/Assignment**	1	15-10-2025			

UNIT – V: PROGRAMMING IN RT LINUX [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.	Overview of RT Linux,	1	15-10-2025			
33.	Core RT Linux API,	1	16-10-2025			
34.	Program to display a message periodically,	1	16-10-2025			
35.	Semaphore management,	1	22-10-2025			
36.	Mutex, Management,	1	23-10-2025			
37.	Case Study of Appliance Control by RT Linux System	1	23-10-2025			
38.	**Revision / Tutorial,/Assignment**	1	29-10-2025			

BEYOND THE SYLLABUS & REVISION [2 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.	Synchronize two identical threads using RTOS	1	30-10-2025			
40.	Reader's Writer's Problem for concurrent Tasks.	1	30-10-2025			

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

PART – C

Academic Calendar: 2025 – 26 (V Semester)

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

CO 1	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply the fault tolerance techniques, evaluation of reliability.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the working of real time operating systems and real time database.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Create mathematical model of the system and to develop real time algorithm for task scheduling.	Categorize, Analyze, Illustrate, Infer Select

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. LACHI REDDY] [Mr. K. SASI BHUSHAN]	[Dr. P. LACHI REDDY]	[Dr. P. LACHI REDDY]	[Dr. G. SRINIVASULU]

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. P. NARENDRA BABU
Course Name & Code **:** Introduction to Artificial Intelligence and Data Science– 20ADM1
L-T-P Structure **: 3-0-0** **Credits:**3
Program/Branch/Sem **: B.Tech/Minor /V** **A.Y.: 2025-26**

PRE-REQUISITE: Knowledge of Computer fundamentals & Data structures & algorithms

Course Educational Objective:

The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and provide fundamentals of Data Science.

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

CO1	Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
CO2	Apply the basic principles of AI in problem solving. **(Apply-L3).**
CO3	Choose the appropriate representation of Knowledge. **(Understand-L2)**
CO4	Enumerate the fundamentals of data science and NumPy. **(Understand-L2)**
CO5	Summarize and compute descriptive statistics using pandas. **(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	PSO2
CO1	2	3	2	-	3	-	-	-	-	-	-	2	3	-	-
CO2	2	3	3	3	3	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	2	3	-	-
CO4	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CO5	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-

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

BOS APPROVED TEXT BOOKS:

T1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach",3rd edition, Prentice Hall, 2009.
T2. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2072.
T3. Rachel Schutt&O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449- 35865-5, 1st edition, October 2073.

BOS APPROVED REFERENCE BOOKS:

R1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2071

R2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

R3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2070.

R4. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.

R5. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2075

R6. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2076.

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.	Discussion of CEO's and CO's, Introduction to	1	02-07-2025		-	
2.	Introduction: What Is AI?,	1	03-07-2025		TLM1	
3.	The Foundations of Artificial Intelligence	1	03-07-2025		TLM1	
4.	The History of Artificial Intelligence,	1	09-07-2025		TLM1	
5.	The State of the Art.	1	10-07-2025		TLM1	
6.	Agents and Environments	1	10-07-2025		TLM1	
7.	Types of agents	1	16-07-2025		TLM2	
8.	Good Behavior: The Concept of Rationality	1	17-07-2025		TLM1	
9.	Omniscience vs Rational agent	1	17-07-2025		TLM1	
10.	The Nature of Environments	1	23-07-2025		TLM1	
11.	The Structure of Agents	1	24-07-2025		TLM1	
12.	Assignment/Quiz-2	1	24-07-2025		TLM1	
No. of classes required to complete UNIT-I: 12						

UNIT-II: PROBLEM SOLVING

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.	Problem-Solving Agents	1	30-07-2025		TLM1	
2.	Example Problems	1	31-07-2025		TLM1	
3.	Searching for Solutions	1	31-07-2025		TLM1	
4.	Uninformed Search Strategies	3	06-08-2025 07-08-2025		TLM1	
5.	Informed (Heuristic) Search Strategies	3	13-08-2025 14-08-2025		TLM1	
6.	Local Search Algorithms	1	20-08-2025		TLM1	
No. of classes required to complete UNIT-II: 10						

UNIT-III: KNOWLEDGE REPRESENTATION TECHNIQUES

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.	Knowledge-Based Agents	1	21-08-2025		TLM1	
2.	Propositional Logic	2	22-08-2025 22-08-2025		TLM1	
3.	Ontological Engineering	1	22-08-2025		TLM1	
4.	Categories and Objects	2	03-09-2025 04-09-2025		TLM1	
5.	Events	3	04-09-2025 10-09-2025 11-09-2025		TLM1	
6.	Reasoning Systems for Categories	1	11-09-2025		TLM1	
No. of classes required to complete UNIT-III: 10						

UNIT-IV: DATA SCIENCE

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 & Datafication	2	17-09-2025 18-09-2025		TLM1	
2.	Exploratory Data Analysis	2	18-09-2025 24-09-2025		TLM1	

3.	**NumPy Basics**: A Multidimensional Array Object	1	24-09-2025		TLM1	
4.	Creating ndarrays	1	08-10-2025		TLM1	
5.	Data Types for ndarrays	2	09-10-2025 09-10-2025		TLM1	
6.	Basic Indexing and Slicing	2	15-10-2025 16-10-2025		TLM1	
7.	Boolean Indexing,	1	16-10-2025		TLM2	
8.	Fancy Indexing	1	22-10-2025		TLM1	
No. of classes required to complete UNIT-IV: 12						

UNIT-V: GETTING STARTED WITH PANDAS

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 pandas	1	23-10-2025		-	
2.	Library Architecture, Features, Applications	1	23-10-2025		TLM1	
3.	Data Structures Operations	1	29-10-2025		TLM1	
4.	Series, Data frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis	1	30-10-2025		TLM1	
5.	Indexing and selection	1	30-10-2025		TLM1	
6.	Pandas Operations	1	30-10-2025		TLM1	
No. of classes required to complete UNIT-V: 06						

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

	responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real timeproblems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr. P.NARENDRA BABU**	**Mr. P.NARENDRA BABU**	**Dr.V. Suryanarayana**	**Dr. P. Bhagath**
Signature				

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. P. RAJASEKHAR

Course Name & Code : Introduction to Database Systems - 23CSM4

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

Program/Sem/Sec : B.Tech/ V-Sem/Minors A.Y: 2025-26

PRE-REQUISITE: Elementary set theory, concepts of relations and functions, propositional logic data structures (trees, Graphs, dictionaries) & File Concepts.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the students to know about Basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing, and Indexing.

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

CO1	State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand -L2)**
CO2	Examine the relational model using Structured Query Language (SQL). **(Apply- L3)**
CO3	Employ principles of normalization for effective database design. **(Apply- L3)**
CO4	Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand- L2)**
CO5	Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand- 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	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	1	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO4	2	1	2	-	-	-	-	-	-	-	-	-	1	3	-
CO5	2	1	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).

TEXT BOOKS:

T1 Henry F. Korth, Abraham Silberschatz, S.Sudarshan, "Database System Concepts", McGraw Hill, 6th edition, 2009.

T2 RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", Addison Wesley, 6th edition, 2010.

REFERENCE BOOKS:

R1 Raghu Ramakrishnan, JohanneseGehrke, "Database Management System", McGraw Hill, 3rd edition, 2000.

R2 Date C J, "An Introduction to Database System", Pearson Education, 8th edition, 2003

R3 Sharad Maheshwari, Ruchin Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi, 2005

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT –I: Introduction & Data modeling using the Entity Relationship Model

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 , An overview of database managemen t system	1	02/07/25		**TLM1**	CO1	T1,T2,R1	
2.	Database system Vs file system	1	03/07/25		**TLM1**	CO1	T1,T2,R1	
3.	Database system concepts and architecture	1	03/07/25		**TLM1**	CO1	T1,T2,R1	
4.	Data models schema and instances	1	09/07/25		**TLM1**	CO1	T1,T2,R1	
5.	Data independenc e and data base language and interfaces	1	10/07/25		**TLM1**	CO1	T1,T2,R1	
6.	Data definitions language, DML, Overall Database Structure	1	10/07/25		**TLM1**	CO1	T1,T2,R1	
7.	**Tutorial – I**	1	16/07/25		**TLM3**			
8.	ER model concepts- notation for ER diagram	1	17/07/25		**TLM1/ TLM2**	CO1	T1,T2,R1	
9.	Mapping constraints, keys	1	17/07/25		**TLM1**	CO1	T1,T2,R1	
10.	Concepts of Super Key,	1	23/07/25		**TLM1**	CO1	T1,T2,R1	

	candidate key, primary key, Generalization, aggregation							
11.	Reduction of an ER diagrams to tables, Extended ER model, Relationships of higher degree	1	24/07/25		**TLM1/ TLM2**	CO1	T1,T2,R1	
12.	**Tutorial – II**	1	24/07/25		**TLM3**	CO1		
No. of classes required to complete UNIT-I		12			No. of classes taken:			

UNIT –II: Relational data Model and Language & Introduction to SQL

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
13.	Relational data model concepts	1	30/07/25		**TLM1**	CO2	T1,T2,R1	
14.	Integrity constraints: entity integrity, referential integrity	1	31/07/25		**TLM1**	CO2	T1,T2,R1	
15.	Keys constraints, Domain constraints	1	31/07/25		**TLM1**	CO2	T1,T2,R1	
16.	Relational algebra	1	06/08/25		**TLM1**	CO2	T1,T2,R1	
17.	Tutorial – III	1	07/08/25		**TLM3**			
18.	Characteristics of SQL, Advantage of SQL	1	07/08/25		**TLM1**	CO2	T1,T2,R1	
19.	SQL data types and literals, Types of SQL commands	1	13/08/25		**TLM1**	CO2	T1,T2,R1	
20.	SQL operators and their procedure	1	14/08/25		**TLM1**	CO2	T1,T2,R1	
21.	Tables, views and indexes,	1	14/08/25		**TLM1**	CO2	T1,T2,R1	
22.	Queries and sub queries,	1	20/08/25		**TLM1/ TLM2**	CO2	T1,T2,R1	

	Aggregate functions							
23.	Insert, update and delete operations	1	21/08/25		**TLM1**	CO2	T1,T2,R1	
24.	Unions, Intersection, Minus, Cursors in SQL	1	21/08/25		**TLM1**	CO2	T1,T2,R1	
No. of classes required to complete **UNIT-2**		12			No. of classes taken:			

UNIT –III: Normalization

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
25.	Functional Dependencies	1	03/09/25		**TLM1**	CO3	T1,T2,R1	
26.	Normal Forms: First, Second	1	04/09/25		**TLM1**	CO3	T1,T2,R1	
27.	Third Normal Forms	1	04/09/25		**TLM1**	CO3	T1,T2,R1	
28.	BCNF, Inclusion Dependences	1	10/09/25		**TLM1**	CO3	T1,T2,R1	
29.	Loss Less Join Decompositions	1	11/09/25		**TLM1**	CO3	T1,T2,R1	
30.	Normalization Using FD,MVD	1	11/09/25		**TLM3**			
31.	Normalization Using JD	1	17/09/25		**TLM1**	CO3	T1,T2,R1	
32.	Alternative Approaches to Database Design	1	18/09/25		**TLM1**	CO3	T1,T2,R1	
No. of classes required to complete **UNIT-3**		8			No. of classes taken:			

UNIT –IV: Transaction Processing Concepts *&*Concurrency Control techniques

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
33.	Transaction System	1	18/09/25		**TLM1**	CO4	T1,T2,R1	
34.	Testing Of Serializability	1	24/09/25		**TLM1**	CO4	T1,T2,R1	
35.	Serializability Of Schedules	1	25/09/25		**TLM1**	CO4	T1,T2,R1	
36.	Conflict & View Serializable Schedule	1	25/09/25		**TLM1**	CO4	T1,T2,R1	
37.	Recoverability, Log Based	1	01/10/25		**TLM1**	CO4	T1,T2,R1	

	Recovery, Checkpoints,							
38.	ARIES Algorithm, Deadlock Handling	1	08/10/25		**TLM1/ TLM2**	CO4	T1,T2,R1	
39.	Concurrency Control	1	09/10/25		**TLM1**	CO4	T1,T2,R1	
40.	Techniques For Concurrency Control	1	09/10/25		**TLM1**	CO4	T1,T2,R1	
41.	Time Stamping Protocols For Concurrency Control	1	15/10/25		**TLM1**	CO4	T1,T2,R1	
42.	Locking, Validation Based Protocol	1	16/10/25		**TLM1**	CO4	T1,T2,R1	
43.	Multiple Granularity, Concurrent Transactions	1	16/10/25		**TLM1**	CO4	T1,T2,R1	
No. of classes required to complete **UNIT-4**		11			No. of classes taken:			

UNIT-V: Storage and Indexing

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
44.	RAID Levels	1	22/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
45.	Page Formats	1	23/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
46.	Record Formats	1	23/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
47.	File Types And Organization	1	29/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
48.	B-Tree	1	30/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
49.	B+-Tree	1	30/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
No. of classes required to complete **UNIT-5**		06			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

PART-C

EVALUATION PROCESS (R23 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. P Rajasekhar	Mr. P Rajasekhar	Dr. D. Venkata Subbaiah	Dr. S. Nagarjuna Reddy

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

COURSE HANDOUT

PART-A

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

ACADEMIC YEAR : 2025-26

COURSE NAME & CODE : **Real Time Operating Systems** Lab

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

COURSE INSTRUCTOR : **Dr. P. Lachi Reddy / Mr. Sasi Bhushan. K**
Dr. Y. Amar Babu / Mr. M. Samba Siva Reddy
Mr. N. Dharmachari

COURSE OBJECTIVE:

To provide hands-on experience through practical experimentation and simulation in real-time embedded system development using ARM-based processors and RTOS and enabling them to implement task management, synchronization, inter-process communication, device interfacing, and data communication for real-time applications.

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

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

CO1	**Develop** real-time applications on ARM-based platforms using various RTOS environments through task creation, synchronization, and resource sharing mechanisms.
CO2	**Design** real-time embedded system architectures by modeling tasks, managing memory, and scheduling using RTOS principles.
CO3	**Construct** embedded solutions for real-world applications through case studies and implement device interfacing, data communication, and system porting using Linux and RTOS tools.
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					
	Part-I: Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction , Syllabus Discussion & CO-PO Discussion, Installation of Software	3	04-07-2025		**TLM2**	
2.	**Installation of open source RTOS** Coo-Cox-Software-Platform	3	11-07-2025			
3.	Register a new command in CLI.	3	18-07-2025			
4.	Create a new Task.	3	25-07-2025		**TLM8**	
5.	Interrupt handling.	3	01-08-2025		**TLM8**	
6.	Allocate resource using semaphores.	3	08-08-2025		**TLM8**	
7.	Share resource using MUTEX.	3	22-08-2025		**TLM8**	
8.	Avoid deadlock using BANKER'S algorithm.	3	05-09-2025		**TLM8**	
9.	Synchronize two identical threads using MONITOR.	3	12-09-2025		**TLM8**	
10.	Reader's Writer's Problem for concurrent Tasks.	3	19-09-2025		**TLM8**	
	CYCLE -2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)					
11.	Implement the interfacing of display with the ARM- CORTEX processor.	3	26-09-2025		**TLM8**	
12.	Interface ADC and DAC ports with the Input and Output sensitive devices.	3	10-10-2025		**TLM8**	
13.	Simulate the temperature DATA Logger with the SERIAL communication with PC.	3	17-10-2025		**TLM8**	
14.	Implement the developer board as a modem for data communication using serial port communication between two PC's	3	24-10-2025		**TLM8**	
15.	Internal Examination	3	31-10-2025			
No. of classes required to complete:		45	No. of classes conducted:			

PART-C

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

Academic Calendar: 2025 – 26

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy) **(Dr. Y. Amar Babu** **(Mr. Sasi Bhushan. K)** **(Mr. M. Samba Siva Reddy)** **(Mr. N. Dharmachari)**	**(Dr. Y. Amar Babu)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

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L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.
hodads@lbrce.ac.in, ads@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. NARENDRA BABU P
Course Name & Code **:** Introduction to Artificial Intelligence and Data Science Lab(23ADM2)
L-T-P Structure **:** 1-0-2 **Credits:** 2
Program/Sem/Sec : B.Tech./Minor/V-Sem., Section – A. **A.Y.:** 2025-26

PRE-REQUISITE: Knowledge of Computer fundamentals & Data structures& Algorithms.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and also provide fundamentals of Data Science.

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

CO1	Apply the basic principles of AI in problem solving using Python (**Apply L3**)
CO2	Implement different algorithms using Python (**Apply L3**)
CO3	Perform various operations using numpy and pandas **(Understand - L2)**
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	1	-	2	-	2	-	-	-	-	-	2	2	3	-	-
CO2	1	-	2	-	2	-	-	-	-	-	2	2	-	-	-
CO3	1	-	2	-	2	-	-	-	-	-	2	2	-	-	-
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Low **2 –**Medium **3-** High

Web References:

WR1	https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience- beginners/
WR2	https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guideto-key- concepts/
WR3	https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
WR4	https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit- learn/
WR5	https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration python/

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Implementation of DFS for **water jug problem** using python	3	04/07/2025		**DM5**	
2.	Implementation of BFS for **tic-tac-toe problem** using python	3	11/07/2025		**DM5**	
3.	Implementation of Hill-climbing to solve **8- Puzzle Problem** using python	3	18/07/2025		**DM5**	
4.	Implementation of **Monkey Banana Problem** using PROLOG	3	25/07/2025		**DM5**	
5.	Numpy & Pandas Introduction	6	01/08/2025 & 08/08/2025		**DM5**	
6.	Creating a NumPy Array	3	22/08/2025		**DM5**	
7.	The Shape and Reshaping of NumPy Array	3	12/09/2025		**DM5**	
8.	Indexing and Slicing of NumPy Array	3	19/09/2025		**DM5**	
9.	pandas operations	3	26/09/2025		**DM5**	
10.	file formats using pandas	3	03/10/2025		**DM5**	

11.	visualizations using matplotlib	3	10/10/2025		**DM5**	
12.	Internal exam	3	17/10/2025		**DM4**	

Teaching Learning Methods			
DM1	Chalk and Talk	**DM4**	Assignment/Test/Quiz
DM2	ICT Tools	**DM5**	Laboratory/Field Visit
DM3	Tutorial	**DM6**	Web-based Learning

PART-C

EVALUATION PROCESS (R20 Regulations):

Evaluation Task	**Marks**
Report	B1 = 10
Quality of Work	B2 = 10
Presentation	B3 = 20
Interaction/ Queries	B4 = 10
Viva voce	B5 = 5
SEE Total: (B1+B2+B3+B4+B5)	**50**

PART-D

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 modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: 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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr. P.NARENDRA BABU**	**Mr. P.NARENDRA BABU**	**Dr. V. Suryanarayana**	**Dr. P. Bhagath**
Signature				

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hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor: Mr. P. Rajasekhar
Course Name & Code : Introduction To Database Systems Lab -23CSM9
L-T-P Structure : 0-0-3 **Credits:**1.5
Program/Sem/Sec : B. Tech/V Sem/Minors **A.Y.:** 2025-26

PRE-REQUISITE: Programming language and Data Structures.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This Course will enable students to

1. Populate and query a database using SQL DDL/DML Commands
2. Declare and enforce integrity constraints on a database
3. Writing Queries using advanced concepts of SQL
4. Programming PL/SQL including procedures, functions, cursors and triggers

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

CO 1	Implement SQL queries using DDL/DML commands.(**Apply-L3**)
CO 2	Apply different Integrity constraints & Normalization techniques for effective database design. (**Apply-L3**)
CO 3	Implement PL/SQL including procedures, functions, cursors and triggers. (**Apply-L3**)
CO 4	Improve individual / teamwork skills, communication & report writing skills with ethical Values

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

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

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Create, alter, insert rows and Dropping of table	3	04/07/25		TLM4	
2	Select Queries with Various Constraints	3	11/07/25		TLM4	
3	Sub Queries with Operations	3	18/07/25		TLM4	
4	Queries Using Aggregate Functions	3	25/07/25		TLM4	
5	Queries using Conversion functions -date-time	3	01/08/25		TLM4	
6	Queries using Conversion functions– strings	3	08/08/25		TLM4	
7	Simple PL/SQL program	3	22/08/25		TLM4	
8	COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.	3	05/09/25		TLM4	
9	Programs include NESTED IF, CASE	3	12/09/25		TLM4	
10	Programs using WHILE & FOR loops	3	19/09/25		TLM4	
11	creation of procedures – IN & OUT parameters	3	26/09/25		TLM4	
12	Stored functions in PL/SQL	3	03/10/25		TLM4	
13	Programs using CURSORS	3	10/10/25		TLM4	
14	Programs using TRIGGERS	3	17/10/25		TLM4	
15	Search operations using Index and Non-Index, Design database for Case study	3	24/10/25		TLM4	
16	Internal Exam	3	31/10/25		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 (R23 Regulations):

Evaluation Task	Marks
Day to Day Work	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Vice-voce	20
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 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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. P Rajasekhar	Mr. P Rajasekhar	Dr. D. Venkata Subbaiah	Dr. S. Nagarjuna Reddy

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART: A

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section –B
Academic Year : 2025-26
Course Name & Code : **Analog & Digital IC Applications–** 23EC08
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr.B.Y.V.N.R.Swamy

Course Objectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

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

CO 1	Apply the operational principles and characteristics of op-amps to design and analyze analog circuits such as amplifiers and active filters.(**Apply-L3**)	L3
CO 2	Design waveform generators and comparator circuits using op-amps for signal processing applications.(**Apply-L3**)	L3
CO 3	Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications. (**Apply-L3**)	L3
CO 4	Construct combinational logic circuits using digital ICs.(**Apply-L3**)	L3
CO 5	Develop sequential circuits using flip-flops, counters, and shift registers, and analyse their use in digital memory systems, including ROM, RAM, and their variants. (**Analyse-L4**)	L4

Course Articulation Matrix-Correlation between COs, Pos & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	1	2	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO 5	2	3	2							-	1	2		2	

CorrelationLevels:**1**-Slight(Low),**2**-Moderate(Medium),**3**-Substantial(High)andNocorrelation:**'-'**

Textbooks(T) and References(R):

TEXTBOOKS:

1. RamakanthA.Gayakwad-Op-Amps&LinearICs,PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,PearsonEducation,2005.

REFERENCEBOOKS:

1. D.Roy Chowdhury–Linear Integrated Circuits, New Age International(p) Ltd,2nd Ed.,2003.
2. John.F.Wakerly–Digital Design Principles and Practices, 3rd Ed.,Pearson,2009.
3. Salivahana-Linear Integrated Circuits and Applications,TMH,2008.
4. William D. Stanley-Operational Amplifiers with Linear Integrated Circuits,4th Ed. Pearson Education India, 2009

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Operational Amplifiers

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Ideal and Practical Op-Amp	1	03-07-25		**TLM2**	
2.	Op-Amp Characteristics	1	07-07-25		**TLM2**	
3.	DCCharacteristics	1	08-07-25		**TLM1**	
4.	AC Characteristics	1	09-07-25		**TLM1**	
5.	Features of 741 Op-Amp	1	10-07-25		**TLM1**	
6.	Modes of Operation-Inverting, Non-Inverting, Differential	1	14-07-25		**TLM1**	
7.	Instrumentation Amplifier, AC Amplifier	1	15-07-25		**TLM1**	
8.	Differentiators and Integrators	1	16-07-25		**TLM1**	
9.	Comparators	1	17-07-25		**TLM1**	
10.	Schmitt Trigger	1	21-07-25		**TLM1**	
11.	Introduction to Voltage Regulators	1	22-07-25		**TLM1**	
12.	Features of 723 Regulator	1	30-07-25		**TLM1**	
13.	Three Terminal Voltage Regulators	1	31-07-25		**TLM1**	
No. of classes required to complete UNIT-I :13			**No. of classes taken:**			

UNIT-II: Op-Amps, IC-555 & IC565 Applications

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 Active Filters	1	04-08-25		**TLM1**	
2.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	05-08-25		**TLM1**	
3.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	06-08-25		**TLM1**	
4.	Characteristics of Band pass, Band reject and All Pass Filters	1	07-08-25		**TLM1**	
5.	Characteristics of Band pass, Band reject and All Pass Filters	1	11-08-25		**TLM1**	
6.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	12-08-25		**TLM1**	
7.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	13-08-25		**TLM1**	
8.	IC555 Timer-Functional	1	14-08-25		**TLM1**	
9.	Monostable and Astable Operations	1	18-08-25		**TLM1**	
10.	Monostable and Astable Applications	1	20-08-25		**TLM1**	
11.	IC565 PLL- principle and Applications	1	21-08-25		**TLM1**	
No. of classes required to complete UNIT-II:11			**No. of classes taken:**			

UNIT-III: Data Converters

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Data Converters: Introduction, Basic DAC techniques, Different types of DACs		01-09-25		**TLM2**	
2.	Weighted resistor DAC		02-09-25		**TLM2**	

3.	R-2R ladder DAC and Inverted R-2R DAC		03-09-25		**TLM2**	
4.	Different Types of ADCs		04-09-25		**TLM2**	
5.	Parallel Comparator Type ADC		08-09-25		**TLM2**	
6.	Counter Type ADC		09-09-25		**TLM2**	
7.	Successive Approximation ADC		10-09-25		**TLM2**	
8	Dual Slope ADC		11-09-25		**TLM2**	
9.	DAC and ADC Specifications		16-09-25		**TLM2**	
No. of classes required to complete UNIT-III:9			**No. of classes taken:**			

UNIT-IV: Combinational Logic ICs

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**Combinational Logic ICs:** Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs		18-09-25		**TLM2**	
2.	Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs		19-09-25		**TLM2**	
3.	Code Converters		22-09-25		**TLM2**	
4.	Decoders, LED & LCD Decoders with Drivers		23-09-25		**TLM2**	
5.	Encoders, Priority Encoders		24-09-25		**TLM2**	
6.	Multiplexers, De-multiplexers		25-09-25		**TLM2**	
7.	Priority Generators/Checkers		06-10-25		**TLM2**	
8.	Parallel Binary Adder/Subtractor		07-10-25		**TLM2**	
9.	Magnitude Comparators		08-10-25		**TLM2**	
No.of classes required to complete UNIT-IV: 09			**No. of classes taken:**			

UNIT-V: Sequential Logic IC's and Memories

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Sequential Logic IC's and Memories:		09-10-25		**TLM2**	
2.	Familiarity with commonly available 74XX & CMOS40XX Series ICs		13-10-25		**TLM2**	
3.	All Types of Flip-flops		14-10-25		**TLM2**	
4.	Synchronous Counters		15-10-25		**TLM2**	
5.	Decade Counters		16-10-25		**TLM2**	
6.	Shift Registers.		21-10-25		**TLM2**	
7.	Memories:		22-10-25		**TLM2**	
8.	ROM Architecture		23-10-25		**TLM2**	
9.	Types of ROMS & Applications		27-10-25		**TLM2**	
10.	RAM Architecture		28-10-25		**TLM2**	
11.	Static & Dynamic RAMs		29-10-25		**TLM2**	
12	Assignment-2		30-10-25		**TLM2**	
No. of classes required to complete UNIT-V:14			**No. of classes taken:**			

Content 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.	Introduction to VLSI	1	01-11-25			

Teaching Learning Methods

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

PART-C: EVALUATION PROCESS:

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex

	engineering activities with an understanding of the limitations
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PO 7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

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

Date: 01-07-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. B.Y.V.N.R.Swamy	Dr. B.Y.V.N.R.Swamy	Dr. B.V.N.R. Siva Kumar	Dr. G. Srinivasulu

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section – B
Academic Year : 2025-26
Course Name & Code : **Digital Communications– 23EC09**
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr. K. Rani Rudrama

Course Objectives:

1	To get basic knowledge on different digital modulation techniques.
2	To know the different concepts on information theory, block codes and convolution codes.
3	To Learn the complete information regarding the design of optimum receivers for digital communication systems and their performance analysis.

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

CO1	**Understand** the principles and components of digital communication system, sampling, quantization, and modulation techniques.	L2
CO2	**Summarize** the concepts of baseband and passband digital modulation techniques in terms of signal representation and system design.	L2
CO3	**Evaluate** the performance of digital modulation schemes, using signal-to-noise ratio (SNR), bit error rate (BER),and probability of error, under noisy channel conditions.	L3
CO4	**Apply** error control coding methods to enhance data transmission efficiency and reliability.	L3

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

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

Correlation Levels: **1.** Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

Textbooks (T):

T1 Simon Haykin, *"Digital Communications"*,John Wiley & sons, 2nd Edition.
T2 Taub and Schilling, *"Principles of Communication Systems"*, TMH Publications, 3rd edition

Reference Books(R)

R1 J. S. Chitode, *"Digital Communications"*,Technical Publications, first edition
R2 V.Chandra Sekar**,** *"Communication Systems"*,Oxford University Press**.**
R3 Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, Pearson Education India, 2010

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - B

UNIT-I: Introduction to Digital Communication

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 Digital communication, Analog and Digital signals.	1	30-06-25			
2.	Need for Digital Communication.	1	01-07-25			
3.	Line Codes- Unipolar, Polar and Bipolar	1	02-07-25			
4.	Elements of a Digital Communication System.	1	03-07-25			
5.	Sampling, quantization, Types of quantization, Quantization noise and error	1	07-07-25			
6.	Need for non-uniform quantization, Companding- μ-law, A-law	1	08-07-25			
7.	Source encoder- decoder, Channel Encoder-decoder.	1	09-07-25			
8.	Application of TDM in Telephony, Problems related to TDM	1	10-07-25		Innovative	
9.	Bit Rate, Baud Rate, System Bandwidth, Channel Bandwidth	1	14-07-25			
10.	Characteristics of channel and types of channels.	1	15-07-25			
11.	Tutorial-I	1	16-07-25			
12.	Revision	1	17-07-25			
No. of classes required to complete UNIT-I: 12			**No. of classes taken:**			

UNIT-II: Pulse Digital Modulation

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Block diagram of Pulse Code Modulation,	1	21-07-25			
14.	Regenerative repeaters	1	22-07-25			
15.	Bandwidth for PCM, Quantization noise.	1	23-07-25			
16.	Output Signal to noise ratio in PCM	1	24-07-25			
17.	Delta Modulation-Transmitter	1	28-07-25			
18.	Delta Modulation-Receiver.	1	29-07-25			
19.	Bandwidth for DM, Effect of noise in DM - slope overload distortion.	1	30-07-25			
20.	Granular noise, Adaptive Delta Modulation Transmitter Block diagram	1	31-07-25			
21.	ADM -Receiver	1	04-08-25		Innovative	
22.	Comparison of PCM , DM , ADM	1	05-08-25			
23.	Tutorial-II	1	06-08-25			
24.	Revision	1	07-08-25			
No. of classes required to complete UNIT-II :12			**No. of classes taken:**			

UNIT-III: Digital Modulation Techniques

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Digital modulation types	1	11-08-25			
26.	Coherent Binary Modulation Techniques: BASK	1	12-08-25			
27.	Binary Phase Shift Keying(BPSK)	1	13-08-25			
28.	Binary Frequency Shift Keying(BFSK)	1	14-08-25			
29.	Quadrature Phase shift Keying (QPSK)	1	18-08-25			
30.	M-ary Modulation techniques	1	19-08-25			
31.	Bandwidth efficiency for M-ary PSK	1	20-08-25			
32.	Bandwidth efficiency for M-ary FSK	1	21-08-25			
33.	Non Coherent Digital modulation techniques: ASK,	1	01-09-25			
34.	Non Coherent Digital modulation techniques: FSK and QPSK	1	02-09-25			
35.	Quadrature AmplitudeModulation QAM.	1	03-09-25		Innovative	
36.	Tutorial-III	1	04-09-25			
No. of classes required to complete UNIT-III:12			**No. of classes taken:**			

UNIT-IV: Optimal Reception of Digital Signal

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Model of digital communication system	1	08-09-25			
38.	signal detection in noise,	1	09-09-25			
39.	Receiver Techniques: Correlation receiver.	1	10-09-25			
40.	Probability of error for Coherent BASK,	1	11-09-25			
41.	Probability of error for Coherent BPSK,	1	15-09-25			
42.	Probability of error for Coherent BFSK,	1	16-09-25			
43.	Probability of error for non-coherent FSK and DPSK	1	17-09-25			
44.	Bit Error Rate Vs Signal to Noise Ratio for M-ary FSK	1	18-09-25			
45.	Bit Error Rate Vs Signal to Noise Ratio for M-ary PSK	1	22-09-25		Innovative	
46.	Tutorial-IV	1	23-09-25			
No. of classes required to complete UNIT-IV:10			**No. of classes taken:**			

UNIT-V: Linear Block Codes

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Matrix description of Linear Block codes	1	24-09-25			
48.	Syndrome Decoding.	1	25-09-25			
49.	Hamming codes- encoding and decoding	1	06-10-25			
50.	Binary Cyclic Codes-Algebraic structure	1	07-10-25			
51.	Systematic and Non Systematic form, Encoding, Syndrome calculation.	1	08-10-25			
52.	**Convolution Codes:** Encoding of Convolution Codes	1	09-10-25			
53.	Time domain approach, Transform domain approach	1	13-10-25			
54.	Graphical approach- State diagram, Code tree and Trellis diagram	1	14-10-25			
55.	Decoding of Convolution Codes- Viterbi decoding algorithm.	1	15-10-25	Innovative		
56.	Tutorial-V	1	16-10-25			
57.	Problem Solving Session	1	20-10-25			
58.	Revision	1	22-10-25			
No. of classes required to complete UNIT-V:11			**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
59.	Quadrature Amplitude Modulation **256-QAM**	**1**	23-10-2025			
60.	OFDM (Orthogonal Frequency Division Multiplexing)	**1**	27-10-2025			

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

PART-C: EVALUATION PROCESS:

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

Program Specific Outcomes (PSOs):

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

Date Dr. K.RaniRudrama Dr. K.RaniRudrama Dr. M.V.Sudhakar Dr.G.Srinivasulu

30.06.2025 Course Instructor Course Coordinator Module Coordinator HOD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC with 'A' Grade and NBA (ECE,EEE,CSE,IT,ME,CIV & ASE)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, NTR Dist, Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. P.Rakesh Kumar
Course Name & Code : Antennas and Wave Propagation & 23EC10
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., V-Sem., Section- B A.Y:2025-26

Pre-Requisites: EM Waves and Transmission Lines.

Course Objectives: This course provides the knowledge on Antennas and Radiation fundamentals. The course will expose different types of Antennas and their applications. The course also gives the complete information regarding Propagation of Radio wave in atmosphere.

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

CO1	**Understand** fundamental antenna parameters and basic radiation mechanisms and characteristics of radio wave propagations **(Understand – L2)**
CO2	**Understand** the operation and characteristics of thin linear wire , loop antennas, HF, VHF and UHF Antennas **(Understand – L2)**
CO3	**Apply** principles of antenna array design to compute and interpret radiation patterns and directivity **(Apply – L3)**
CO4	**Analyze** wave propagation modes and antenna measurement setups using theoretical models and equations **(Analyze – L4)**

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

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

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

TEXT BOOK(S):

T1 Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & sons Publishers,2nd Edition

T2 John D. Kraus, "Antennas for all applications", TMH Publishers

REFERENCE BOOK(S):

R1 G.S.N Raju, "Antennas and Wave Propagation", Pearson Education Publishers.

R2 Jordan and Balmain, Electromagnetic fields and Radiating systems, Pearson Education Publishers.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: Antenna Fundamentals :

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	30-06-2025		**TLM1**	
2.	Radiation mechanism-Single wire Antenna	1	03-07-2025		**TLM1**	
3.	Current Distribution on a thin wire antenna	1	04-07-2025		**TLM1**	
4.	Field Regions	1	05-07-2025		**TLM6**	
5.	Isotropic Radiators, Directional Antennas	1	07-07-2025		**TLM1**	
6.	Antenna Parameters**:** Radiation intensity, Radiation Pattern,	1	10-07-2025		**TLM2**	
7.	Total Power radiated	1	11-07-2025		**TLM2**	
8.	Gain, Directivity,	1	14-07-2025		**TLM2**	
9.	Radiation efficiency	1	17-07-2025 18-07-2025		**TLM1**	
10.	Power gain, HPBW, FNBW	1	19-07-2025		**TLM1**	
11.	Beam Efficiency, Bandwidth, Polarization	1	21-07-2025		**TLM1**	
12.	Effective aperture	1	24-07-2025 25-07-2025		**TLM1**	
13.	Effective length	1	28-07-2025		**TLM1**	
14.	Illustrated Problems	1	31-07-2025		**TLM1**	
No. of classes required to complete UNIT-I : 14			No. of classes taken :			

UNIT-II: THIN LINEAR WIRE ANTENNAS:

S. No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Retarded Potentials	1	01-08-2025		**TLM1**	
16.	Potential functions for sinusoidal oscillations	1	02-08-2025		**TLM1**	
17.	Analysis of Radiation fields of a Alternating current element	1	04-08-2025		**TLM6**	
18.	Quarter wave Monopole and half wave dipole	1	07-08-2025		**TLM1**	
19.	Power radiated by current element	1	08-08-2025		**TLM1**	
20.	Radiation resistance of current element, quarter wave Monopole and half wave dipole	1	09-08-2025		**TLM2**	
21.	End-Fire array	1	11-08-2025		**TLM1**	
22.	Method of pattern multiplication	1	14-08-2025		**TLM2**	
23.	Binomial array	1	18-08-2025		**TLM1**	
24.	Loop Antennas: Small Loops - Field Components		21-08-2025			

25.	Comparison of far fields of small loop and short dipole, Concept of short magnetic dipole		22-08-2025			
26.	D and R_r relations for small loops	1	23-08-2025		**TLM1**	
No. of classes required to complete UNIT-II		**12**	No. of classes taken:			

UNIT-III: ANTENNA ARRAYS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	2 element arrays – different cases	1	01-09-2025		**TLM1**	
28.	Principle of Pattern Multiplication	2	04-09-2025		**TLM1**	
29.	N element Uniform Linear Arrays – Broadside, End-fire Arrays	1	05-09-2025		**TLM1**	
30.	EFA with Increased Directivity, Derivation of their characteristics and comparison, Scanning Arrays	1	06-09-2025		**TLM2**	
31.	Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions,	1	08-09-2025		**TLM2**	
32.	Design Relations Arrays with Parasitic Elements,	2	11-09-2025		**TLM1**	
33.	Yagi-Uda Antenna	1	12-09-2025		**TLM1**	
34.	Folded Dipoles and their characteristics	1	13-09-2025		**TLM1**	
No. of classes required to complete UNIT-III : 08				No. of classes taken:		

UNIT-IV: BROADBAND ANTENNAS & UHF AND MICROWAVE ANTENNAS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Log periodic antenna, Basic principle	2	15-09-2025		**TLM1**	
36.	Helical Antennas – Significance, Geometry, basic properties	1	18-09-2025		**TLM1**	
37.	Design considerations for monofilar helical antennas in Axial Mode and Normal Modes	2	20-09-2025		**TLM1**	
38.	Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns	2	22-09-2025 25-09-2025		**TLM1**	
39.	Paraboloidal Reflectors: Geometry, characteristics, types of feeds,	1	26-09-2025		**TLM1**	
40.	F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Case grain Feeds.	1	27-09-2025		**TLM1**	
41.	Microstrip Antennas-Introduction, Features, Advantages and Limitations	1	29-09-2025		**TLM1**	
42.	Rectangular Patch Antennas – Geometry and Parameters	1	06-10-2025		**TLM6**	
43.	Impact of different parameters on characteristics	1	09-10-2025		**TLM1**	
44.	Illustrated Problems.	1	10-10-2025		**TLM1**	

No. of classes required to complete UNIT-IV: 10	No. of classes taken:

UNIT-V: ANTENNA MEASUREMENTS, WAVE PROPAGATION :

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	FRIIS Transmission Equation, Patterns Required	1	11-10-2025		**TLM1**	
46.	Set Up, Distance Criterion, Directivity	1	13-10-2025		**TLM1**	
47.	Gain Measurements (Comparison, Absolute and 3-Antenna Methods)	1	16-10-2025		**TLM1**	
48.	TYPES of propagations	1	17-10-2025		**TLM1**	
49.	Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics	1	16-10-2025		**TLM1**	
50.	Mechanism of Reflection and Refraction	1	17-10-2025		**TLM1**	
51.	Critical Frequency, MUF and Skip Distance	1	18-10-2025		**TLM1**	
52.	Space Wave Propagation – Mechanism	1	27-10-2025		**TLM1**	
53.	Fundamental Equation for free space Propagation	1	30-10-2025		**TLM1**	
54.	LOS and Radio Horizon	1	31-10-2025		**TLM2**	
55.	Field strength equation,	1	01-11-2025		**TLM1**	
No. of classes required to complete UNIT-V :11			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.	Design of microstrip patch Antennas	1	01-11-2025		TLM2	

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

PART-C

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
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PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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. P.Rakesh Kumar	Dr. B. Siva Hari Prasad	Dr. M. V. Sudhakar	Dr.G.Srinivasulu

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.M. Ramya Harika

Course Name & Code : DIGITAL SYSTEM DESIGN THROUGH HDL & 23EC12

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

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

Pre-Requisites: Digital logic circuits.

Course Objectives: This course provides the language constructs of Verilog HDL. It also provides exposure on Design and synthesis of combinational and sequential logic circuits and analyzing using test benches.

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

CO1	Understand the language constructs and programming fundamentals of Verilog HDL (**Understand-L2**).
CO2	Construct Combinational and sequential circuits in different modelling styles using Verilog HDL (**Apply-L3**).
CO3	Design and synthesize combinational and sequential logic circuits (**Apply-L3**).
CO4	Analyze and verify the functionality of digital circuits/systems using test benches.**(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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	1		-	-	-	-	-	-	1	-	1	-
CO2	3	2	2	2		-	-	-	-	-	-	2	-	3	-
CO3	1	2	3	2	2	-	-	-	-	-	-	2	-	3	-
CO4	1	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 BOOK(S):

T1 Samir Palnitkar, "Verilog HDL A Guide to Digital and Synthesis",2nd Edition, Pearson Education,2006.

T2 Michael, D. Ciletti, "Advanced digital design with the Verilog HDL", Pearson Education India,2005.

REFERENCE BOOK(S):

R1 Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016

R2 S. Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rdEdision 2014.

R3 J. Bhasker, "A Verilog HDL Primer" 2nd edition, BS Publications, 2001.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I: Introduction to Verilog HDL and Gate Level Modelling

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 subject & Course Outcomes discussion	1	30.06.25			
2.	Verilog as HDL, Levels of Design Description	1	01.07.25			
3.	Basics of Concepts of Verilog	1	03.07.25			
4.	Data Types	1	04.07.25			
5.	System Task, Compiler directives		05.07.25			
6.	modules and ports	1	08.07.25			
7.	AND Gate Primitive, Module Structure, Other Gate Primitives	1	10.07.25			
8.	Illustrative Examples	1	11.07.25		Innovative	
9.	Tri-State Gates	1	12.07.25			
10.	Array of Instances of Primitives	1	15.07.25			
11.	Additional Examples	1	17.07.25			
12.	Design of Flip-flops with Gate Primitives	1	18.07.25			
13.	Delay	1	19.07.25			
No. of classes required to complete UNIT-I		13	No. of classes taken			

UNIT-II: Behavioural Modelling

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	Introduction	1	22.07.25			
15.	structured procedures	1	24.07.25			
16.	procedural assignments	1	25.07.25			
17.	Timing controls	1	26.07.25			
18.	conditional statements	1	29.07.25			
19.	multi-way branching, loops	1	31.07.25			
20.	sequential and parallel blocks	1	01.08.25			

21.	generate blocks	1	02.08.25			
22.	Design of Decoders in Behavioral model	1	05.08.25		Innovative	
23.	Design of Multiplexers in Behavioral model	1	07.08.25			
24.	Design of Flip-flops in Behavioral model		08.08.25			
25.	Design of Registers in Behavioral model	1	09.08.25			
26.	Design of Counters in Behavioral model	1	12.08.25			
No. of classes required to complete UNIT-II		12	No. of classes taken			

UNIT-III: Modelling at Data flow Level & **Switch Level Modelling:**

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Introduction	1	14.08.25			
28.	Continuous Assignment Structures	1	19.08.25			
29.	Delays and Continuous Assignments	1	21.08.25			
30.	Assignment to Vectors, Operators	1	22.08.25			
31.	Design of Decoders	1	23.08.25		Innovative	
32.	Design of Multiplexers	1	02.09.25			
33.	Design of Flip-flops	1	04.09.25			
34.	Design of Registers & Counters in dataflow model	1	05.09.25			
35.	Design of Counters in dataflow model	1	06.09.25			
36.	Switch Level Modelling: Introduction	1	09.09.25			
37.	Basic Transistor Switches	1	11.09.25			
38.	CMOS Switch	1	12.09.25			
39.	Bi-directional Gates	1	13.09.25			
40.	Time Delays with Switch Primitive delays.	1	16.09.25			
No. of classes required to complete UNIT-III			**13**	No. of classes taken		

UNIT-IV: FSM Design:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41.	Functions, Tasks	1	18.09.25			

42.	User-Defined Primitives (UDP)	1	19.09.25			
43.	FSM Design	1	20.09.25			
44.	Moore Machines	1	23.09.25			
45.	Mealy Machines	1	25.09.25			
46.	Binary Encoding Style	1	26.09.25			
47.	One Hot Encoding Style	1	27.09.25			
48.	Introduction to Synthesis	1	03.10.25			
49.	Synthesis of combinational logic	1	04.10.25			
50.	Synthesis of sequential logic with latches	1	07.10.25			
51.	Synthesis of sequential logic with flip-flops	1	09.10.25			
52.	Synthesis of Explicit and Implicit State Machines	1	10.10.25		Innovative	
53.	Synthesis of Explicit and Implicit State Machines	1	11.10.25			
No. of classes required to complete UNIT-IV			13	No. of classes taken		

UNIT-V: Components Test and Verification:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
54.	Introduction	1	14.10.25			
55.	Test Bench – Combinational Circuits Testing	1	16.10.25			
56.	Test Bench – Combinational Circuits Testing	1	17.10.25			
57.	Test Bench – Sequential Circuits Testing	1	18.10.25			
58.	Test Bench –Sequential Circuits Testing	1	23.10.25			
59.	Test Bench Techniques	1	24.10.25		Innovative	
60.	Design Verification	1	25.10.25			
61.	Assertion Verification	1	28.10.25			
62.	Assertion Verification	1	30.10.25			
63.	Revision	1	31.10.25			
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.	ASIC design flow, FPGA Architecture, CPLD Architecture	1	01.11.25			

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

PART-C

EVALUATION PROCESS:

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

PART-D

Program Educational Objectives (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

PO 2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex

engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO 6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: **Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Date	Smt. M.Ramya Harika	Smt. T. Kalpana	Dr.P.lachi Reddy	Dr. G. Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. SHAIK JAMEER
Course Name & Code : Python Programming for AI & ML (23AM81)
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech. ECE/III/B-Sec. A.Y.: 2025-26

Pre Requisite: Python Programming, Familiarity with mathematics

COURSE EDUCATIONAL OBJECTIVE (CEO):

- Learn Python programming fundamentals and libraries.
- To learn the basics of AI and apply various search algorithms to solve problems effectively.
- To understand and apply data handling and preprocessing techniques using NumPy and Pandas for effective data analysis and machine learning.
- To Understand data handling, visualization, and preprocessing in Python.
- To understand and apply basic ML algorithms using Python.

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

CO1:	Learn how to use Python to work with lists, sets, tuples, and dictionaries, and apply loops and conditions to solve basic problems.	Understand –Level 2
CO2:	Apply the basics of Artificial Intelligence, AI agents, and apply different search algorithms like BFS, DFS, Uniform Cost Search, Greedy Search, and A* to solve problems.	Apply – Level 3
CO3:	Apply Python libraries such as NumPy and Pandas for efficient data manipulation and preprocessing.	Apply – Level 3
CO4:	Understand the Visualize and explore data using tools like Matplotlib and Seaborn for effective data analysis and interpretation	Apply – Level 3
CO5:	Apply the basics of Machine Learning, its types and uses, and understand how supervised, unsupervised, and reinforcement learning methods work.	Apply – Level 3

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**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	-
CO3	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO4	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO5	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**1**	-	-

1 – Low **2** – Medium **3** – High

TEXTBOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2019 **(Unit-I)**
2. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig (for AI concepts) **(Unit-II)**
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024 Python Machine Learning – Sebastian Raschka **(Unit-III to V)**

REFERENCE BOOKS:

1. **Allen B. Downey**, *Think Python: How to Think Like a Computer Scientist*, 2nd Ed., O'Reilly Media.
2. Stefanie Molin, Hands-On Data Analysis with Pandas, Packt Publishing, 2021.
3. **Stuart Russell & Peter Norvig**, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson, 2020.
4. **"Machine Learning",** TomM. Mitchell, McGraw-HillPublication, 2017
5. **Aurélien Géron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (3rd Ed.), O'Reilly Media, 2022.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT – I: Python Basic Data Structures

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.	Discussion of CO's and PO's, brief introduction about python	1	30-06-2025		TLM1	
2.	Python programming introduction, Basics	1	04-07-2025		TLM2	
3.	Creating Lists, Accessing and Manipulating Lists	1	05-07-2025		TLM1	
4.	Sets	1	07-07-2025		TLM2	
5.	Tuples	1	11-07-2025		TLM1	
6.	Dictionaries	1	14-07-2025		TLM2	
7.	Understanding the differences among them	1	18-07-2025		TLM1	
8.	Applications of the Data Structures	1	19-07-2025		TLM2	
9.	Using Branching and Control loops with Data structures	1	21-07-2025		TLM2	
10.	Unit-I Exam	1	25-07-2025		TLM2	
No. of classes required to complete UNIT – I: 10				**No. of classes taken:**		

UNIT – II: Python for AI Concepts

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.	Introduction to Artificial Intelligence	1	26-07-2025		TLM2	
12.	AI agents	1	28-07-2025		TLM2	
13.	AI agents	1	01-08-2025		TLM1	
14.	Problem Solving	1	02-08-2025		TLM1	
15.	Search Algorithms: Informed searching strategies: BFS (Breadth-First Search)	1	04-08-2025		TLM2	
16.	DFS (Depth-First Search)	1	08-08-2025		TLM1	
17.	Uniformed cost search	1	11-08-2025		TLM1	
18.	Uninformed searching strategies: Best first Search	1	18-08-2025		TLM1	
19.	Greedy best first search	1	22-08-2025		TLM1	

20.	A* algorithm	1	23-08-2025		TLM1	
No. of classes required to complete UNIT – II: 10				**No. of classes taken:**		

UNIT – III: NumPy, Pandas & Data Preprocessing

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.	Introduction to Numpy: Arrays	1	01-09-2025		TLM2	
22.	Indexing, Operations	1	05-09-2025		TLM1	
23.	Introduction to Pandas: Data Frames, Series	1	06-09-2025		TLM2	
24.	Data Cleaning: Handling Missing Values	1	08-09-2025		TLM1	
25.	Outliers	1	12-09-2025		TLM2	
26.	Feature Encoding: Label Encoding	1	15-09-2025		TLM2	
27.	One-Hot Encoding	1	19-09-2025		TLM2	
28.	Feature Scaling: MinMax	1	20-09-2025		TLM2	
29.	Standard Scaler	1	22-09-2025		TLM1	
30.	Data Splitting: Train-Test Split	1	26-09-2025		TLM2	
No. of classes required to complete UNIT – III: 10				**No. of classes taken:**		

UNIT – IV: Data Visualization and Exploratory Data Analysis (EDA)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Introduction to Matplotlib	1	27-09-2025		TLM2	
32.	Seaborn, Plotting Line	1	29-09-2025		TLM1	
33.	Bar, Histogram	1	03-10-2025		TLM2	
34.	Box, and Heatmaps	1	04-10-2025		TLM2	
35.	Pair plots, Correlation Matrix	1	06-10-2025		TLM2	
36.	Visualizing Categorical & Numerical Data	1	10-10-2025		TLM2	
37.	Understanding Data Distributions	1	11-10-2025		TLM1	
38.	Patterns	1	13-10-2025		TLM2	
No. of classes required to complete UNIT – IV: 08				**No. of classes taken:**		

UNIT – V: Introduction to Machine Learning

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	Introduction of Machine Learning	1	17-10-2025		TLM2	
40.	Types of ML, Applications of ML	1	18-10-2025		TLM2	
41.	Supervised Learning: Linear Regression	1	20-10-2025		TLM2	
42.	Logistic Regression	1	24-10-2025		TLM1	
43.	K-Nearest Neighbours	1	25-10-2025		TLM1	
44.	Support Vector Machine	1	27-10-2025		TLM1	

45.	Introduction to Unsupervised Learning	1	31-10-2025		TLM1	
46.	Intro. to Reinforcement Learning.	1	01-11-2025		TLM1	
No. of classes required to complete UNIT – V: 08				**No. of classes taken:**		

Content Beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Reinforcement Learning, Types of Data	1	18-10-2025		TLM2	
48.	Introduction to Deep Learning	1	01-11-2025		TLM2	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: 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 engaging independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1	The ability to apply Software Engineering practices and strategies in software project development using open-source programming environment for the success of organization.
PSO2	The ability to design and develop computer programs in networking, web applications and IoT asper the society needs.
PSO3	To inculcate an ability to analyze, design and implement database applications.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Dr. Shaik Jameer	Dr. Shaik Jameer	Dr. Shaik Jameer	Dr. S Jayaprada
Signature				

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program : B.Tech. V-Sem., ECE., Section–B
Academic Year : 2025-26
Course Name & Code : **Analog & Digital IC Applications Lab** – 23EC56
L-T-P-Cr : 0-0-3-1.5
Course Instructors : Dr.B.Y.V.N.R.Swamy, Mr. M. Siva Sankara Rao & Mrs. T. Kalpana.

Course Objectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

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

CO 1	Demonstrate the characteristics and applications of Op-Amp, Timer, VCO and PLL.	L2
CO 2	Design Active filters, arithmetic circuits, waveform generators and data converters using Op-Amp	L3
CO 3	Analyze operation of combinational and sequential circuits using digital ICs.	L4
CO 4	Adapt effective Communication, presentation and report writing skills.	L3

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

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

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

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	01-07-2025		TLM4	
2.	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	08-07-2025		TLM4	
3.	Integrator and Differentiator Circuits using IC 741.	3	15-07-2025		TLM4	
4.	Active Filter Applications – LPF, HPF (first order)	3	22-07-2025		TLM4	
5.	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	29-07-2025		TLM4	
6.	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	05-08-2025		TLM4	
7.	Function Generator using OP AMPs.	3	12-08-2025		TLM4	
8.	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	19-08-2025		TLM4	
9.	4 bit DAC using OP AMP.	3	09-09-2025		TLM4	
10.	Realization of Logic Gates	3	16-09-2025		TLM4	
11.	3 to 8 Decoder- 74138	3	23-09-2025		TLM4	
12.	D Flip-Flop- 7474	3	30-09-2025		TLM4	
13.	Decade Counter- 7490	3	07-10-2025		TLM4	
14.	Revision		21-10-2025			
15.	Lab Internal Examination	3	28-10-2025			
No. of classes required:45				**No. of classes taken:**		

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

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	05-07-2025		TLM4	
2	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	12-07-2025		TLM4	
3	Integrator and Differentiator Circuits using IC 741.	3	19-07-2025		TLM4	
4	Active Filter Applications – LPF, HPF (first order)	3	26-07-2025		TLM4	
5	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	02-08-2025		TLM4	
6	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	09-08-2025		TLM4	
7	Function Generator using OP AMPs.	3	23-08-2025		TLM4	
8	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	06-09-2025		TLM4	
9	4 bit DAC using OP AMP.	3	13-09-2025		TLM4	
10	Realization of Logic Gates	3	20-09-2025		TLM4	
11	3 to 8 Decoder- 74138	3	27-09-2025		TLM4	
12	D Flip-Flop- 7474	3	04-10-2025		TLM4	
13	Decade Counter- 7490	3	11-10-2025		TLM4	
14	Revision	3	18-10-2025			
15	Lab Internal Examination	3	25-10-2025			
No. of classes required:45				**No. of classes taken:**		

Teaching Learning Methods

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

Program Educational Objectives (PEOs):

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

Program Outcomes (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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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 12:	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. B.Y.V.N.R.Swamy Mr.M. Sivasankara Rao Mrs. T.Kalpana	Dr. B.Y.V.N.R.Swamy	Dr. B.V.N.R. Siva Kumar	Dr. G. Srinivasulu

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - B
Course Instructor : Dr. K. RaniRudrama / Mr.Ch.Sivarama Krishna
Course Name & Code : Analog & Digital Communications Lab – 23EC54
L-T-P-Cr Structure : 0-0-3-1.5
Academic Year : 2025-26

Course Objectives:

1	To provide practical exposure on different aspects of analog and digital communications.
2	To demonstrate the importance of different modulation techniques in analog and digital communication systems.

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

CO1	**Demonstrate** basic analog communication techniques such as amplitude and frequency modulation/demodulation and understand their characteristics. **(Understand-L2)**	L2
CO2	**Apply** Sampling Theorem and implement pulse modulation techniques including PAM, PWM and PPm using suitable hardware and simulation tools. **(Apply-L3)**	L3
CO3	**Design** and implement digital communication methods like PCM, DM, FSK, PSK and DPSK using simulation hardware or simulation tools**. (Apply-L3)**	L3
CO4	**Design** and test basic multiplexing and channel coding techniques including TDM, linear block codes and Cyclic codes **(Analyze-L4)**	L3
CO5	**Adopt** effective communication, presentation and report writing skills **(Apply-L3)**	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	2	2	2	2	-	-	-	2	2	-	2	2	-	-
CO2	3	2	3	2	3	-	-	-	2	2	-	2	3	-	-
CO3	3	3	2	3	3	-	-	-	2	1	-	2	3	-	-
CO4	3	3	2	2	3	-	-	-	2	1	-	2	3	-	-
CO5	1	-	-	-	1	-	-	2	3	3	-	2	1	-	-

Correlation Levels: **1.**Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

TEXT BOOKS:

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers - Rudra Pratap, Oxford University Press

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - B

Batch -I (23761A0467 to 23761A04A1)

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, COs, POs, Matlab Demonstration to ADCLab	3	05-07-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	12-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	19-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	02-08-25			
5.	Verification of Sampling Theorem	3	09-08-25			
6.	Pluse Amplitude Modulation & Demodulation	3	23-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	06-09-25			
8.	Time division multiplexing	3	13-09-25			
9.	Pluse code Modulation	3	20-09-25			
10.	Delta modulation	3	27-09-25			
11.	Frequency shift keying	3	04-10-25			
12.	Phase shift keying	3	11-10-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	18-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	25-10-25			
15.	Internal Exam	3	01-11-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

Batch -II (23761A04A2 to 23761A04D2, 24765A0407-412)

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, COs,POs, MATLAB,ADC Lab Demonstration	3	01-07-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	08-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	15-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	22-07-25			
5.	Verification of Sampling Theorem	3	29-07-25			
6.	Pluse Amplitude Modulation & Demodulation	3	05-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	12-08-25			
8.	Time division multiplexing	3	19-08-25			
9.	Pluse code modulation	3	02-09-25			
10.	Delta modulation	3	09-09-25			
11.	Frequency shift keying	3	16-09-25			
12.	Phase shift keying	3	23-10-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	07-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	14-10-25			
15.	Internal Exam	3	28-10-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	Experiment Nos.	Marks
Day to Day work	1,2,3,4,5,6,7,8,9,10	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10	30
Total Marks = CIE + SEE		100

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

Program Specific Outcomes (PSOs):

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

Date	Dr. K. RaniRudrama	Dr. K. Ravi Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - B
Course Instructor : Dr. G.L.N.Murthy, Professor of ECE
Course Name & Code : Design and Simulation of Antennas Lab – 23EC58
L-T-P-Cr Structure : 0-0-2-1
Academic Year : 2025-26

Course Objectives:

To equip students with practical knowledge and simulation skills in antenna design, electromagnetic wave analysis, impedance matching, and development of modern antennas for wireless applications.

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

CO1	Analyze EM wave characteristics and perform impedance matching using Smith Chart for efficient antenna performance **(Analyze – L4)**	L2
CO2	Design and simulate various antennas including dipole, monopole, and microstrip types **(Apply – L3)**	L3
CO3	Interpret radiation patterns and assess antenna suitability for wireless applications like Bluetooth, Wi-Fi, and WiMAX **(Apply – L3)**	L3
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**	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	2	2	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	1	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	2	2	3		1	-	-	-

Correlation Levels: **1.**Slight (Low),**2-**Moderate(Medium), **3-**Substantial (High).

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., IV-Sem., Section - A

UNIT-I: Amplitude Modulation

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 the course	2	30.06.2025			
2.	Generation of EM-Wave	2	07.07.2025			
3.	Impedance Matching using Smith Chart	2	14.07.2025			
4.	Calculation of phase and group velocity	2	21.07.2025			
5.	Introduction to HFSS	2	28.07.2025			
6.	Design of Microstrip Patch Antenna with Strip Line Feed	2	04.08.2025			
7.	Design and Analysis of Rectangular Microstrip Patch Antenna	2	11.08.2025			
8.	Design of Patch Antenna for Bluetooth Applications	2	18.08.2025			
9.	Design of Patch Antenna for Wi-Fi Applications	2	01.09.2025			
10.	Design of Patch Antenna for WiMAX Applications	2	08.09.2025			
11.	Design and Simulation of Circular Microstrip Patch Antenna	2	15.09.2025			
12.	Design and Simulation of Hexagonal Microstrip Patch Antenna	2	22.09.2025			
13.	Design of Dual Band Patch Antennas	2	06.10.2025			
14.	Design of Wideband Patch Antennas	2	13.10.2025			
15.	Content beyond syllabus – Design reconfigurable antennas	2	20.10.2025			
16.	Internal Exam	2	27.10.2025			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	Experiment Nos.	Marks
Day to Day work	1,2,3,4,5,6,7,8,9,10,11,12	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10,11,12	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10,11,12	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10,11,12	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10,11,12	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10,11,12	30
Total Marks = CIE + SEE		100

PART-D:

Program Educational Objectives (PEOs):

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Program Outcomes(POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
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	leader in diverse teams, and in multidisciplinary settings.
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Program Specific Outcomes (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
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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	Dr. G.L.N.Murthy	Dr. P.Rakesh Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : M.Sambasiva Reddy/Mr.V.V. Rama Krishna/Mrs.B.Rajeswari
Course Name & Code : Idea Implementation Lab & 23ECS2
L-T-P Structure : 0-1-2 Credits : 2
Program/Sem/Sec : B.Tech., ECE., V-Sem., Sections- B A.Y :2025-26

Pre-Requisites: Python Programming

Course Objectives: In this course, student will learn about idea implementation and procedure to develop prototypes for engineering applications.

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

CO1	Understand the programming concepts of IOT. (**Understand – L2)**
CO2	Develop real time applications using Internet of Things. (**Apply – L3)**
CO3	Demonstrate the integration of sensors with IOT. (**Understand – L2)**
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**

TEXTBOOKS:

1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017.
2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition.

REFERENCES:

1. ArshdeepBahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, University Press, 2015
2. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford Press.

PART-B (Theory)

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**IoT Basics:** IoT, Frame work	1	02-07-2025			
2.	Architectural View	1	09-07-2025			
3.	Technology, Sources	1	16-07-2025			
4.	M2M communication	1	23-07-2025			
5.	Sensors	1	30-7-2025			
6.	Participatory sensing	1	06-08-2025			
7.	RFID	1	13-08-2025			
8.	Wireless sensor network elements	1	20-08-2025			
No. of classes required to complete UNIT-I : 08			No. of classes taken :			

UNIT-II:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	IoT Applications	1	03-09-2025			
10.	Prototyping embedded devices for M2M and IoT	1	10-09-2025			
11.	M2M and IoT case studies	1	17-09-2025			
12.	Case studies	1	24-09-2025			
13.	Case studies	1	08-10-2025			
14.	Case studies	1	15-10-2025			
15.	Case studies	1	22-10-2025			
No. of classes required to complete UNIT-II		**7**	No. of classes taken:			

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Experiment Name	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Lab	2	02-07-2025			
2.	Interfacing LED. DHT11-Temperature and, humidity sensor using Arduino	2	09-07-2025			
3.	Interfacing Ultrasonic sensor and PIR sensor using Arduino	2	16-07-2025			
4.	Design of Traffic Light Simulator using Arduino	2	23-07-2025			
5.	Design of Water flow detection using an Arduino board	2	30-7-2025			
6.	Interfacing of LED, Push button with Raspberry Pi and Python Program	2	06-08-2025			
7.	Design of Motion Sensor Alarm using PIR Sensor	2	13-08-2025			

8.	Interfacing DHT11-Temperature and Humidity Sensor with Raspberry Pi	2	20-08-2025			
9.	Interfacing DS18B20 Temperature Sensor with Raspberry Pi	2	03-09-2025			
10.	Implementation of DC Motor and Stepper Motor Control with Raspberry Pi	2	10-09-2025			
11.	Raspberry Pi based Smart Phone Controlled Home Automation	2	17-09-2025			
12.	Smart Traffic light Controller	2	24-09-2025			
13.	Smart Health Monitoring System	2	08-10-2025			
14.	Idea Implementation	2	15-10-2025			
15.	Idea Implementation	2	22-10-2025			
16.	Documentation	2	29-10-2025			
No. of classes required to complete Laboratory : 32				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Descriptive Examination	**15**
Objective Examination	**10**
Assignment	**5**
Day-to-Day	**10**
Total CIE(A)	**40**
Total SEE(B)	**70**
Total(A+B)	**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 complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO 3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO 4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

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PO 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: 30-06-2025

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

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

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

Course Instructor : Dr. P. Lachi Reddy Professor

Mr. Sasi Bhushan. K, Associate Professor

Course Name & Code : Real Time Operating Systems – 23ECH4

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

Academic Year : 2025 – 26

Pre requisite:

COURSE EDUCATIONAL OBJECTIVES:

The course aims to equip students with knowledge of RTOS concepts, programming with various real-time kernels, case-based modeling of embedded systems, Linux-based development and image creation, and RT Linux programming, enabling them to design and implement reliable, real-time embedded applications.

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

CO1:	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems
CO2:	Apply the fault tolerance techniques, evaluation of reliability.
CO3:	Analyze the working of real time operating systems and real time database.
CO4:	Create mathematical model of the system and to develop real time algorithm for task scheduling.

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

Prescribed Syllabus:

UNIT-I: Introduction

OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device, File and IO Systems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues.

UNIT-II: RTOS Programming

Basic Functions and Types of RTOS for Embedded Systems, RTOS mCOS-II, RTOS Vx Works, Programming concepts of above RTOS with relevant Examples, Programming concepts of RTOS Windows CE, RTOS Linux 2.6.x and RTOS RT Linux.

UNIT-III: Program Modeling – Case Studies

case study of digital camera hardware and software architecture, Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car, Case Study of Embedded System for a Smart Card, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-IV: Target Image Creation & Programming in Linux

Operating System Software, Target Image Creation for Window XP Embedded, Porting RTOS on a Micro Controller based Development Board. Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming

UNIT-V: Programming in RT Linux

Overview of RT Linux, Core RT Linux API, Program to display a message periodically, semaphore management, Mutex, Management, Case Study of Appliance Control by RT Linux System

TEXT BOOKS:

1. Rajkamal: “Embedded Systems-Architecture, Programming and Design”, Tata McGraw Hill Publications, Second Edition, 2008.
2. Dr. K.V.K.K. Prasad: “Embedded/Real-Time Systems” Dream Tech Publications, 2005 Edition, Black pad book.

REFERENCES:

1. Labrosse, “Embedding system building blocks “, CMP publishers.
2. Rob Williams,” Real time Systems Development”, Butterworth Heinemann Publications.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION [10 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Introduction, Discussion of Syllabus and Course Outcomes	1	02-07-2025			
2.	OS Services: Process Management, Timer Functions, Event Functions,	1	03-07-2025			
3.	Memory Management, Device, File and IO Systems Management,	1	03-07-2025			
4.	Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls	1	09-07-2025			
5.	Real-Time Operating Systems,	1	10-07-2025			
6.	Basic Design Using an RTOS,	1	10-07-2025			
7.	RTOS Task Scheduling Models,	1	16-07-2025			
8.	Interrupt Latency and Response of the Tasks as Performance Metrics,.	1	17-07-2025			
9.	OS Security Issues	1	17-07-2025			
10.	**Revision/Tutorial,/Assignment**	1	23-07-2025			

UNIT- II: RTOS PROGRAMMING [13 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.	Basic Functions and Types of RTOS for Embedded Systems,	2	24-07-2025			
12.	RTOS mCOS-II,	1	30-07-2025			
13.	RTOS Vx Works,.	2	31-07-2025			
14.	Programming concepts of above RTOS with relevant Examples,	1	06-08-2025			
15.	Programming concepts of RTOS Windows CE,	2	07-08-2025			
16.	RTOS Linux 2.6.x	1	13-08-2025			
17.	RTOS RT Linux	2	14-08-2025			
18.	Programming - logical and decision making operations	2	20-08-2025 21-08-2025			
19.	**Revision / Tutorial,/Assignment**	1	21-08-2025			

UNIT – III: PROGRAM MODELING – CASE STUDIES [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.	case study of digital camera hardware and software architecture,	2	03-09-2025 04-09-2025			
21.	Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car,	2	04-09-2025 10-09-2025			
22.	Case Study of Embedded System for a Smart Card,	2	11-09-2025 11-09-2025			
23.	Case Study of Embedded System of Mobile Phone Software for Key Inputs.	2	17-09-2025 18-09-2025			
24.	**Revision / Tutorial,/Assignment**	1	**18-09-2025**			

UNIT – IV: TARGET IMAGE CREATION & PROGRAMMING IN LINUX [7 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
25.	Operating System Software,	1	24-09-2025			
26.	Target Image Creation for Window XP Embedded,	1	25-09-2025			
27.	Porting RTOS on a Micro Controller based Development Board.	1	25-09-2025			
28.	Overview and programming concepts of Unix/Linux Programming,	1	08-10-2025			
29.	Shell Programming,	1	09-10-2025			
30.	System Programming	1	09-10-2025			
31.	**Revision / Tutorial,/Assignment**	1	15-10-2025			

UNIT – V: PROGRAMMING IN RT LINUX [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.	Overview of RT Linux,	1	15-10-2025			
33.	Core RT Linux API,	1	16-10-2025			
34.	Program to display a message periodically,	1	16-10-2025			
35.	Semaphore management,	1	22-10-2025			
36.	Mutex, Management,	1	23-10-2025			
37.	Case Study of Appliance Control by RT Linux System	1	23-10-2025			
38.	**Revision / Tutorial,/Assignment**	1	29-10-2025			

BEYOND THE SYLLABUS & REVISION [2 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.	Synchronize two identical threads using RTOS	1	30-10-2025			
40.	Reader's Writer's Problem for concurrent Tasks.	1	30-10-2025			

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

PART – C

Academic Calendar: 2025 – 26 (V Semester)

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

CO 1	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply the fault tolerance techniques, evaluation of reliability.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the working of real time operating systems and real time database.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Create mathematical model of the system and to develop real time algorithm for task scheduling.	Categorize, Analyze, Illustrate, Infer Select

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. LACHI REDDY] [Mr. K. SASI BHUSHAN]	[Dr. P. LACHI REDDY]	[Dr. P. LACHI REDDY]	[Dr. G. SRINIVASULU]

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

COURSE HANDOUT

PART-A

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

ACADEMIC YEAR : 2025-26

COURSE NAME & CODE : **Real Time Operating Systems** Lab

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

COURSE INSTRUCTOR : **Dr. P. Lachi Reddy / Mr. Sasi Bhushan. K**
Dr. Y. Amar Babu / Mr. M. Samba Siva Reddy
Mr. N. Dharmachari

COURSE OBJECTIVE:

To provide hands-on experience through practical experimentation and simulation in real-time embedded system development using ARM-based processors and RTOS and enabling them to implement task management, synchronization, inter-process communication, device interfacing, and data communication for real-time applications.

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

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

CO1	**Develop** real-time applications on ARM-based platforms using various RTOS environments through task creation, synchronization, and resource sharing mechanisms.
CO2	**Design** real-time embedded system architectures by modeling tasks, managing memory, and scheduling using RTOS principles.
CO3	**Construct** embedded solutions for real-world applications through case studies and implement device interfacing, data communication, and system porting using Linux and RTOS tools.
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					
	Part-I: Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction , Syllabus Discussion & CO-PO Discussion, Installation of Software	3	04-07-2025		**TLM2**	
2.	**Installation of open source RTOS** Coo-Cox-Software-Platform	3	11-07-2025			
3.	Register a new command in CLI.	3	18-07-2025			
4.	Create a new Task.	3	25-07-2025		**TLM8**	
5.	Interrupt handling.	3	01-08-2025		**TLM8**	
6.	Allocate resource using semaphores.	3	08-08-2025		**TLM8**	
7.	Share resource using MUTEX.	3	22-08-2025		**TLM8**	
8.	Avoid deadlock using BANKER'S algorithm.	3	05-09-2025		**TLM8**	
9.	Synchronize two identical threads using MONITOR.	3	12-09-2025		**TLM8**	
10.	Reader's Writer's Problem for concurrent Tasks.	3	19-09-2025		**TLM8**	
	CYCLE -2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)					
11.	Implement the interfacing of display with the ARM- CORTEX processor.	3	26-09-2025		**TLM8**	
12.	Interface ADC and DAC ports with the Input and Output sensitive devices.	3	10-10-2025		**TLM8**	
13.	Simulate the temperature DATA Logger with the SERIAL communication with PC.	3	17-10-2025		**TLM8**	
14.	Implement the developer board as a modem for data communication using serial port communication between two PC's	3	24-10-2025		**TLM8**	
15.	Internal Examination	3	31-10-2025			
No. of classes required to complete:		45	No. of classes conducted:			

PART-C

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

Academic Calendar: 2025 – 26

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
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PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy) **(Dr. Y. Amar Babu** **(Mr. Sasi Bhushan. K)** **(Mr. M. Samba Siva Reddy)** **(Mr. N. Dharmachari)**	**(Dr. Y. Amar Babu)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.
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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor: Mr. P. Rajasekhar
Course Name & Code : Introduction To Database Systems Lab -23CSM9
L-T-P Structure : 0-0-3 **Credits:**1.5
Program/Sem/Sec : B. Tech/V Sem/Minors **A.Y.:** 2025-26

PRE-REQUISITE: Programming language and Data Structures.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This Course will enable students to

1. Populate and query a database using SQL DDL/DML Commands
2. Declare and enforce integrity constraints on a database
3. Writing Queries using advanced concepts of SQL
4. Programming PL/SQL including procedures, functions, cursors and triggers

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

CO 1	Implement SQL queries using DDL/DML commands.(**Apply-L3**)
CO 2	Apply different Integrity constraints & Normalization techniques for effective database design. (**Apply-L3**)
CO 3	Implement PL/SQL including procedures, functions, cursors and triggers. (**Apply-L3**)
CO 4	Improve individual / teamwork skills, communication & report writing skills with ethical Values

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

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

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Create, alter, insert rows and Dropping of table	3	04/07/25		TLM4	
2	Select Queries with Various Constraints	3	11/07/25		TLM4	
3	Sub Queries with Operations	3	18/07/25		TLM4	
4	Queries Using Aggregate Functions	3	25/07/25		TLM4	
5	Queries using Conversion functions -date-time	3	01/08/25		TLM4	
6	Queries using Conversion functions– strings	3	08/08/25		TLM4	
7	Simple PL/SQL program	3	22/08/25		TLM4	
8	COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.	3	05/09/25		TLM4	
9	Programs include NESTED IF, CASE	3	12/09/25		TLM4	
10	Programs using WHILE & FOR loops	3	19/09/25		TLM4	
11	creation of procedures – IN & OUT parameters	3	26/09/25		TLM4	
12	Stored functions in PL/SQL	3	03/10/25		TLM4	
13	Programs using CURSORS	3	10/10/25		TLM4	
14	Programs using TRIGGERS	3	17/10/25		TLM4	
15	Search operations using Index and Non-Index, Design database for Case study	3	24/10/25		TLM4	
16	Internal Exam	3	31/10/25		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 (R23 Regulations):

Evaluation Task	Marks
Day to Day Work	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Vice-voce	20
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
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PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and 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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. P Rajasekhar	Mr. P Rajasekhar	Dr. D. Venkata Subbaiah	Dr. S. Nagarjuna Reddy

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

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

hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. P. RAJASEKHAR

Course Name & Code : Introduction to Database Systems - 23CSM4

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

Program/Sem/Sec : B.Tech/ V-Sem/Minors A.Y: 2025-26

PRE-REQUISITE: Elementary set theory, concepts of relations and functions, propositional logic data structures (trees, Graphs, dictionaries) & File Concepts.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the students to know about Basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing, and Indexing.

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

CO1	State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand -L2)**
CO2	Examine the relational model using Structured Query Language (SQL). **(Apply- L3)**
CO3	Employ principles of normalization for effective database design. **(Apply- L3)**
CO4	Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand- L2)**
CO5	Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand- 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	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	1	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO4	2	1	2	-	-	-	-	-	-	-	-	-	1	3	-
CO5	2	1	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).

TEXT BOOKS:

T1 Henry F. Korth, Abraham Silberschatz, S.Sudarshan, "Database System Concepts", McGraw Hill, 6th edition, 2009.

T2 RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", Addison Wesley, 6th edition, 2010.

REFERENCE BOOKS:

R1 Raghu Ramakrishnan, JohanneseGehrke, "Database Management System", McGraw Hill, 3rd edition, 2000.

R2 Date C J, "An Introduction to Database System", Pearson Education, 8th edition, 2003

R3 Sharad Maheshwari, Ruchin Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi, 2005

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT –I: Introduction & Data modeling using the Entity Relationship Model

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 , An overview of database managemen t system	1	02/07/25		**TLM1**	CO1	T1,T2,R1	
2.	Database system Vs file system	1	03/07/25		**TLM1**	CO1	T1,T2,R1	
3.	Database system concepts and architecture	1	03/07/25		**TLM1**	CO1	T1,T2,R1	
4.	Data models schema and instances	1	09/07/25		**TLM1**	CO1	T1,T2,R1	
5.	Data independenc e and data base language and interfaces	1	10/07/25		**TLM1**	CO1	T1,T2,R1	
6.	Data definitions language, DML, Overall Database Structure	1	10/07/25		**TLM1**	CO1	T1,T2,R1	
7.	**Tutorial – I**	1	16/07/25		**TLM3**			
8.	ER model concepts- notation for ER diagram	1	17/07/25		**TLM1/ TLM2**	CO1	T1,T2,R1	
9.	Mapping constraints, keys	1	17/07/25		**TLM1**	CO1	T1,T2,R1	
10.	Concepts of Super Key,	1	23/07/25		**TLM1**	CO1	T1,T2,R1	

	candidate key, primary key, Generalization, aggregation							
11.	Reduction of an ER diagrams to tables, Extended ER model, Relationships of higher degree	1	24/07/25		**TLM1/ TLM2**	CO1	T1,T2,R1	
12.	**Tutorial – II**	1	24/07/25		**TLM3**	CO1		
No. of classes required to complete UNIT-I		12			No. of classes taken:			

UNIT –II: Relational data Model and Language & Introduction to SQL

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
13.	Relational data model concepts	1	30/07/25		**TLM1**	CO2	T1,T2,R1	
14.	Integrity constraints: entity integrity, referential integrity	1	31/07/25		**TLM1**	CO2	T1,T2,R1	
15.	Keys constraints, Domain constraints	1	31/07/25		**TLM1**	CO2	T1,T2,R1	
16.	Relational algebra	1	06/08/25		**TLM1**	CO2	T1,T2,R1	
17.	Tutorial – III	1	07/08/25		**TLM3**			
18.	Characteristics of SQL, Advantage of SQL	1	07/08/25		**TLM1**	CO2	T1,T2,R1	
19.	SQL data types and literals, Types of SQL commands	1	13/08/25		**TLM1**	CO2	T1,T2,R1	
20.	SQL operators and their procedure	1	14/08/25		**TLM1**	CO2	T1,T2,R1	
21.	Tables, views and indexes,	1	14/08/25		**TLM1**	CO2	T1,T2,R1	
22.	Queries and sub queries,	1	20/08/25		**TLM1/ TLM2**	CO2	T1,T2,R1	

	Aggregate functions							
23.	Insert, update and delete operations	1	21/08/25		**TLM1**	CO2	T1,T2,R1	
24.	Unions, Intersection, Minus, Cursors in SQL	1	21/08/25		**TLM1**	CO2	T1,T2,R1	
No. of classes required to complete **UNIT-2**		12			No. of classes taken:			

UNIT –III: Normalization

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
25.	Functional Dependencies	1	03/09/25		**TLM1**	CO3	T1,T2,R1	
26.	Normal Forms: First, Second	1	04/09/25		**TLM1**	CO3	T1,T2,R1	
27.	Third Normal Forms	1	04/09/25		**TLM1**	CO3	T1,T2,R1	
28.	BCNF, Inclusion Dependences	1	10/09/25		**TLM1**	CO3	T1,T2,R1	
29.	Loss Less Join Decompositions	1	11/09/25		**TLM1**	CO3	T1,T2,R1	
30.	Normalization Using FD,MVD	1	11/09/25		**TLM3**			
31.	Normalization Using JD	1	17/09/25		**TLM1**	CO3	T1,T2,R1	
32.	Alternative Approaches to Database Design	1	18/09/25		**TLM1**	CO3	T1,T2,R1	
No. of classes required to complete **UNIT-3**		8			No. of classes taken:			

UNIT –IV: Transaction Processing Concepts *&*Concurrency Control techniques

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
33.	Transaction System	1	18/09/25		**TLM1**	CO4	T1,T2,R1	
34.	Testing Of Serializability	1	24/09/25		**TLM1**	CO4	T1,T2,R1	
35.	Serializability Of Schedules	1	25/09/25		**TLM1**	CO4	T1,T2,R1	
36.	Conflict & View Serializable Schedule	1	25/09/25		**TLM1**	CO4	T1,T2,R1	
37.	Recoverability, Log Based	1	01/10/25		**TLM1**	CO4	T1,T2,R1	

	Recovery, Checkpoints,							
38.	ARIES Algorithm, Deadlock Handling	1	08/10/25		**TLM1/ TLM2**	CO4	T1,T2,R1	
39.	Concurrency Control	1	09/10/25		**TLM1**	CO4	T1,T2,R1	
40.	Techniques For Concurrency Control	1	09/10/25		**TLM1**	CO4	T1,T2,R1	
41.	Time Stamping Protocols For Concurrency Control	1	15/10/25		**TLM1**	CO4	T1,T2,R1	
42.	Locking, Validation Based Protocol	1	16/10/25		**TLM1**	CO4	T1,T2,R1	
43.	Multiple Granularity, Concurrent Transactions	1	16/10/25		**TLM1**	CO4	T1,T2,R1	
No. of classes required to complete **UNIT-4**		11			No. of classes taken:			

UNIT-V: Storage and Indexing

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
44.	RAID Levels	1	22/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
45.	Page Formats	1	23/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
46.	Record Formats	1	23/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
47.	File Types And Organization	1	29/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
48.	B-Tree	1	30/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
49.	B+-Tree	1	30/10/25		**TLM1/TLM2**	CO5	T1,T2,R1	
No. of classes required to complete **UNIT-5**		06			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

PART-C

EVALUATION PROCESS (R23 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr. P Rajasekhar	Mr. P Rajasekhar	Dr. D. Venkata Subbaiah	Dr. S. Nagarjuna Reddy

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. P. NARENDRA BABU
Course Name & Code **:** Introduction to Artificial Intelligence and Data Science– 20ADM1
L-T-P Structure **: 3-0-0** **Credits:**3
Program/Branch/Sem **: B.Tech/Minor /V** **A.Y.: 2025-26**

PRE-REQUISITE: Knowledge of Computer fundamentals & Data structures & algorithms

Course Educational Objective:

The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and provide fundamentals of Data Science.

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

CO1	Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
CO2	Apply the basic principles of AI in problem solving. **(Apply-L3).**
CO3	Choose the appropriate representation of Knowledge. **(Understand-L2)**
CO4	Enumerate the fundamentals of data science and NumPy. **(Understand-L2)**
CO5	Summarize and compute descriptive statistics using pandas. **(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	PSO2
CO1	2	3	2	-	3	-	-	-	-	-	-	2	3	-	-
CO2	2	3	3	3	3	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	2	3	-	-
CO4	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CO5	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-

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

BOS APPROVED TEXT BOOKS:

T1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach",3rd edition, Prentice Hall, 2009.
T2. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2072.
T3. Rachel Schutt&O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449- 35865-5, 1st edition, October 2073.

BOS APPROVED REFERENCE BOOKS:

R1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2071

R2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

R3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2070.

R4. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.

R5. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2075

R6. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2076.

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.	Discussion of CEO's and CO's, Introduction to	1	02-07-2025		-	
2.	Introduction: What Is AI?,	1	03-07-2025		TLM1	
3.	The Foundations of Artificial Intelligence	1	03-07-2025		TLM1	
4.	The History of Artificial Intelligence,	1	09-07-2025		TLM1	
5.	The State of the Art.	1	10-07-2025		TLM1	
6.	Agents and Environments	1	10-07-2025		TLM1	
7.	Types of agents	1	16-07-2025		TLM2	
8.	Good Behavior: The Concept of Rationality	1	17-07-2025		TLM1	
9.	Omniscience vs Rational agent	1	17-07-2025		TLM1	
10.	The Nature of Environments	1	23-07-2025		TLM1	
11.	The Structure of Agents	1	24-07-2025		TLM1	
12.	Assignment/Quiz-2	1	24-07-2025		TLM1	
No. of classes required to complete UNIT-I: 12						

UNIT-II: PROBLEM SOLVING

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.	Problem-Solving Agents	1	30-07-2025		TLM1	
2.	Example Problems	1	31-07-2025		TLM1	
3.	Searching for Solutions	1	31-07-2025		TLM1	
4.	Uninformed Search Strategies	3	06-08-2025 07-08-2025		TLM1	
5.	Informed (Heuristic) Search Strategies	3	13-08-2025 14-08-2025		TLM1	
6.	Local Search Algorithms	1	20-08-2025		TLM1	
No. of classes required to complete UNIT-II: 10						

UNIT-III: KNOWLEDGE REPRESENTATION TECHNIQUES

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.	Knowledge-Based Agents	1	21-08-2025		TLM1	
2.	Propositional Logic	2	22-08-2025 22-08-2025		TLM1	
3.	Ontological Engineering	1	22-08-2025		TLM1	
4.	Categories and Objects	2	03-09-2025 04-09-2025		TLM1	
5.	Events	3	04-09-2025 10-09-2025 11-09-2025		TLM1	
6.	Reasoning Systems for Categories	1	11-09-2025		TLM1	
No. of classes required to complete UNIT-III: 10						

UNIT-IV: DATA SCIENCE

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 & Datafication	2	17-09-2025 18-09-2025		TLM1	
2.	Exploratory Data Analysis	2	18-09-2025 24-09-2025		TLM1	

3.	**NumPy Basics**: A Multidimensional Array Object	1	24-09-2025		TLM1	
4.	Creating ndarrays	1	08-10-2025		TLM1	
5.	Data Types for ndarrays	2	09-10-2025 09-10-2025		TLM1	
6.	Basic Indexing and Slicing	2	15-10-2025 16-10-2025		TLM1	
7.	Boolean Indexing,	1	16-10-2025		TLM2	
8.	Fancy Indexing	1	22-10-2025		TLM1	
No. of classes required to complete UNIT-IV: 12						

UNIT-V: GETTING STARTED WITH PANDAS

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 pandas	1	23-10-2025		-	
2.	Library Architecture, Features, Applications	1	23-10-2025		TLM1	
3.	Data Structures Operations	1	29-10-2025		TLM1	
4.	Series, Data frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis	1	30-10-2025		TLM1	
5.	Indexing and selection	1	30-10-2025		TLM1	
6.	Pandas Operations	1	30-10-2025		TLM1	
No. of classes required to complete UNIT-V: 06						

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

	responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real timeproblems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr. P.NARENDRA BABU**	**Mr. P.NARENDRA BABU**	**Dr.V. Suryanarayana**	**Dr. P. Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. NARENDRA BABU P
Course Name & Code **:** Introduction to Artificial Intelligence and Data Science Lab(23ADM2)
L-T-P Structure **:** 1-0-2 **Credits:** 2
Program/Sem/Sec : B.Tech./Minor/V-Sem., Section – A. **A.Y.:** 2025-26

PRE-REQUISITE: Knowledge of Computer fundamentals & Data structures& Algorithms.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to provide a strong foundation of fundamental concepts in Artificial Intelligence and a basic exposition to the goals and methods of Artificial Intelligence and also provide fundamentals of Data Science.

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

CO1	Apply the basic principles of AI in problem solving using Python (**Apply L3**)
CO2	Implement different algorithms using Python (**Apply L3**)
CO3	Perform various operations using numpy and pandas **(Understand - L2)**
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	1	-	2	-	2	-	-	-	-	-	2	2	3	-	-
CO2	1	-	2	-	2	-	-	-	-	-	2	2	-	-	-
CO3	1	-	2	-	2	-	-	-	-	-	2	2	-	-	-
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Low **2 –**Medium **3-** High

Web References:

WR1	https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience- beginners/
WR2	https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guideto-key- concepts/
WR3	https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
WR4	https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit- learn/
WR5	https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration python/

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Implementation of DFS for **water jug problem** using python	3	04/07/2025		**DM5**	
2.	Implementation of BFS for **tic-tac-toe problem** using python	3	11/07/2025		**DM5**	
3.	Implementation of Hill-climbing to solve **8- Puzzle Problem** using python	3	18/07/2025		**DM5**	
4.	Implementation of **Monkey Banana Problem** using PROLOG	3	25/07/2025		**DM5**	
5.	Numpy & Pandas Introduction	6	01/08/2025 & 08/08/2025		**DM5**	
6.	Creating a NumPy Array	3	22/08/2025		**DM5**	
7.	The Shape and Reshaping of NumPy Array	3	12/09/2025		**DM5**	
8.	Indexing and Slicing of NumPy Array	3	19/09/2025		**DM5**	
9.	pandas operations	3	26/09/2025		**DM5**	
10.	file formats using pandas	3	03/10/2025		**DM5**	

11.	visualizations using matplotlib	3	10/10/2025		**DM5**	
12.	Internal exam	3	17/10/2025		**DM4**	

Teaching Learning Methods			
DM1	Chalk and Talk	**DM4**	Assignment/Test/Quiz
DM2	ICT Tools	**DM5**	Laboratory/Field Visit
DM3	Tutorial	**DM6**	Web-based Learning

PART-C

EVALUATION PROCESS (R20 Regulations):

Evaluation Task	**Marks**
Report	B1 = 10
Quality of Work	B2 = 10
Presentation	B3 = 20
Interaction/ Queries	B4 = 10
Viva voce	B5 = 5
SEE Total: (B1+B2+B3+B4+B5)	**50**

PART-D

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 modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: 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	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr. P.NARENDRA BABU**	**Mr. P.NARENDRA BABU**	**Dr. V. Suryanarayana**	**Dr. P. Bhagath**
Signature				

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, NTR Dist, Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. P.Rakesh Kumar
Course Name & Code : Antennas and Wave Propagation & 23EC10
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech., ECE., V-Sem., Section- C A.Y:2025-26

Pre-Requisites: EM Waves and Transmission Lines.

Course Objectives: This course provides the knowledge on Antennas and Radiation fundamentals. The course will expose different types of Antennas and their applications. The course also gives the complete information regarding Propagation of Radio wave in atmosphere.

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

CO1	**Understand** fundamental antenna parameters and basic radiation mechanisms and characteristics of radio wave propagations **(Understand – L2)**
CO2	**Understand** the operation and characteristics of thin linear wire , loop antennas, HF, VHF and UHF Antennas **(Understand – L2)**
CO3	**Apply** principles of antenna array design to compute and interpret radiation patterns and directivity **(Apply – L3)**
CO4	**Analyze** wave propagation modes and antenna measurement setups using theoretical models and equations **(Analyze – L4)**

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

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

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

TEXT BOOK(S):

T1 Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & sons Publishers,2nd Edition

T2 John D. Kraus, "Antennas for all applications", TMH Publishers

REFERENCE BOOK(S):

R1 G.S.N Raju, "Antennas and Wave Propagation", Pearson Education Publishers.

R2 Jordan and Balmain, Electromagnetic fields and Radiating systems, Pearson Education Publishers.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I: Antenna Fundamentals :

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	01-07-2025		**TLM1**	
2.	Radiation mechanism-Single wire Antenna	1	03-07-2025		**TLM1**	
3.	Current Distribution on a thin wire antenna	1	04-07-2025		**TLM1**	
4.	Field Regions	1	05-07-2025		**TLM6**	
5.	Isotropic Radiators, Directional Antennas	1	08-07-2025		**TLM1**	
6.	Antenna Parameters**:** Radiation intensity, Radiation Pattern,	1	10-07-2025		**TLM2**	
7.	Total Power radiated	1	11-07-2025		**TLM2**	
8.	Gain, Directivity,	1	15-07-2025		**TLM2**	
9.	Radiation efficiency	1	17-07-2025 18-07-2025		**TLM1**	
10.	Power gain, HPBW, FNBW	1	19-07-2025		**TLM1**	
11.	Beam Efficiency, Bandwidth, Polarization	1	22-07-2025		**TLM1**	
12.	Effective aperture	1	24-07-2025 25-07-2025		**TLM1**	
13.	Effective length	1	29-07-2025		**TLM1**	
14.	Illustrated Problems	1	31-07-2025		**TLM1**	
No. of classes required to complete UNIT-I : 14			No. of classes taken :			

UNIT-II: THIN LINEAR WIRE ANTENNAS:

S. No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Retarded Potentials	1	01-08-2025		**TLM1**	
16.	Potential functions for sinusoidal oscillations	1	02-08-2025		**TLM1**	
17.	Analysis of Radiation fields of a Alternating current element	1	05-08-2025		**TLM6**	
18.	Quarter wave Monopole and half wave dipole	1	07-08-2025		**TLM1**	
19.	Power radiated by current element	1	08-08-2025		**TLM1**	
20.	Radiation resistance of current element, quarter wave Monopole and half wave dipole	1	09-08-2025		**TLM2**	
21.	End-Fire array	1	12-08-2025		**TLM1**	
22.	Method of pattern multiplication	1	14-08-2025		**TLM2**	
23.	Binomial array	1	19-08-2025		**TLM1**	
24.	Loop Antennas: Small Loops - Field Components		21-08-2025			

25.	Comparison of far fields of small loop and short dipole, Concept of short magnetic dipole		22-08-2025			
26.	D and R_r relations for small loops	1	23-08-2025		**TLM1**	
No. of classes required to complete UNIT-II		**12**	No. of classes taken:			

UNIT-III: ANTENNA ARRAYS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	2 element arrays – different cases	1	02-09-2025		**TLM1**	
28.	Principle of Pattern Multiplication	2	04-09-2025		**TLM1**	
29.	N element Uniform Linear Arrays – Broadside, End-fire Arrays	1	05-09-2025		**TLM1**	
30.	EFA with Increased Directivity, Derivation of their characteristics and comparison, Scanning Arrays	1	06-09-2025		**TLM2**	
31.	Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions,	1	09-09-2025		**TLM2**	
32.	Design Relations Arrays with Parasitic Elements,	2	11-09-2025		**TLM1**	
33.	Yagi-Uda Antenna	1	12-09-2025		**TLM1**	
34.	Folded Dipoles and their characteristics	1	13-09-2025		**TLM1**	
No. of classes required to complete UNIT-III : 08				No. of classes taken:		

UNIT-IV: BROADBAND ANTENNAS & UHF AND MICROWAVE ANTENNAS:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Log periodic antenna, Basic principle	2	16-09-2025		**TLM1**	
36.	Helical Antennas – Significance, Geometry, basic properties	1	18-09-2025		**TLM1**	
37.	Design considerations for monofilar helical antennas in Axial Mode and Normal Modes	2	20-09-2025		**TLM1**	
38.	Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns	2	23-09-2025 25-09-2025		**TLM1**	
39.	Paraboloidal Reflectors: Geometry, characteristics, types of feeds,	1	26-09-2025		**TLM1**	
40.	F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Case grain Feeds.	1	27-09-2025		**TLM1**	
41.	Microstrip Antennas-Introduction, Features, Advantages and Limitations	1	30-09-2025		**TLM1**	
42.	Rectangular Patch Antennas – Geometry and Parameters	1	07-10-2025		**TLM6**	
43.	Impact of different parameters on characteristics	1	09-10-2025		**TLM1**	
44.	Illustrated Problems.	1	10-10-2025		**TLM1**	

No. of classes required to complete UNIT-IV: 10	No. of classes taken:

UNIT-V: ANTENNA MEASUREMENTS, WAVE PROPAGATION :

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	FRIIS Transmission Equation, Patterns Required	1	11-10-2025		**TLM1**	
46.	Set Up, Distance Criterion, Directivity	1	14-10-2025		**TLM1**	
47.	Gain Measurements (Comparison, Absolute and 3-Antenna Methods)	1	16-10-2025		**TLM1**	
48.	TYPES of propagations	1	17-10-2025		**TLM1**	
49.	Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics	1	16-10-2025		**TLM1**	
50.	Mechanism of Reflection and Refraction	1	17-10-2025		**TLM1**	
51.	Critical Frequency, MUF and Skip Distance	1	18-10-2025		**TLM1**	
52.	Space Wave Propagation – Mechanism	1	28-10-2025		**TLM1**	
53.	Fundamental Equation for free space Propagation	1	30-10-2025		**TLM1**	
54.	LOS and Radio Horizon	1	31-10-2025		**TLM2**	
55.	Field strength equation,	1	01-11-2025		**TLM1**	
No. of classes required to complete UNIT-V :11			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.	Design of microstrip patch Antennas	1	01-11-2025		TLM2	

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

PART-C

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

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

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Smt. T. Kalpana

Course Name & Code : Digital System Design Through HDL & 23EC12

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

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

Pre-Requisites: Digital logic circuits.

Course Objectives: This course provides the language constructs of Verilog HDL. It also provides exposure on Design and synthesis of combinational and sequential logic circuits and analyzing using test benches.

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

CO1	Understand the language constructs and programming fundamentals of Verilog HDL (**Understand-L2**).
CO2	Construct Combinational and sequential circuits in different modelling styles using Verilog HDL (**Apply-L3**).
CO3	Design and synthesize combinational and sequential logic circuits (**Apply-L3**).
CO4	Analyze and verify the functionality of digital circuits/systems using test benches.**(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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	1		-	-	-	-	-	-	1	-	1	-
CO2	3	2	2	2		-	-	-	-	-	-	2	-	3	-
CO3	1	2	3	2	2	-	-	-	-	-	-	2	-	3	-
CO4	1	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 BOOK(S):

T1 Samir Palnitkar, "Verilog HDL A Guide to Digital and Synthesis",2nd Edition, Pearson Education,2006.

T2 Michael, D. Ciletti, "Advanced digital design with the Verilog HDL", Pearson Education India,2005.

REFERENCE BOOK(S):

R1 Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016

R2 S. Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rdEdision 2014.

R3 J. Bhasker, "A Verilog HDL Primer" 2nd edition, BS Publications, 2001.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I: Introduction to Verilog HDL and Gate Level Modelling

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 subject & Course Outcomes discussion,	1	30.06.25			
2.	Verilog as HDL, Levels of Design Description	1	01.07.25			
3.	Basics of Concepts of Verilog	1	02.07.25			
4.	Data Types, System Task	1	05.07.25			
5.	Compiler directives, modules and ports.	1	07.07.25			
6.	AND Gate Primitive, Module Structure, Other Gate Primitives	1	08.07.25			
7.	Illustrative Examples	1	09.07.25		Innovative	
8.	Tri-State Gates	1	12.07.25			
9.	Array of Instances of Primitives,	1	14.07.25			
10.	Additional Examples	1	15.07.25			
11.	Design of Flip-flops with Gate Primitives,	1	16.07.25			
12.	Delay	1	19.07.25			
13.	Tutorial-1	1	21.07.25			
No. of classes required to complete UNIT-I		13	No. of classes taken			

UNIT-II: Behavioural Modelling

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	Introduction	1	22.07.25			
15.	Structured processors	1	23.07.25			
16.	Procedural assignments	1	26.07.25			
17.	Timing controls	1	28.07.25			
18.	Conditional statements	1	29.07.25			
19.	Multi-way branching, loops	1	30.07.25			
20.	Sequential and parallel blocks	1	02.08.25			
21.	Generate blocks	1	04.08.25			

22.	Design of Decoders in Behavioral model	1	05.08.25		Innovative	
23.	Design of Multiplexers, Flip-flops in Behavioral model	1	06.08.25			
24.	Design of Registers in Behavioral model	1	09.08.25			
25.	Design of Counters in Behavioral model	1	11.08.25			
26.	Tutorial-2	1	12.08.25			
27.	Revision	1	13.08.25			
No. of classes required to complete UNIT-II		14	No. of classes taken			

UNIT-III: Modelling at Data flow Level:& **Switch Level Modelling:**

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Introduction	1	16.08.25			
29.	Continuous Assignment Structures,	1	18.08.25			
30.	Delays and Continuous Assignments	1	19.08.25			
31.	Assignment to Vectors, Operators	1	20.08.25			
32.	Design of Decoders, Multiplexers	1	23.08.25		Innovative	
33.	Design of Flip-flops	1	01.09.25			
34.	Design of Registers & Counters in the dataflow model,	1	02.09.25			
35.	Switch Level Modelling: Introduction	1	03.09.25			
36.	Basic Transistor Switches	1	06.09.25			
37.	CMOS Switch	1	08.09.25			
38.	Bi-directional Gates	1	09.09.25			
39.	Time Delays with Switch Primitive delays.	1	10.09.25			
40.	Tutorial-3	1	13.09.25			
41.	Revision	1	15.09.25			
No. of classes required to complete UNIT-III			**14**	No. of classes taken		

UNIT-IV: FSM Design:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Functions, Tasks	1	16.09.25			
43.	User-defined	1	17.09.25			

44.	Primitives: Introduction	1	20.09.25			
45.	Function, Tasks	1	22.09.25			
46.	User-Defined Primitives (UDP),	1	23.09.25			
47.	FSM Design (Moore and Mealy Machines),	1	24.09.25			
48.	Encoding Style: From Binary to One Hot.	1	27.09.25			
49.	Introduction to Synthesis	1	29.09.25			
50.	Synthesis of combinational logic	1	30.09.25			
51.	Synthesis of sequential logic with latches	1	01.10.25			
52.	Synthesis of sequential logic with flip-flops,	1	04.10.25			
53.	Synthesis of Explicit and Implicit State Machines	1	06.10.25		Innovative	
54.	Synthesis of Explicit and Implicit State Machines	1	07.10.25			
55.	Tutorial-4	1	08.10.25			
No. of classes required to complete UNIT-IV			**14**	No. of classes taken		

UNIT-V: Components Test and Verification:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
56.	Introduction	1	11.10.25			
57.	Test Bench – Combinational Circuits Testing	1	13.10.25			
58.	Test Bench – Combinational Circuits Testing	1	14.10.25			
59.	Test Bench – Sequential Circuits Testing	1	15.10.25			
60.	Test Bench –Sequential Circuits Testing	1	18.10.25			
61.	Test Bench Techniques	1	21.10.25		Innovative	
62.	Design Verification	1	22.10.25			
63.	Assertion Verification	1	25.10.25			
64.	Tutorial-5	1	27.10.25			
65.	Revision	1	28.10.25			
66.	Revision	1	29.10.25			
No. of classes required to complete UNIT-V		**11**	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.	ASIC design flow, FPGA Architecture, CPLD Architecture	1	01.11.25			

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

PART-C

EVALUATION PROCESS:

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

PART-D

Program Educational Objectives (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

PO 2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO 6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: **Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Date	Smt. T. Kalpana	Smt. T. Kalpana	Dr. P. Lachi Reddy	Dr. G. Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - C
Course Instructor : Dr. K. Rani Rudrama / Dr.K.RaviKumar
Course Name & Code : Analog & Digital Communications Lab – 23EC54
L-T-P-Cr Structure : 0-0-3-1.5
Academic Year : 2025-26

Course Objectives:

1	To provide practical exposure on different aspects of analog and digital communications.
2	To demonstrate the importance of different modulation techniques in analog and digital communication systems.

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

CO1	**Demonstrate** basic analog communication techniques such as amplitude and frequency modulation/demodulation and understand their characteristics. **(Understand-L2)**	L2
CO2	**Apply** Sampling Theorem and implement pulse modulation techniques including PAM, PWM and PPm using suitable hardware and simulation tools. **(Apply-L3)**	L3
CO3	**Design** and implement digital communication methods like PCM, DM, FSK, PSK and DPSK using simulation hardware or simulation tools**. (Apply-L3)**	L3
CO4	**Design** and test basic multiplexing and channel coding techniques including TDM, linear block codes and Cyclic codes **(Analyze-L4)**	L3
CO5	**Adopt** effective communication, presentation and report writing skills **(Apply-L3)**	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	2	2	2	2	-	-	-	2	2	-	2	2	-	-
CO2	3	2	3	2	3	-	-	-	2	2	-	2	3	-	-
CO3	3	3	2	3	3	-	-	-	2	1	-	2	3	-	-
CO4	3	3	2	2	3	-	-	-	2	1	-	2	3	-	-
CO5	1	-	-	-	1	-	-	2	3	3	-	2	1	-	-

Correlation Levels: **1.**Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

TEXT BOOKS:

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers - Rudra Pratap, Oxford University Press

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - C

Batch _I (23761A04D3 to 23761A04G8)

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, COs, POs, Matlab Demonstration to ADCLab	3	05-07-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	12-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	19-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	02-08-25			
5.	Verification of Sampling Theorem	3	09-08-25			
6.	Pluse Amplitude Modulation & Demodulation	3	23-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	06-09-25			
8.	Time division multiplexing	3	13-09-25			
9.	Pluse code Modulation	3	20-09-25			
10.	Delta modulation	3	27-09-25			
11.	Frequency shift keying	3	04-10-25			
12.	Phase shift keying	3	11-10-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	18-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	25-10-25			
15.	Internal Exam	3	01-11-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

Batch -II (23761A04G9 to 23761A04J8, 24765A0413-418)

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, COs,POs, MATLAB,ADC Lab Demonstration	3	02-07-25			
2.	Amplitude Modulation-Modulation & Demodulation	3	09-07-25			
3.	AM-DSBSC-Modulation & Demodulation	3	16-07-25			
4.	Frequency Modulation-Modulation & Demodulation	3	23-07-25			
5.	Verification of Sampling Theorem	3	30-07-25			
6.	Pluse Amplitude Modulation & Demodulation	3	06-08-25			
7.	PWM, PPM-Modulation & Demodulation	3	13-08-25			
8.	Time division multiplexing	3	20-08-25			
9.	Pluse code modulation	3	03-09-25			
10.	Delta modulation	3	10-09-25			
11.	Frequency shift keying	3	17-09-25			
12.	Phase shift keying	3	24-10-25			
13.	Linear Block code-Encoder and Decoder and Binary cyclic code – Encode and Decoder	3	08-10-25			
14.	Content Beyond Syllabus: QPSK using SDR Innovation- Models using Breadboard	3	15-10-25			
15.	Revision	3	22-10-25			
16.	Internal Exam	3	29-10-25			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	Experiment Nos.	Marks
Day to Day work	1,2,3,4,5,6,7,8,9,10	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10	30
Total Marks = CIE + SEE		100

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

Program Specific Outcomes (PSOs):

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

Date	Dr. K. RaniRudrama	Dr. K. Ravi Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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COURSE HANDOUT

PART: A

Program/Sem/Sec : B.Tech., ECE., IV-Sem., Section –C
Academic Year : 2025-26
Course Name & Code : **Analog & Digital IC Applications–** 23EC08
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr.B.Y.V.N.R.Swamy

Course Objectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

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

CO 1	Apply the operational principles and characteristics of op-amps to design and analyze analog circuits such as amplifiers and active filters.(**Apply-L3**)	L3
CO 2	Design waveform generators and comparator circuits using op-amps for signal processing applications.(**Apply-L3**)	L3
CO 3	Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications. (**Apply-L3**)	L3
CO 4	Construct combinational logic circuits using digital ICs.(**Apply-L3**)	L3
CO 5	Develop sequential circuits using flip-flops, counters, and shift registers, and analyse their use in digital memory systems, including ROM, RAM, and their variants. (**Analyse-L4**)	L4

Course Articulation Matrix-Correlation between COs, Pos & PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	1	2	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO 5	2	3	2							-	1	2		2	

CorrelationLevels:**1**-Slight(Low),**2**-Moderate(Medium),**3**-Substantial(High)andNocorrelation:**'-'**

Textbooks(T) and References(R):

TEXTBOOKS:

1. RamakanthA.Gayakwad-Op-Amps&LinearICs,PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,PearsonEducation,2005.

REFERENCEBOOKS:

1. D.Roy Chowdhury–Linear Integrated Circuits, New Age International(p) Ltd,2nd Ed.,2003.
2. John.F.Wakerly–Digital Design Principles and Practices, 3rd Ed.,Pearson,2009.
3. Salivahana-Linear Integrated Circuits and Applications,TMH,2008.
4. William D. Stanley-Operational Amplifiers with Linear Integrated Circuits,4th Ed. Pearson Education India, 2009

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Operational Amplifiers

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Ideal and Practical Op-Amp	1	03-07-25		TLM2	
2.	Op-Amp Characteristics	1	07-07-25		TLM2	
3.	DCCharacteristics	1	08-07-25		TLM1	
4.	AC Characteristics	1	09-07-25		TLM1	
5.	Features of 741 Op-Amp	1	10-07-25		TLM1	
6.	Modes of Operation-Inverting, Non-Inverting, Differential	1	14-07-25		TLM1	
7.	Instrumentation Amplifier, AC Amplifier	1	15-07-25		TLM1	
8.	Differentiators and Integrators	1	16-07-25		TLM1	
9.	Comparators	1	17-07-25		TLM1	
10.	Schmitt Trigger	1	21-07-25		TLM1	
11.	Introduction to Voltage Regulators	1	22-07-25		TLM1	
12.	Features of 723 Regulator	1	30-07-25		TLM1	
13.	Three Terminal Voltage Regulators	1	31-07-25		TLM1	
No. of classes required to complete UNIT-I :13			**No. of classes taken:**			

UNIT-II: Op-Amps, IC-555 & IC565 Applications

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 Active Filters	1	04-08-25		TLM1	
2.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	05-08-25		TLM1	
3.	Characteristics and Analysis of 1st order LPF & HPF Butterworth Filters	1	06-08-25		TLM1	
4.	Characteristics of Band pass, Band reject and All Pass Filters	1	07-08-25		TLM1	
5.	Characteristics of Band pass, Band reject and All Pass Filters	1	11-08-25		TLM1	
6.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	12-08-25		TLM1	
7.	Waveform Generators – Triangular, Saw-tooth and Square Wave	1	13-08-25		TLM1	
8.	IC555 Timer-Functional	1	14-08-25		TLM1	
9.	Monostable and Astable Operations	1	18-08-25		TLM1	
10.	Monostable and Astable Applications	1	20-08-25		TLM1	
11.	IC565 PLL- principle and Applications	1	21-08-25		TLM1	
No. of classes required to complete UNIT-II:11			**No. of classes taken:**			

UNIT-III: Data Converters

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Data Converters: Introduction, Basic DAC techniques, Different types of DACs		01-09-25		TLM2	
2.	Weighted resistor DAC		02-09-25		TLM2	

3.	R-2R ladder DAC and Inverted R-2R DAC		03-09-25		**TLM2**	
4.	Different Types of ADCs		04-09-25		**TLM2**	
5.	Parallel Comparator Type ADC		08-09-25		**TLM2**	
6.	Counter Type ADC		09-09-25		**TLM2**	
7.	Successive Approximation ADC		10-09-25		**TLM2**	
8	Dual Slope ADC		11-09-25		**TLM2**	
9.	DAC and ADC Specifications		16-09-25		**TLM2**	
No. of classes required to complete UNIT-III:9			**No. of classes taken:**			

UNIT-IV: Combinational Logic ICs

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**Combinational Logic ICs:** Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs		18-09-25		**TLM2**	
2.	Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs		19-09-25		**TLM2**	
3.	Code Converters		22-09-25		**TLM2**	
4.	Decoders, LED & LCD Decoders with Drivers		23-09-25		**TLM2**	
5.	Encoders, Priority Encoders		24-09-25		**TLM2**	
6.	Multiplexers, De-multiplexers		25-09-25		**TLM2**	
7.	Priority Generators/Checkers		06-10-25		**TLM2**	
8.	Parallel Binary Adder/Subtractor		07-10-25		**TLM2**	
9.	Magnitude Comparators		08-10-25		**TLM2**	
No.of classes required to complete UNIT-IV: 09			**No. of classes taken:**			

UNIT-V: Sequential Logic IC's and Memories

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Sequential Logic IC's and Memories:		09-10-25		**TLM2**	
2.	Familiarity with commonly available 74XX & CMOS40XX Series ICs		13-10-25		**TLM2**	
3.	All Types of Flip-flops		14-10-25		**TLM2**	
4.	Synchronous Counters		15-10-25		**TLM2**	
5.	Decade Counters		16-10-25		**TLM2**	
6.	Shift Registers.		21-10-25		**TLM2**	
7.	Memories:		22-10-25		**TLM2**	
8.	ROM Architecture		23-10-25		**TLM2**	
9.	Types of ROMS & Applications		27-10-25		**TLM2**	
10.	RAM Architecture		28-10-25		**TLM2**	
11.	Static & Dynamic RAMs		29-10-25		**TLM2**	
12	Assignment-2		30-10-25		**TLM2**	
No. of classes required to complete UNIT-V:14			**No. of classes taken:**			

Content 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.	Introduction to VLSI	1	01-11-25			

Teaching Learning Methods

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

PART-C: EVALUATION PROCESS:

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

PART-D:

Program Educational Objectives (PEOs):

PEO 1:	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.
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Program Outcomes (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex

	engineering activities with an understanding of the limitations
PO 6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
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PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

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

Date: 01-07-2025

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. B.Y.V.N.R.Swamy	Dr. B.Y.V.N.R.Swamy	Dr. B.V.N.R. Siva Kumar	Dr. G. Srinivasulu

COURSE HANDOUT

PART-A:

Program : B.Tech. V-Sem., ECE., Section–C
Academic Year : 2025-26
Course Name & Code : **Analog & Digital IC Applications Lab** – 23EC56
L-T-P-Cr : 0-0-3-1.5
Course Instructors : Dr.B.Y.V.N.R.Swamy, Mr. M. Siva Sankara Rao & Mrs. T. Kalpana.

Course Objectives:

This course provides the knowledge on operational amplifiers along with its applications. It also introduces the concepts of data converters. It provides exposure on design of combinational and sequential circuits using ICs.

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

CO 1	Demonstrate the characteristics and applications of Op-Amp, Timer, VCO and PLL.	L2
CO 2	Design Active filters, arithmetic circuits, waveform generators and data converters using Op-Amp	L3
CO 3	Analyze operation of combinational and sequential circuits using digital ICs.	L4
CO 4	Adapt effective Communication, presentation and report writing skills.	L3

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

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

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

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	02-07-2025		TLM4	
2.	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	09-07-2025		TLM4	
3.	Integrator and Differentiator Circuits using IC 741.	3	16-07-2025		TLM4	
4.	Active Filter Applications – LPF, HPF (first order)	3	23-07-2025		TLM4	
5.	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	30-07-2025		TLM4	
6.	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	06-08-2025		TLM4	
7.	Function Generator using OP AMPs.	3	13-08-2025		TLM4	
8.	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	20-08-2025		TLM4	
9.	4 bit DAC using OP AMP.	3	10-09-2025		TLM4	
10.	Realization of Logic Gates	3	17-09-2025		TLM4	
11.	3 to 8 Decoder- 74138	3	24-09-2025		TLM4	
12.	D Flip-Flop- 7474	3	08-10-2025		TLM4	
13.	Decade Counter- 7490	3	15-10-2025		TLM4	
14.	Revision		22-10-2025			
15.	Lab Internal Examination	3	29-10-2025			
No. of classes required:45				**No. of classes taken:**		

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

S.No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to ADICA Lab experiments, Cos, POs and PSOs.	3	05-07-2025		TLM4	
2	OP AMP Applications – Adder, Subtractor, Comparator Circuits.	3	12-07-2025		TLM4	
3	Integrator and Differentiator Circuits using IC 741.	3	19-07-2025		TLM4	
4	Active Filter Applications – LPF, HPF (first order)	3	26-07-2025		TLM4	
5	Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.	3	02-08-2025		TLM4	
6	IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.	3	09-08-2025		TLM4	
7	Function Generator using OP AMPs.	3	23-08-2025		TLM4	
8	IC 555 Timer – Astable& Mono-stable Operation Circuit.	3	06-09-2025		TLM4	
9	4 bit DAC using OP AMP.	3	13-09-2025		TLM4	
10	Realization of Logic Gates	3	20-09-2025		TLM4	
11	3 to 8 Decoder- 74138	3	27-09-2025		TLM4	
12	D Flip-Flop- 7474	3	04-10-2025		TLM4	
13	Decade Counter- 7490	3	11-10-2025		TLM4	
14	Revision	3	18-10-2025			
15	Lab Internal Examination	3	25-10-2025			
No. of classes required:45				**No. of classes taken:**		

Teaching Learning Methods

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

Program Educational Objectives (PEOs):

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

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PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. B.Y.V.N.R.Swamy Mr.M. Sivasankara Rao Mrs. T.Kalpana	Dr. B.Y.V.N.R.Swamy	Dr. B.V.N.R. Siva Kumar	Dr. G. Srinivasulu

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section - C
Course Instructor : Dr. P.Rakesh Kumar, Associate Professor of ECE
Course Name & Code : Design and Simulation of Antennas Lab – 23EC58
L-T-P-Cr Structure : 0-0-2-1
Academic Year : 2025-26

Course Objectives:

To equip students with practical knowledge and simulation skills in antenna design, electromagnetic wave analysis, impedance matching, and development of modern antennas for wireless applications.

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

CO1	Analyze EM wave characteristics and perform impedance matching using Smith Chart for efficient antenna performance **(Analyze – L4)**	L2
CO2	Design and simulate various antennas including dipole, monopole, and microstrip types **(Apply – L3)**	L3
CO3	Interpret radiation patterns and assess antenna suitability for wireless applications like Bluetooth, Wi-Fi, and WiMAX **(Apply – L3)**	L3
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**	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	2	2	-	1	-	-	-	-	-	-	-	3	-	-
CO2	3	1	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	2	-	-	-	2	2	3		1	-	-	-

Correlation Levels: **1.**Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

TEXT BOOKS:

1. Rudra Pratap , "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers" , Oxford University Press .
2. JR James, PS Hall "Handbook of Microstrip Antennas" IEE Electromagnetic waves series, 1986.

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - C

UNIT-I: Amplitude Modulation

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 the course	2	01.07.2025			
2.	Generation of EM-Wave	2	08.07.2025			
3.	Impedance Matching using Smith Chart	2	15.07.2025			
4.	Calculation of phase and group velocity	2	22.07.2025			
5.	Introduction to HFSS	2	29.07.2025			
6.	Design of Microstrip Patch Antenna with Strip Line Feed	2	05.08.2025			
7.	Design and Analysis of Rectangular Microstrip Patch Antenna	2	12.08.2025			
8.	Design of Patch Antenna for Bluetooth Applications	2	19.08.2025			
9.	Design of Patch Antenna for Wi-Fi Applications	2	02.09.2025			
10.	Design of Patch Antenna for WiMAX Applications	2	09.09.2025			
11.	Design and Simulation of Circular Microstrip Patch Antenna	2	16.09.2025			
12.	Design and Simulation of Hexagonal Microstrip Patch Antenna	2	23.09.2025			
13.	Design of Dual Band Patch Antennas	2	07.10.2025			
14.	Design of Wideband Patch Antennas	2	14.10.2025			
15.	Content beyond syllabus – Design of Reconfigurable antennas	2	21.10.2025			
16.	Internal Exam	2	28.10.2025			
No. of weeks required to complete experiments :12			**No. of classes taken:**			

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

PART-C: EVALUATION PROCESS:

Evaluation Task	Experiment Nos.	Marks
Day to Day work	1,2,3,4,5,6,7,8,9,10,11,12	A1 =10
Record and observation	1,2,3,4,5,6,7,8,9,10,11,12	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8,9,10,11,12	C1=15
Cumulative Internal Examination (CIE): (A1+B1+C1)	1,2,3,4,5,6,7,8,9,10,11,12	30
Semester End Examination (SEE)	1,2,3,4,5,6,7,8,9,10,11,12	70
Total Marks=CIE+SEE 100	1,2,3,4,5,6,7,8,9,10,11,12	30
Total Marks = CIE + SEE		100

PART-D:

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Date	Dr. P.Rakesh Kumar	Dr. P.Rakesh Kumar	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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

COURSE HANDOUT

PART-A

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

ACADEMIC YEAR : 2025-26

COURSE NAME & CODE : **Real Time Operating Systems** Lab

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

COURSE INSTRUCTOR : **Dr. P. Lachi Reddy / Mr. Sasi Bhushan. K**
Dr. Y. Amar Babu / Mr. M. Samba Siva Reddy
Mr. N. Dharmachari

COURSE OBJECTIVE:

To provide hands-on experience through practical experimentation and simulation in real-time embedded system development using ARM-based processors and RTOS and enabling them to implement task management, synchronization, inter-process communication, device interfacing, and data communication for real-time applications.

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

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

CO1	**Develop** real-time applications on ARM-based platforms using various RTOS environments through task creation, synchronization, and resource sharing mechanisms.
CO2	**Design** real-time embedded system architectures by modeling tasks, managing memory, and scheduling using RTOS principles.
CO3	**Construct** embedded solutions for real-world applications through case studies and implement device interfacing, data communication, and system porting using Linux and RTOS tools.
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					
	Part-I: Experiments using ARM-926 with PERFECT RTOS					
1.	Introduction , Syllabus Discussion & CO-PO Discussion, Installation of Software	3	04-07-2025		**TLM2**	
2.	**Installation of open source RTOS** Coo-Cox-Software-Platform	3	11-07-2025			
3.	Register a new command in CLI.	3	18-07-2025			
4.	Create a new Task.	3	25-07-2025		**TLM8**	
5.	Interrupt handling.	3	01-08-2025		**TLM8**	
6.	Allocate resource using semaphores.	3	08-08-2025		**TLM8**	
7.	Share resource using MUTEX.	3	22-08-2025		**TLM8**	
8.	Avoid deadlock using BANKER'S algorithm.	3	05-09-2025		**TLM8**	
9.	Synchronize two identical threads using MONITOR.	3	12-09-2025		**TLM8**	
10.	Reader's Writer's Problem for concurrent Tasks.	3	19-09-2025		**TLM8**	
	CYCLE -2					
	Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)					
11.	Implement the interfacing of display with the ARM- CORTEX processor.	3	26-09-2025		**TLM8**	
12.	Interface ADC and DAC ports with the Input and Output sensitive devices.	3	10-10-2025		**TLM8**	
13.	Simulate the temperature DATA Logger with the SERIAL communication with PC.	3	17-10-2025		**TLM8**	
14.	Implement the developer board as a modem for data communication using serial port communication between two PC's	3	24-10-2025		**TLM8**	
15.	Internal Examination	3	31-10-2025			
No. of classes required to complete:		45	No. of classes conducted:			

PART-C

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

Academic Calendar: 2025 – 26

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. P. Lachi Reddy) **(Dr. Y. Amar Babu** **(Mr. Sasi Bhushan. K)** **(Mr. M. Samba Siva Reddy)** **(Mr. N. Dharmachari)**	**(Dr. Y. Amar Babu)**	**(Dr. P. Lachi Reddy)**	**(Dr. G. Srinivasulu)**

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

COURSE HANDOUT

PART-A

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

Course Instructor : Dr. P. Lachi Reddy Professor

Mr. Sasi Bhushan. K, Associate Professor

Course Name & Code : Real Time Operating Systems – 23ECH4

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

Academic Year : 2025 – 26

Pre requisite:

COURSE EDUCATIONAL OBJECTIVES:

The course aims to equip students with knowledge of RTOS concepts, programming with various real-time kernels, case-based modeling of embedded systems, Linux-based development and image creation, and RT Linux programming, enabling them to design and implement reliable, real-time embedded applications.

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

CO1:	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems
CO2:	Apply the fault tolerance techniques, evaluation of reliability.
CO3:	Analyze the working of real time operating systems and real time database.
CO4:	Create mathematical model of the system and to develop real time algorithm for task scheduling.

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

Prescribed Syllabus:

UNIT-I: Introduction

OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device, File and IO Systems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues.

UNIT-II: RTOS Programming

Basic Functions and Types of RTOS for Embedded Systems, RTOS mCOS-II, RTOS Vx Works, Programming concepts of above RTOS with relevant Examples, Programming concepts of RTOS Windows CE, RTOS Linux 2.6.x and RTOS RT Linux.

UNIT-III: Program Modeling – Case Studies

case study of digital camera hardware and software architecture, Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car, Case Study of Embedded System for a Smart Card, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-IV: Target Image Creation & Programming in Linux

Operating System Software, Target Image Creation for Window XP Embedded, Porting RTOS on a Micro Controller based Development Board. Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming

UNIT-V: Programming in RT Linux

Overview of RT Linux, Core RT Linux API, Program to display a message periodically, semaphore management, Mutex, Management, Case Study of Appliance Control by RT Linux System

TEXT BOOKS:

1. Rajkamal: “Embedded Systems-Architecture, Programming and Design”, Tata McGraw Hill Publications, Second Edition, 2008.
2. Dr. K.V.K.K. Prasad: “Embedded/Real-Time Systems” Dream Tech Publications, 2005 Edition, Black pad book.

REFERENCES:

1. Labrosse, “Embedding system building blocks “, CMP publishers.
2. Rob Williams,” Real time Systems Development”, Butterworth Heinemann Publications.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION [10 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Introduction, Discussion of Syllabus and Course Outcomes	1	02-07-2025			
2.	OS Services: Process Management, Timer Functions, Event Functions,	1	03-07-2025			
3.	Memory Management, Device, File and IO Systems Management,	1	03-07-2025			
4.	Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls	1	09-07-2025			
5.	Real-Time Operating Systems,	1	10-07-2025			
6.	Basic Design Using an RTOS,	1	10-07-2025			
7.	RTOS Task Scheduling Models,	1	16-07-2025			
8.	Interrupt Latency and Response of the Tasks as Performance Metrics,.	1	17-07-2025			
9.	OS Security Issues	1	17-07-2025			
10.	**Revision/Tutorial,/Assignment**	1	23-07-2025			

UNIT- II: RTOS PROGRAMMING [13 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.	Basic Functions and Types of RTOS for Embedded Systems,	2	24-07-2025			
12.	RTOS mCOS-II,	1	30-07-2025			
13.	RTOS Vx Works,.	2	31-07-2025			
14.	Programming concepts of above RTOS with relevant Examples,	1	06-08-2025			
15.	Programming concepts of RTOS Windows CE,	2	07-08-2025			
16.	RTOS Linux 2.6.x	1	13-08-2025			
17.	RTOS RT Linux	2	14-08-2025			
18.	Programming - logical and decision making operations	2	20-08-2025 21-08-2025			
19.	**Revision / Tutorial,/Assignment**	1	21-08-2025			

UNIT – III: PROGRAM MODELING – CASE STUDIES [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.	case study of digital camera hardware and software architecture,	2	03-09-2025 04-09-2025			
21.	Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car,	2	04-09-2025 10-09-2025			
22.	Case Study of Embedded System for a Smart Card,	2	11-09-2025 11-09-2025			
23.	Case Study of Embedded System of Mobile Phone Software for Key Inputs.	2	17-09-2025 18-09-2025			
24.	**Revision / Tutorial,/Assignment**	1	**18-09-2025**			

UNIT – IV: TARGET IMAGE CREATION & PROGRAMMING IN LINUX [7 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
25.	Operating System Software,	1	24-09-2025			
26.	Target Image Creation for Window XP Embedded,	1	25-09-2025			
27.	Porting RTOS on a Micro Controller based Development Board.	1	25-09-2025			
28.	Overview and programming concepts of Unix/Linux Programming,	1	08-10-2025			
29.	Shell Programming,	1	09-10-2025			
30.	System Programming	1	09-10-2025			
31.	**Revision / Tutorial,/Assignment**	1	15-10-2025			

UNIT – V: PROGRAMMING IN RT LINUX [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.	Overview of RT Linux,	1	15-10-2025			
33.	Core RT Linux API,	1	16-10-2025			
34.	Program to display a message periodically,	1	16-10-2025			
35.	Semaphore management,	1	22-10-2025			
36.	Mutex, Management,	1	23-10-2025			
37.	Case Study of Appliance Control by RT Linux System	1	23-10-2025			
38.	**Revision / Tutorial,/Assignment**	1	29-10-2025			

BEYOND THE SYLLABUS & REVISION [2 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.	Synchronize two identical threads using RTOS	1	30-10-2025			
40.	Reader's Writer's Problem for concurrent Tasks.	1	30-10-2025			

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

PART – C

Academic Calendar: 2025 – 26 (V Semester)

B.Tech V Semester - 2023 Admitted Batch			
Class work Commence From	**30-06-2025**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	**30-06-2025**	23-08-2025	8 Weeks
I Mid Examinations	**25-08-2025**	**30-08-2025**	1 Week
II Phase Instructions	01-09-2025	**01-11-2025**	8 Weeks
II Mid Examinations	**03-11-2025**	**08-11-2025**	1 Week
Preparation & Practicals	10-11-2025	15-11-2025	1 Week
Semester End Examinations	**17-11-2025**	**29-11-2025**	2 Weeks

EVALUATION PROCESS:

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

CO 1	Understand Resource Sharing and dependencies for Scheduling Real-time tasks in multiprocessor and distributed systems	Describe, Explain, Paraphrase, Restate, Associate, Contrast, Summarize, Differentiate, Interpret, Discuss
CO 2	Apply the fault tolerance techniques, evaluation of reliability.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Experiment, Show, Examine, Modify
CO 3	Analyze the working of real time operating systems and real time database.	Classify, Outline, Break down, Categorize, Analyze, Diagram, Illustrate, Infer, Select
CO 4	Create mathematical model of the system and to develop real time algorithm for task scheduling.	Categorize, Analyze, Illustrate, Infer Select

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. LACHI REDDY] [Mr. K. SASI BHUSHAN]	[Dr. P. LACHI REDDY]	[Dr. P. LACHI REDDY]	[Dr. G. SRINIVASULU]

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., V-Sem., Section – C
Academic Year : 2025-26
Course Name & Code : **Digital Communications– 23EC09**
L-T-P-Cr Structure : 3-0-0-3
Course Instructor : Dr. K. Rani Rudrama

Course Objectives:

1	To get basic knowledge on different digital modulation techniques.
2	To know the different concepts on information theory, block codes and convolution codes.
3	To Learn the complete information regarding the design of optimum receivers for digital communication systems and their performance analysis.

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

CO1	**Understand** the principles and components of digital communication system, sampling, quantization, and modulation techniques.	L2
CO2	**Summarize** the concepts of baseband and passband digital modulation techniques in terms of signal representation and system design.	L2
CO3	**Evaluate** the performance of digital modulation schemes, using signal-to-noise ratio (SNR), bit error rate (BER),and probability of error, under noisy channel conditions.	L3
CO4	**Apply** error control coding methods to enhance data transmission efficiency and reliability.	L3

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

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

Correlation Levels: **1.** Slight (Low),**2**-Moderate(Medium), **3**-Substantial (High).

Textbooks (T):

T1 Simon Haykin, *"Digital Communications"*,John Wiley & sons, 2nd Edition.
T2 Taub and Schilling, *"Principles of Communication Systems"*, TMH Publications, 3rd edition

Reference Books(R)

R1 J. S. Chitode, *"Digital Communications"*,Technical Publications, first edition
R2 V.Chandra Sekar**,** *"Communication Systems"*,Oxford University Press**.**
R3 Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, Pearson Education India, 2010

PART-B: Course Delivery Plan (Lesson Plan): B.Tech., ECE., V-Sem., Section - C

UNIT-I: Introduction to Digital Communication

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 Digital communication, Analog and Digital signals.	1	30-06-25			
2.	Need for Digital Communication.	1	01-07-25			
3.	Line Codes- Unipolar, Polar and Bipolar	1	03-07-25			
4.	Elements of a Digital Communication System.	1	04-07-25			
5.	Sampling, quantization, Types of quantization, Quantization noise and error	1	07-07-25			
6.	Need for non-uniform quantization, Companding- μ-law, A-law	1	08-07-25			
7.	Source encoder- decoder, Channel Encoder-decoder.	1	10-07-25			
8.	Application of TDM in Telephony, Problems related to TDM	1	11-07-25		Innovative	
9.	Bit Rate, Baud Rate, System Bandwidth, Channel Bandwidth	1	14-07-25			
10.	Characteristics of channel and types of channels.	1	15-07-25			
11.	Tutorial-I	1	17-07-25			
12.	Revision	1	18-07-25			
No. of classes required to complete UNIT-I:		**12**	**No. of classes taken:**			

UNIT-II: Pulse Digital Modulation

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Block diagram of Pulse Code Modulation,	1	21-07-25			
14.	Regenerative repeaters	1	22-07-25			
15.	Bandwidth for PCM, Quantization noise.	1	24-07-25			
16.	Output Signal to noise ratio in PCM	1	25-07-25			
17.	Delta Modulation-Transmitter	1	28-07-25			
18.	Delta Modulation-Receiver.	1	29-07-25			
19.	Bandwidth for DM, Effect of noise in DM - slope overload distortion.	1	31-07-25			
20.	Granular noise, Adaptive Delta Modulation Transmitter Block diagram	1	01-08-25			
21.	ADM -Receiver	1	04-08-25		Innovative	
22.	Comparison of PCM , DM , ADM	1	05-08-25			
23.	Tutorial-II	1	07-08-25			
24.	Revision	1	08-08-25			
No. of classes required to complete UNIT-II :12			**No. of classes taken:**			

UNIT-III: Digital Modulation Techniques

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Digital modulation types	1	11-08-25			
26.	Coherent Binary Modulation Techniques: BASK	1	12-08-25			
27.	Binary Phase Shift Keying(BPSK)	1	14-08-25			
28.	Binary Frequency Shift Keying(BFSK)	1	18-08-25			
29.	Quadrature Phase shift Keying(QPSK)	1	19-08-25			
30.	M-ary Modulation techniques	1	21-08-25			
31.	Bandwidth efficiency for M-ary PSK	1	22-08-25			
32.	Bandwidth efficiency for M-ary FSK	1	02-09-25			
33.	Non Coherent Digital modulation techniques: ASK,	1	04-09-25			
34.	Non Coherent Digital modulation techniques: FSK and QPSK	1	05-09-25			
35.	QAM	1	08-09-25		Innovative	
36.	Tutorial-III	1	09-09-25			
No. of classes required to complete UNIT-III:12			**No. of classes taken:**			

UNIT-IV: Optimal Reception of Digital Signal

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Model of digital communication system	1	11-09-25			
38.	signal detection in noise,	1	12-09-25			
39.	Receiver Techniques: Correlation receiver.	1	15-09-25			
40.	Probability of error for Coherent BASK,	1	16-09-25			
41.	Probability of error for Coherent BPSK,	1	18-09-25			
42.	Probability of error for Coherent BFSK,	1	19-09-25			
43.	Probability of error for non-coherent FSK and DPSK	1	22-09-25			
44.	Bit Error Rate Vs Signal to Noise Ratio for M-ary FSK	1	23-09-25			
45.	Bit Error Rate Vs Signal to Noise Ratio for M-ary PSK	1	25-09-25		Innovative	
46.	Tutorial-IV	1	26-09-25			
No. of classes required to complete UNIT-IV:10			**No. of classes taken:**			

UNIT-V: Linear Block Codes

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Matrix description of Linear Block codes	1	06-10-25			
48.	Syndrome Decoding.	1	07-10-25			
49.	Hamming codes- encoding and decoding	1	09-10-25			
50.	Binary Cyclic Codes-Algebraic structure	1	10-10-25			
51.	Systematic and Non Systematic form, Encoding, Syndrome calculation.	1	13-10-25			
52.	**Convolution Codes:** Encoding of Convolution Codes	1	14-10-25			
53.	Time domain approach, Transform domain approach	1	16-10-25			
54.	Graphical approach- State diagram, Code tree and Trellis diagram	1	17-10-25			
55.	Decoding of Convolution Codes- Viterbi decoding algorithm.	1	20-10-25	Innovative		
56.	Tutorial-V	1	23-10-25			
57.	Problem Solving Session	1	24-10-25			
58.	Revision	1	27-10-25			
No. of classes required to complete UNIT-V:11			**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
59.	Quadrature Amplitude Modulation **256-QAM**	**1**	28-10-2025			
60.	OFDM (Orthogonal Frequency Division Multiplexing)	**1**	30-10-2025			

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

PART-C: EVALUATION PROCESS:

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes(POs):

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

Program Specific Outcomes (PSOs):

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

Date	Dr. K.RaniRudrama	Dr. K.RaniRudrama	Dr. M.V.Sudhakar	Dr.G.Srinivasulu
30.06.2025	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC with "A" Grade and NBA(ASE, CE, CSE, ECE, EEE, IT &ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, NTR Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : M.Sambasiva Reddy/Mr.V.V. Rama Krishna/Mrs.B.Rajeswari
Course Name & Code : Idea Implementation Lab & 23ECS2
L-T-P Structure : 0-1-2 Credits : 2
Program/Sem/Sec : B.Tech., ECE., V-Sem., Sections- C A.Y :2025-26

Pre-Requisites: Python Programming

Course Objectives: In this course, student will learn about idea implementation and procedure to develop prototypes for engineering applications.

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

CO1	Understand the programming concepts of IOT. (**Understand – L2)**
CO2	Develop real time applications using Internet of Things. (**Apply – L3)**
CO3	Demonstrate the integration of sensors with IOT. (**Understand – L2)**
CO4	Adapt effective Communication, presentation and report writing skills **(Apply – L3)**

TEXTBOOKS:

1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017.
2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition.

REFERENCES:

1. ArshdeepBahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, University Press, 2015
2. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford Press.

PART-B (Theory)

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**IoT Basics:** IoT, Frame work	1	30-06-2025			
2.	Architectural View	1	07-07-2025			
3.	Technology, Sources	1	14-07-2025			
4.	M2M communication	1	21-07-2025			
5.	Sensors	1	28-7-2025			
6.	Participatory sensing	1	04-08-2025			
7.	RFID	1	11-08-2025			
8.	Wireless sensor network elements	1	18-08-2025			
No. of classes required to complete UNIT-I : 08			No. of classes taken :			

UNIT-II:

S.No.	Topic/s	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	IoT Applications	1	01-09-2025			
10.	Prototyping embedded devices for M2M and IoT	1	08-09-2025			
11.	M2M and IoT case studies	1	15-09-2025			
12.	Case studies	1	22-09-2025			
13.	Case studies	1	29-09-2025			
14.	Case studies	1	06-10-2025			
15.	Case studies	1	13-10-2025			
No. of classes required to complete UNIT-II		**7**	No. of classes taken:			

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

S.No.	Experiment Name	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Lab	2	30-06-2025			
2.	Interfacing LED. DHT11-Temperature and, humidity sensor using Arduino	2	07-07-2025			
3.	Interfacing Ultrasonic sensor and PIR sensor using Arduino	2	14-07-2025			
4.	Design of Traffic Light Simulator using Arduino	2	21-07-2025			
5.	Design of Water flow detection using an Arduino board	2	28-7-2025			
6.	Interfacing of LED, Push button with Raspberry Pi and Python Program	2	04-08-2025			
7.	Design of Motion Sensor Alarm using PIR Sensor	2	11-08-2025			

8.	Interfacing DHT11-Temperature and Humidity Sensor with Raspberry Pi	2	18-08-2025			
9.	Interfacing DS18B20 Temperature Sensor with Raspberry Pi	2	01-09-2025			
10.	Implementation of DC Motor and Stepper Motor Control with Raspberry Pi	2	08-09-2025			
11.	Raspberry Pi based Smart Phone Controlled Home Automation	2	15-09-2025			
12.	Smart Traffic light Controller	2	22-09-2025			
13.	Smart Health Monitoring System	2	29-09-2025			
14.	Idea Implementation	2	06-10-2025			
15.	Idea Implementation	2	13-10-2025			
16.	Documentation	2	20-10-2025			
17.	Documentation	2	27-10-2025			
No. of classes required to complete Laboratory : 34				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Descriptive Examination	**15**
Objective Examination	**10**
Assignment	**5**
Day-to-Day	**10**
Total CIE(A)	**40**
Total SEE(B)	**70**
Total(A+B)	**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 complexengineering 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: 30-06-2025

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

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.K.RaviKumar
Course Name & Code : Python Programming for AI & ML (23AM81)
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech. ECE/III/C-Sec. A.Y.: 2025-26

Pre Requisite: Python Programming, Familiarity with mathematics

COURSE EDUCATIONAL OBJECTIVE (CEO):

- Learn Python programming fundamentals and libraries.
- To learn the basics of AI and apply various search algorithms to solve problems effectively.
- To understand and apply data handling and preprocessing techniques using NumPy and Pandas for effective data analysis and machine learning.
- To Understand data handling, visualization, and preprocessing in Python.
- To understand and apply basic ML algorithms using Python.

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

CO1:	Learn how to use Python to work with lists, sets, tuples, and dictionaries, and apply loops and conditions to solve basic problems.	Understand –Level 2
CO2:	Apply the basics of Artificial Intelligence, AI agents, and apply different search algorithms like BFS, DFS, Uniform Cost Search, Greedy Search, and A* to solve problems.	Apply – Level 3
CO3:	Apply Python libraries such as NumPy and Pandas for efficient data manipulation and preprocessing.	Apply – Level 3
CO4:	Understand the Visualize and explore data using tools like Matplotlib and Seaborn for effective data analysis and interpretation	Apply – Level 3
CO5:	Apply the basics of Machine Learning, its types and uses, and understand how supervised, unsupervised, and reinforcement learning methods work.	Apply – Level 3

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**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	-
CO3	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO4	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**2**	-	**2**
CO5	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**	**1**	-	-

1 – Low **2** – Medium **3** – High

TEXTBOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2019 **(Unit-I)**
2. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig (for AI concepts) **(Unit-II)**
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024 Python Machine Learning – Sebastian Raschka **(Unit-III to V)**

REFERENCE BOOKS:

1. **Allen B. Downey**, *Think Python: How to Think Like a Computer Scientist*, 2nd Ed., O'Reilly Media.
2. Stefanie Molin, Hands-On Data Analysis with Pandas, Packt Publishing, 2021.
3. **Stuart Russell & Peter Norvig**, *Artificial Intelligence: A Modern Approach* (4th Edition), Pearson, 2020.
4. **"Machine Learning",** TomM. Mitchell, McGraw-HillPublication, 2017
5. **Aurélien Géron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (3rd Ed.), O'Reilly Media, 2022.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT – I: Python Basic Data Structures

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.	Discussion of CO's and PO's, brief introduction about python	1	02/07/2025		TLM1	
2.	Python programming introduction, Basics	1	03/07/2025		TLM2	
3.	Creating Lists, Accessing and Manipulating Lists	1	05/07/2025		TLM1	
4.	Sets	1	09/07/2025		TLM2	
6.	Tuples	1	10/07/2025		TLM2	
7.	Dictionaries	1	16/07/2025		TLM1	
8.	Understanding the differences among them	1	17/07/2025		TLM2	
9.	Applications of the Data Structures	1	19/07/2025		TLM2	
10.	Using Branching and Control loops with Data structures	1	23/07/2025		TLM2	
11.	Conti..Using Branching and Control loops with Data structures	1	24/07/2025		TLM2	
12.	Unit-1 Exam	1	26/07/2025			
No. of classes required to complete UNIT – I: 11				**No. of classes taken:**		

UNIT – II: Python for AI Concepts

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction to Artificial Intelligence	1	30/07/2025		TLM2	
14.	AI agents	1	31/07/2025		TLM2	
15.	AI agents	1	02/08/2025		TLM1	
16.	Problem Solving	1	06/08/2025		TLM1	
17.	Search Algorithms: Informed searching strategies: BFS (Breadth-First Search)	1	07/08/2025		TLM2	
18.	DFS (Depth-First Search)	1	13/08/2025		TLM1	
19.	Uniformed cost search	1	14/08/2025		TLM1	
20.	Uninformed searching strategies: Best first Search	1	20/08/2025		TLM1	
21.	Greedy best first search	1	21/08/2025		TLM1	

22.	A* algorithm	1	23/08/2025		TLM1	
No. of classes required to complete UNIT – II: 10				**No. of classes taken:**		

UNIT – III: NumPy, Pandas & Data Preprocessing

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Introduction to Numpy: Arrays	1	03/09/2025		TLM2	
25.	Indexing, Operations	1	04/09/2025		TLM1	
26.	Introduction to Pandas: DataFrames	1	06/09/2025		TLM2	
27.	Series	1	10/09/2025		TLM1	
28.	Data Cleaning: Handling Missing Values, Outliers	1	11/09/2025		TLM2	
30.	Feature Encoding: Label Encoding, One-Hot Encoding	1	13/09/2025		TLM2	
32.	Feature Scaling: MinMax	1	18/09/2025		TLM1	
33.	Standard Scaler, Data Splitting: Train-Test Split	1	20/09/2025		TLM2	
No. of classes required to complete UNIT – III: 8				**No. of classes taken:**		

UNIT – IV: Data Visualization and Exploratory Data Analysis (EDA)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Introduction to Matplotlib	1	24/09/2025		TLM2	
37.	Seaborn	1	25/09/2025		TLM1	
38.	Plotting Line	1	27/09/2025		TLM2	
39.	Bar, Histogram	1	01/10/2025		TLM2	
40.	Box, and Heatmaps	1	04/10/2025		TLM2	
41.	Pair plots, Correlation Matrix	1	08/10/2025		TLM2	
42.	Visualizing Categorical & Numerical Data	1	09/10/2025		TLM1	
43.	Understanding Data Distributions, Patterns	1	11/10/2025		TLM2	
No. of classes required to complete UNIT – IV: 12				**No. of classes taken:**		

UNIT – V: Introduction to Machine Learning

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 of Machine Learning, Types of ML, Applications of ML	1	15/10/2025		TLM2	
48.	Supervised Learning	1	16/10/2025		TLM2	
49.	Linear Regression, Logistic Regression	1	18/10/2025		TLM2	
50.	K-Nearest Neighbours	1	22/10/2025		TLM1	
51.	Support Vector Machine	1	23/10/2025		TLM1	
52.	Introduction to Unsupervised Learning	1	25/10/2025		TLM1	

53.	Intro. to Reinforcement Learning	1	29/10/2025		TLM1	

No. of classes required to complete UNIT – V: 7	**No. of classes taken:**

Content Beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
58.	Reinforcement Learning, Types of Data	1	30/10/2025		TLM2	
59.	Introduction to Deep Learning	1	01/11/2025		TLM2	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: 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 engaging independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1	The ability to apply Software Engineering practices and strategies in software project development using open-source programming environment for the success of organization.
PSO2	The ability to design and develop computer programs in networking, web applications and IoT asper the society needs.
PSO3	To inculcate an ability to analyze, design and implement database applications.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mr.K.Ravi Kumar	Dr. Shaik Jameer	Dr. Sk .Salma Asiya Begum	Dr. S Jayaprada
Signature				