LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program : B.Tech. VII-Sem., ECE., Section–A
Academic Year : 2026-27
Course Name & Code : Cellular &Mobile Communications -23EC26
L-T-P-Cr : 3-0-0-3
Course Instructure : Dr. M. V. Sudhakar

Course Objective:

The course enables students to understand the principles of cellular mobile communication systems, radio propagation characteristics, interference, frequency management, and handoff mechanisms. It develops the ability to analyze cellular network design aspects such as coverage, capacity, antenna systems, and channel assignment techniques. The course also introduces modern digital cellular technologies including GSM, CDMA, LTE, MIMO, OFDM, and emerging 5G wireless systems.

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

CO 1	Summarize the fundamental concepts of cellular mobile communication systems, including limitations of conventional systems, frequency reuse, propagation effects, and fading. **(Understand-L2)**
CO 2	Apply knowledge of interference mechanisms and implement appropriate antenna configurations and diversity techniques to improve system performance. **(Apply-L3)**
CO 3	Implement principles of frequency management, channel assignment, and cell coverage analysis for efficient cellular network design. **(Apply-L3)**
CO 4	Describe cellular system components, including antennas and handoff mechanisms, and modern digital communication technologies such as GSM, multiple access schemes, LTE, OFDM, MIMO, and 5G. (**Understand-L2**)

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

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

Textbooks (T) and References (R):

T1: Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
T2: Wireless Communications–Principles and Practice, T.S. Rappaport, Pearson, 2nd edition, 2010, ISBN 9788131731864

R1: Principles of Mobile Communications–Gordon L.Stuber, Springer International 2nd Edition, 2001.
R2: Modern Wireless Communication – Symon Haykin Michael Moher, Pearson Education, 2005.
R3: Wireless Communication theory and Techniques, Asrar U.H.Sheikh,Springer,2004.
R4: Wireless Communications, A.Goldsmith, Cambridge Univ Press,2005
R5: Fundamentals of Wireless Communications, D.Tse and P.Viswanath, Cambridge Univ Press, 2005

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Cellular Systems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	CO &POs, Introduction to the course	1	29-06-2026			
2.	Limitations of Conventional System,	1	30-06-2026			
3.	Basic Cellular Mobile System,	1	01-07-2026			
4.	First, second, third and fourth and Generation cellular wireless systems.	1	03-07-2026			
5.	Operation of Cellular System.	1	06-07-2026			
6.	Uniqueness of Mobile Radio Environment	1	07-07-2026			
7.	Fading, coherence bandwidth	1	08-07-2026			
8.	Doppler Spread.		10-07-2026			
9.	**Fundamentals of cellular Radio System Design: concept of frequency reuse channels; Activity : Flipped class.**	1	13-07-2026			
10.	Co-channel Interference,	1	14-07-2026			
11.	Co-channel Interference Reduction Factor;	1	15-07-2026			
12.	Desired C/I from a normal case in a Omni directional Antenna system.	1	17-07-2026			
13.	Trunking and grade of service	1	20-07-2026			
14.	Revision	1	21-07-2026			
No. of classes required to complete UNIT-I: 14			**No. of classes taken:**			

UNIT-II: Co-Channel & Non-Co-Channel Interference

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.	Co-Channel Interference Fundamentals	1	22-07-2026			
2.	Measurement of Real Time Co-Channel Interference,	1	24-07-2026			
3.	Design of Antenna system,	1	27-07-2026			
4.	Antenna parameters and their effects,	1	28-07-2026			
5.	Diversity techniques: Space Diversity	1	29-07-2026			
6.	Polarization diversity	1	31-07-2026			
7.	Frequency diversity and time diversity.	1	03-08-2026			
8.	Non-co channel interference-adjacent channel interference,	1	04-08-2026			
9.	Near End far end interference,	1	05-08-2026			
10.	**Effect on coverage and interference by power decrease, antenna height decrease;**	1	07-08-2026			

	Activity : Case study.					
11.	Revision	1	10-08-2026			
No. of classes required to complete UNIT-II: 11			**No. of classes taken:**			

UNIT-III: Frequency Management And Channel Assignment, Cell Coverage For Signal And Traffic

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 Frequency Management And Channel Assignment.	1	11-08-2026			
2.	Numbering and grouping,	1	12-08-2026			
3.	setup access and paging channels	1	14-08-2026			
4.	channel assignments to cell sites and mobile units	1	17-08-2026			
5.	Channel sharing and borrowing, sectorization, overlaid cells	1	18-08-2026			
6.	non fixed channel assignment.	1	19-08-2026			
7.	Introduction to Cell Coverage For Signal And Traffic	1	21-08-2026			
8.	Signal reflections in flat and hilly terrain, effect of human made structures	1	31-08-2026			
9.	, phase difference between direct and reflected paths, straight line path loss slope,	1	01-09-2026			
10.	**General formula for mobile propagation over water and flat open area;** **Activity : Problem Based Learning**	1	02-09-2026			
11.	Near and long distance propagation, antenna height gain,	1	07-09-2026			
12.	Form of a point to point model.	1	08-09-2026			
13.	Revision	1	09-09-2026			
No. of classes required to complete UNIT-III: 13			**No. of classes taken:**			

UNIT-IV: Cell site and Mobile Antennas, Handoffs

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.	Cellsite And Mobile Antennas: Sum and difference patterns and their synthesis	1	11-09-2026			
2.	Omni-directional antennas, directional antennas for interference reduction	1	15-09-2026			
3.	space diversity antennas, umbrella pattern antennas,	1	16-09-2026			
4.	Minimum separation of cell site antennas, high gain antennas.	1	18-09-2026			
5.	Handoffs: Handoff Initiation, types of handoff, delaying handoff,	1	21-09-2026			
6.	advantages of Handoff, power difference handoff,	1	22-09-2026			
7.	forced handoff,	1	23-09-2026			
8.	Mobile assisted and soft and Hard handoffs.	1	25-09-2026			
9.	**Inter system and Intra system handoffs,**	1	28-09-2026			

	Activity : Group discussion					
10.	Dropped call rates and their evaluation.	1	29-09-2026			
11.	Revision	1	30-09-2026			
No. of classes required to complete UNIT-IV: 11			**No. of classes taken:**			

UNIT-V: Digital cellular networks And Multiple Access Schemes

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 Digital Cellular Networks And Multiple Access Schemes	1	05-10-2026			
2.	GSM architecture, GSM channels,	1	06-10-2026			
3.	TDMA,	1	07-10-2026			
4.	FDMA, and CDMA.	1	09-10-2026			
5.	Introduction to MIMO systems **Activity : Think pair share**	1	12-10-2026			
6.	Principles of CDMA cellular systems,	1	13-10-2026			
7.	Principles of OFDM based broadband wireless systems,	1	14-10-2026			
8.	4G LTE basics – OFDM, and OFDMA,	1	16-10-2026			
9.	Generalized framework for Filtered OFDM and FBMC,	1	26-10-2026			
10.	Introduction of 5G.	1	27-10-2026			
11.	Revision	1	28-10-2026			
No. of classes required to complete UNIT-V: 11			**No. of classes taken**			

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Optimizing Mobility Management in a 5G Smart City Network	1	30-10-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	**TLM 6**	Assignment or Quiz
TLM 2	PPT	**TLM 7**	Seminar or GD
TLM 3	Tutorial	**TLM 8**	Lab
TLM 4	Problem Solving	**TLM 9**	Case Study
TLM 5	Programming	**TLM 10**	Others

PART-C:

Evaluation Process (R23)

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

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes (POs):

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

Program Specific Outcomes (PSOs):

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

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

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. M.V.Sudhakar	Mr.T.Bala Krishna	Dr.V.Ravi Sekhara Reddy	Dr. G. Srinivasulu

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : B.Tech. - VII-Sem. - ECE – A Section
ACADEMIC YEAR : 2026-27
COURSE NAME & CODE : Management Science – 23HS04
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 2
COURSE INSTRUCTOR : V.Sankara Rao, Sr.Assistant Professor
COURSE COORDINATOR : A.Nageswara Rao, Sr.Assistant Professor
PER-REQUISITE : NIL

COURSE EDUCATIONAL OBJECTIVES:

The main objectives of the course are to

- To make students understand how to manage a business organization effectively.
- To explore the different locations-layouts of plant, work study procedures to ensure optimization of resources.
- To explain quality control mechanism for better process of manufacturing.
- To study role of materials manager for smooth function of different operations.
- To present various networking methods/techniques for a business plan/project execution with optimum resources.
- To create awareness on different stages of HRM.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Understand different theories/principles which helps them to manage business activities by facing present challenges. (Understand-L2)

CO2: Capable of choosing good location, layout and easiest and best method of work for optimization of resources to get maximum output in business. (Understand-L2)

CO3: Apply quality control techniques to test the qualities of manufacturing and ensure good output to customer. (Apply-L3)

CO4: Acquire knowledge on how effectively stores/material can be planned, organized and controlled in the company at economical budget. (Understand-L2)

CO5: Explain the concepts of HR planning, development and controlling to meet organizational goals. (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	3	3	3	2	3				3			3		3	
CO2	3	3	1	2	1				3			3		3	
CO3	3	3	3	2	1				3			3		3	
CO4	3	2	3	2	3				1			3		3	
CO5	2	3	3	2	1				1			3		3	

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

TEXT BOOK:

1. O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi.

REFERENCE BOOKS:

1. Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.
2. Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.
3. Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: CONCEPTS OF MANAGEMENT AND ORGANISATION

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, Functions of Management	1	29.06.2026		TLM1	CO1	T1	
2.	Evolution of management thought	1	03.07.2026		TLM1	CO1	T1	
3.	Taylor's scientific management	1	04.07.2026		TLM1	CO1	T1	
4.	Fayal's principles of management	1	06.07.2026		TLM1	CO1	T1	
5.	Herzberg, Maslow hierarchy of human needs	1	10.07.2026		TLM3	CO1	T1	
6.	Theory x and y, Hawthorne experiment, morale, motivation,	1	11.07.2026		TLM1	CO1	T1	
7.	working environmental conditions, systems approach to management.	1	13.07.2026		TLM1	CO1	T1	
8.	DESIGNING ORGANISATIONAL STRUCTURES: Basic concepts related to organisation	1	17.07.2026		TLM1	CO1	T1	
9.	Departmentation and decentralization, types of organization structures.	1	18.07.2026		TLM1	CO1	T1, R1	
No. of classes required to complete UNIT-I		**9**			No. of classes taken:			

UNIT-II: PLANT LOCATION & WORK STUDY

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
10.	Definition, factors affecting the plant location	1	20.07.2026		TLM1	CO2	T1, R3	
11.	Comparison of rural and urban sites, methods for selection of plant	1	24.07.2026		TLM1	CO2	T1, R3	
12.	Matrix approach. Plant layout - definition, objectives	1	25.07.2026		TLM1	CO2	T1, R3	

13.	Types of plant layout, various data analyzing forms travel chart.	1	27.07.2026		TLM1	CO2	T1, R3	
14.	WORK STUDY: Definition, objectives	1	31.07.2026		TLM1	CO2	T1, R3	
15.	Method study definition, objectives, steps involvedvarious types of associated charts	1	01.08.2026		TLM3	CO2	T1, R3	
16.	Difference between micro motion and memo motion studies.	1	03.08.2026		TLM1	CO2	T1	
17.	Work measurement-definition, time study, steps involved, equipment	1	07.08.2026		TLM1	CO2	T1	
18.	Different methods of performance rating, allowances, standard time calculation.	1	08.08.2026		TLM1	CO2	T1	
19.	Work Sampling - definition, steps involved, standard time calculations, and differences with time study.	1	10.08.2026					
No. of classes required to complete UNIT-II		**10**			No. of classes taken:			

UNIT-III: INTRODUCTION TO PERT / CPM

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
20.	Project management, network modelling-probabilistic model	1	14.08.2026		TLM1	CO3	T1	
21.	various types of activity times estimation, programme evaluation review techniques	1	17.08.2026		TLM1	CO3	T1, R1	
22.	critical path, probability of completing the project, deterministic model	1	21.08.2026		TLM1	CO3	T1, R1	
23.	critical path method (CPM), critical path calculation, crashing of simple of networks	1	22.08.2026		TLM1	CO3	T1	
24.	**INSPECTION AND QUALITY CONTROL:** Types of inspections	1	31.08.2026		TLM3	CO3	T1, R1	
25.	statistical quality control, techniques,	1	04.09.2026		TLM1	CO3	T1, R1	

	variables and attributes							
26.	assignable and non-assignable causes, variable control charts	1	05.09.2026		TLM1	CO3	T1	
27.	R charts, attributes control charts, p charts and c charts. Acceptance sampling plan	1	07.09.2026		TLM1	CO3	T1, R1	
28.	single sampling and double sampling plans, OC curves. Introduction to TQM - quality circles, ISO 9000 series procedures.	1	11.09.2026		TLM1	CO3	T1	
No. of classes required to complete UNIT-III		**9**			No. of classes taken:			

UNIT-IV: MATERIALS MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	Objectives, inventory functions	1	12.09.2026		**TLM1**	CO4	**T1**	
30.	Types, associated costs,	1	14.09.2023		**TLM1**	CO4	**T1**	
31.	Inventory classification techniques-ABC and VED analysis.	1	18.09.2026		**TLM1**	CO4	**T1, R2**	
32.	Inventory control systems	1	19.09.2026		**TLM3**	CO4	**T1, R2**	
33.	continuous review system, periodical review system	1	21.09.2026		**TLM1**	CO4	**T1, R2**	
34.	Stores management and stores records.	1	25.09.2026		**TLM1**	CO4	**T1, R1**	
35.	Purchase management	1	26.09.2026		**TLM1**	CO4	**T1, R1**	
36.	Duties of purchase of manager	1	28.09.2026		**TLM1**	CO4	**T1**	
37.	Associated forms	1	03.10.2026		**TLM3**	CO4	**T1, R1**	
No. of classes required to complete UNIT-IV		9			No. of classes taken:			

UNIT-V: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
38.	Functions of HRM	1	05.10.2026		TLM1	CO5	T1,R2	
39.	job evaluation, different types of	1	09.10.2026		TLM1	CO5	T1, R2	

	evaluation methods							
40.	Job description	1	10.10.2026		TLM1	CO5	T1,R2	
41.	merit rating	1	12.10.2026		TLM1	CO5	T1,R2	
42.	different methods of merit ratings	1	16.10.2026		TLM1	CO5	T1,R2	
43.	wage incentives, different types of wage incentive schemes	1	17.10.2026		TLM1	CO5	T1, R2	
44.	Marketing	1	26.10.2026		TLM1	CO5	T1,R2	
45.	selling	1	30.10.2026		TLM1	CO5	T1,R2	
46.	marketing mix, product life cycle.	1	31.10.2026		TLM1	CO5	T1,R2	
No. of classes required to complete UNIT-V		**9**			No. of classes taken:			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	29-06-2026	22-08-2026	8W
I Mid Examinations	24-08-2026	29-08-2026	1W
II Phase of Instructions	31-08-2026	31-10-2026	7W
II Mid Examinations	02-11-2026	07-11-2026	1W
Preparation and Practicals	09-11-2026	14-11-2026	1W
Semester End Examinations	16-11-2026	28-11-2026	2W

Part – C

EVALUATION PROCESS:

Evaluation Task	**Marks**
Assignment Cycle-I	A1=5
I-Mid Examination (Units I & II)	A2=5
I-Quiz Examination (Units-I,II)	B1=15
Assignment Cycle-II	Q1=10
II-Mid Examination (Units III, IV &V)	A3=5
II-Quiz Examination (Units-III, IV, V)	A4=5
Mid Marks =80% of Max (M1, M2) +20% of Min (M1, M2)	A5=5
Quiz Marks =80% of Max (Q1, Q2) +20% of Min(Q1, Q2)	B2=15
Cumulative Internal Examination (CIE): A+B+M	Q2=10
Semester End Examinations	**SEE=70**
Total Marks: CIE+SEE	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.

PEO2: To Function professionally in the rapidly changing world with advances in technology.

PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.

PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

PO1 - Engineering Knowledge: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2 - Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3 - Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4 - Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5 - Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6 - The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7 - Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8 - Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9 - Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10 - Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11 - Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs):

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

PSO2: Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools.

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

Mr.V.Sankararao	Mr. A.Nageswara Rao	Mr.J.Subba Reddy	Dr.M.B.S.Sreekara Reddy
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., VII-Sem., Section – A,C

Course Instructor : Mr.J DURGA PRASAD Asst. Professor,

Course Name & Code : LOW POWER VLSI DESIGN – 23EC27

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

Academic Year **:** 2026-27

Pre requisite: Digital Electronic Circuits and VLSI Design

Course Educational Objective: This course provides knowledge on fundamentals of low power VLSI design concepts, circuits and subsystems.

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

CO 1	Summarize the Fundamental concepts of Low Power VLSI Design. (Understand – L2)
CO 2	Apply Low Power Design Approaches for IC designs. (Apply – L3)
CO 3	Analyze low voltage low power memories using mathematical models. (Analyze – L4)
CO 4	Design low voltage low power adders and multipliers. (Apply – L3)

CO's	Co-Po Attainment Table														
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2										2		3	
CO2	3	3	3		2		2					2		3	
CO3	3	3		2	3							2		3	2
CO4	3	3	3	2	3		2		1	1	1	2		3	2

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Fundamentals of Low Power CMOS VLSI Design [11 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 to COs	1	29.06.2026			
2.	Introduction	1	30.06.2026			
3.	Sources of Power Dissipation	1	01.07.2026			
4.	Static Power Dissipation	1	02.07.2026			
5.	Short Circuit Power Dissipation	1	03.07.2026			
6.	Leakage Power Dissipation, Glitch Power Dissipation	1	04.07.2026			
7.	Short Channel Effects –Drain Induced Barrier Lowering, Body Effect	1	06.07.2026			
8.	**Flipped Class on Low Power Techniques in VLSI**	1	07.07.2026			
9.	Gate-induced Drain Leakage	1	08.07.2026			
10.	Active power dissipation.	1	09.07.2026			
11.	**Tutorial/Assignment**	1	10.07.2026			

UNIT- II: Circuit techniques for Low-Power Reduction [11 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
12.	Concepts of leakage power	1	11.07.2026			
13.	Circuit techniques for Leakage power reduction	2	13.07.2026 14.07.2026			
14.	Power Gating, Body Biasing Techniques	1	15.07.2026			
15.	Standby leakage control	1	16.07.2026			
16.	Multi-Vth technique	1	17.07.2026			
17.	Supply voltage scaling	1	18.07.2026			
18.	VTMOS circuits, DTMOS circuits	1	22.07.2026			
19.	**Collaborative Learning on MOS circuits**	1	23.07.2026			
20.	Dynamic-Vth technique	1	24.07.2026			
21.	**Tutorial /Assignment**	1	27.07.2026			

UNIT – III: Low-Voltage Low-Power Adders [12 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
22.	Introduction,	1	27.07.2026			
23.	Standard Adder Cells	1	28.07.2026			
24.	CMOS Adder's Architectures	1	29.07.2026 30.07.2026			
25.	Carry Look-Ahead Adder	1	01.08.2026			
26.	Ripple Carry Adders	1	03.08.2026			
27.	Carry Select Adders- **Experimental Learning**	1	04.08.2026			
28.	Mid-1 Review	1	05.08.2026			
29.	Carry Save Adders	1	06.08.2026			
30.	Performance evaluation of various adder architectures	1	07.08.2026			

31.	Performance evaluation of various adder architectures	1	08.08.2026			
32.	**Tutorial/Assignment**	1	10.08.2026			

UNIT – IV: Low-Voltage Low-Power Multipliers [12 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**
33.	Review of Multiplication	1	11.08.2026			
34.	Multiplier Architectures	1	12.08.2026			
35.	Multiplier Architectures	1	14.08.2026			
36.	Braun Multiplier	1	17.08.2026			
37.	Braun Multiplier	1	18.08.2026			
38.	Baugh-Wooley Multiplier	1	19.08.2026			
39.	**Peer Teaching on Multipliers**	1	20.08.2026			
40.	Booth Multiplier	1	22.08.2026			
41.	Booth Multiplier	1	31.08.2026			
42.	Introduction to Wallace Tree Multiplier.	1	01.09.2026			
43.	Wallace Tree Multiplier.	1	02.09.2026			
44.	**Tutorial/Assignment**	1	03.09.2026			

UNIT – V: Low-Voltage Low-Power Memories [14 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Basics of ROM	1	05.09.2026			
46.	Low-Power ROM Technology	1	07.09.2026			
47.	Future Trend and Development of ROMs	1	08.09.2026			
48.	Future Trend and Development of ROMs	1	09.09.2026			
49.	Basics of SRAM, Memory cell	1	10.09.2026			
50.	**Quiz**	1	11.09.2026			
51.	Precharge and Equalization Circuit	1	15.09.2026			
52.	Precharge and Equalization Circuit	1	16.09.2026			
53.	Low-Power SRAM Technologies	1	17.09.2026			
54.	Basics of DRAM	2	18.09.2026 19.09.2026			
55.	Self-Refresh Circuit	1	21.09.2026			
56.	Future Trend and Development of DRAM.	1	22.09.2026			
57.	**Tutorial/Assignment**	1	23.09.2026			

BEYOND THE SYLLABUS & REVISION [3 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
58.	Advanced Power Reduction Techniques	1	12-10-2026			
59.	Sub-threshold and Near-threshold Logic	1	13-10-2026			
60.	Low Power Design Metrics	1	14-10-2026			

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

PART – C

EVALUATION 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): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work	29-06-2025		
I Phase of Instructions	29-06-2026	22-08-2026	8W
Technical Training	29-06-2026	22-08-2026	8W
I Mid Examinations	24-08-2026	29-08-2026	1W
II Phase of Instructions	26-10-2026	31-10-2026	9W
II Mid Examinations	02-11-2026	07-11-2026	1W
Preparation and Practical's	09-11-2026	14-11-2026	1W
Semester End Examinations	16-11-2026	28-11-2026	2W

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mr.J DURGA PRASAD]	[Mr.J Durga Prasad]	[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., VII-Semester, A-Section**

Course Instructor : **Dr. P. Lachi Reddy, Professor**

Course Name & Code : **Design for Testability – 23EC31**

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

Academic Year : **2026 – 27**

Pre-requisites: STLD, VLSI Design

Course Educational Objective:

1. To understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts.
2. To analyze logic and fault simulation techniques for design verification.
3. To learn and apply testability measures and design-for-testability (DFT) techniques.
4. To evaluate advanced testing methodologies including Built-In Self-Test (BIST) and boundary scan techniques.

Course Outcomes: Upon completing this course, the student will be able to

CO1: Understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts and the impact of technology trends on testing methodologies. **(Understand-L2)**

CO2: Apply logic and fault simulation techniques for circuit verification by utilizing true-value simulation, fault simulation algorithms, and ATPG. **(Apply-L3)**

CO3: Evaluate the testability of VLSI circuits using controllability and observability measures (SCOAP) and implement the DFT techniques. **(Apply-L3)**

CO4: Analyze the advanced testing strategies by implementing Built-In Self-Test (BIST), boundary scan techniques and BSDL-based system testing. **(Analyze-L4)**

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

Prescribed Syllabus:

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

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

UNIT – V:

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Testing						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Discussion of Syllabus and Course Outcomes	1	29-06-2026			
2.	Testing Philosophy	1	30-06-2026			
3.	Role of Testing	1	30-06-2026			
4.	Digital and Analog VLSI Testing	1	02-07-2026			
5.	VLSI Technology Trends affecting Testing	1	06-07-2026			
6.	Types of Testing	1	07-07-2026			
7.	Fault Modeling: Defects, Errors and Faults	1	07-07-2026			
8.	Functional Versus Structural Testing	1	09-07-2026			
9.	Levels of Fault Models	1	13-07-2026			
10.	Single Stuck-at Fault	1	14-07-2026			
11.	**Activity: Students Presentation on Faults**	1	14-07-2026			
12.	**Revision / Tutorial / Assignment**	1	16-07-2026			
	Number of hours required for UNIT-I	**12**	**No. of Hours Conducted**			

UNIT- II: Logic and Fault Simulation						
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.	Simulation for Design Verification	1	20-07-2026			
14.	Simulation for Test Evaluation	1	21-07-2026			
15.	Modeling Circuits for Simulation	1	21-07-2026			
16.	Algorithms for True-value Simulation	1	23-07-2026			
17.	Algorithms for Fault Simulation	1	27-07-2026			
18.	ATPG	1	28-07-2026			
19.	D-Algorithm	1	28-07-2026			
20.	PODEM Algorithm	1	30-07-2026			
21.	FAN Algorithm	1	03-08-2026			
22.	**Activity: Students Presentation on Algorithms**	1	04-08-2026			
23.	**Revision / Tutorial / Assignment**	1	04-08-2026			
	Number of hours required for UNIT-II	**11**	**No. of Hours Conducted**			

UNIT – III: Testability Measures						
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.	SCOAP Controllability and Observability	2	06-08-2026, 10-08-2026			
25.	High Level Testability Measures	1	11-08-2026			
26.	Digital DFT and Scan Design	1	11-08-2026			
27.	Ad-Hoc DFT Methods	1	13-08-2026			
28.	Scan Design, Partial-Scan Design	1	17-08-2026			
29.	Variations of Scan	1	18-08-2026			
30.	**Activity: Group discussion on Controllability and Observability**	1	18-08-2026			
31.	**Revision / Tutorial / Assignment**	1	20-08-2026			
	Number of hours required for UNIT-III	**09**	**No. of Hours Conducted**			

UNIT – IV: Built-In Self-Test						
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.	The Economic Case for BIST	1	31-08-2026			
33.	Random Logic BIST: Definitions	1	01-09-2026			
34.	BIST Process	1	01-09-2026			
35.	Pattern Generation	1	03-09-2026			
36.	Response Compaction	1	07-09-2026			
37.	Built-In Logic Block Observers	1	08-09-2026			
38.	Test-Per- Clock, Test-Per-Scan BIST Systems	1	08-09-2026			
39.	Circular Self-Test Path System	1	10-09-2026			
40.	Memory BIST	1	15-09-2026			
41.	Memory BIST	1	15-09-2026			
42.	Delay Fault BIST	1	17-09-2026			
43.	**Activity: Students Presentation on BIST**	1	21-09-2026			
44.	**Revision / Tutorial / Assignment**	1	22-09-2026			
	Number of hours required for UNIT-IV	**13**	**No. of Hours Conducted**			

UNIT – V: Boundary Scan Standard						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Motivation	1	22-09-2026			
46.	System Configuration with Boundary Scan	1	24-09-2026			
47.	TAP Controller and Port	1	28-09-2026			
48.	Boundary Scan Test Instructions	1	29-09-2026			
49.	Pin Constraints of the Standard	1	29-09-2026			
50.	Boundary Scan Description Language	1	01-10-2026			
51.	BDSL Description Components	1	05-10-2026			
52.	Pin Descriptions	1	06-10-2026			
53.	**Activity: Students Presentation/Quiz on Boundary Scan**	1	06-10-2026			
54.	**Revision / Tutorial / Assignment**	1	08-10-2026			
	Number of hours required for UNIT-V	**10**	**No. of Hours Conducted**			

BEYOND THE SYLLABUS & REVISION						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
55.	Hardware/software co-verification	1	12-10-2026			
56.	Revision	2	13-10-2026			
57.	Revision	1	15-10-2026			
58.	Revision	1	26-10-2026			
59.	Revision	1	27-10-2026			
	Number of hours required	**06**	**No. of Hours Conducted**			

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

PART – C

Academic Calendar: 2026 – 27 (VII Semester)

B. Tech VII Semester - 2023 Admitted Batch			
Class work Commence From	**29-06-2026**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	29-06-2026	22-08-2026	8 Weeks
I Mid Examinations	**24-08-2026**	**29-08-2026**	**1 Week**
II Phase of Instructions	31-08-2026	17-10-2026	7 Weeks
Dasara Holidays	19-10-2026	24-10-2026	1 Week
II Phase of Instructions Contd.	26-10-2026	31-10-2026	1 Week
II Mid Examinations	**02-11-2026**	**07-11-2026**	**1 Week**
Preparation & Practicals	09-11-2026	14-11-2026	1 Week
Semester End Examinations	**16-11-2026**	**28-11-2026**	**2 Weeks**

EVALUATION PROCESS:

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

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Date: 27-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. Lachi Reddy]	[Mrs. K. Balavani]	[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.
hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Ms. P. Sarala
Course Name & Code : Principles of Database Management Systems & 23CS83
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B. Tech/VII/ECE-A **A.Y.:** 2026-27
PREREQUISITES : **Data Structures**

COURSE EDUCATIONAL OBJECTIVES (CEOs):
The objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing and Indexing.

COURSE OUTCOMES (COs): After successful completion of the course the students are able to

CO1	State the basic components of Database Management System and data modelling using ER 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 transaction processing, concurrency control mechanisms and recovery strategies in DBMS. (Understand-L2)
CO5	Describe file organization, indexing techniques and selecting NoSQL databases. (Understand-L2)

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

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

TEXTBOOKS:

T1	Henry F. Korth, Abraham Silberschatz, S. Sudarshan – Database System Concepts, McGraw Hill, 6th Edition, 2009.
T2	Shashank Tiwari – Professional NoSQL, John Wiley & Sons, 2011.

REFERENCE BOOKS:

R1	Raghu Ramakrishnan, Johannes Gehrke – Database Management Systems, McGraw Hill, 3rd Edition, 2000.
R2	C.J. Date – An Introduction to Database System, Pearson Education, 8th Edition, 2003.
R3	Ramez Elmasri, Shamkant B. Navathe – Fundamentals of Database Systems, Addison Wesley, 6th Edition, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DBMS & ER Model

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	29-6-26		TLM1,2	
2.	Database System Applications	1	1-7-26		TLM1,2	
3.	Characteristics of Database Approach	1	4-7-26		TLM1,2	
4.	Advantages of DBMS over File System	1	6-7-26		TLM1,2	
5.	Database Users and Administrators	1	8-7-26		TLM1,2	
6.	Three Schema Architecture	1	11-7-26		TLM1,2	
7.	Data Models	1	13-7-26		TLM1,2	
8.	Database Languages (DDL, DML, DCL, TCL)	1	15-7-26		TLM1,2	
9.	Entity Relationship (ER) Model	1	18-7-26		TLM1,2	
10.	ER Diagram Notations	1	20-7-26		TLM1,2	
11.	Mapping Constraints	1	22-7-26		TLM1,2	
12.	Keys in DBMS	1	25-7-26		TLM1,2	
13.	Generalization and Aggregation	1	27-7-26		TLM1,2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Relational Model & SQL

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.	Relational Data Model Concepts	1	29-7-26		TLM1,2	
2.	Relational Integrity Constraints	1	1-8-26		TLM1,2	
3.	Relational Algebra Basics	1	3-8-26		TLM1,2	
4.	SQL Fundamentals	1	5-8-26		TLM1,2	
5.	Data Types and Literals	1	8-8-26		TLM1,2	
6.	Table Creation and Constraints	1	10-8-26		TLM1,2	
7.	Insert, Update and Delete Commands	1	12-8-26		TLM1,2	
8.	Queries using SELECT Statement	1	17-8-26		TLM1,2	
9.	Aggregate Functions, Joins and Nested Queries	1	19-8-26		TLM1,2	
10.	Views and Indexes	1	22-8-26		TLM1,2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Database Design & Normalization

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.	Database Design Guidelines	1	31-8-26		TLM1,2	
2.	Functional Dependencies	1	2-9-26		TLM1,2	
3.	Armstrong's Axioms	1	5-9-26		TLM1,2	
4.	Normalization Concepts	1	7-9-26		TLM1,2	
5.	First Normal Form (1NF), Second Normal Form (2NF)	1	9-9-26		TLM1,2	
6.	Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF)	1	12-9-26		TLM1,2	
7.	Fourth Normal Form (4NF), Fifth Normal Form (5NF)	1	16-9-26		TLM1,2	
8.	Lossless Join Decomposition, Join Dependencies	1	19-9-26		TLM1,2	
No. of classes required to complete UNIT-III: 8				**No. of classes taken:**		

UNIT-IV: Transaction Processing & Concurrency Control

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.	Transaction Concepts	1	21-9-26		TLM1,2	
2.	ACID Properties	1	23-9-26		TLM1,2	
3.	Transaction States	1	26-9-26		TLM1,2	
4.	Serializability, Recoverability	1	28-9-26		TLM1,2	
5.	Concurrency Control Techniques	1	30-9-26		TLM1,2	
6.	Lock Based Protocols, Time Stamping Protocols	1	3-10-26		TLM1,2	
7.	Deadlock Handling	1	5-10-26		TLM1,2	
8.	Deadlock Prevention and Recovery	1	7-10-26		TLM1,2	
No. of classes required to complete UNIT-IV: 8				**No. of classes taken:**		

UNIT-V: Recovery, Indexing & NoSQL Databases

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.	Crash Recovery Techniques	1	10-10-206		TLM1,2	
2.	Log Based Recovery, Checkpoints	1	12-10-26		TLM1,2	
3.	Storage and File Structure, File Organization Methods	1	14-10-26		TLM1,2	

4.	Indexed Files, Hashed Files	1	17-10-26		TLM1,2	
5.	B+ Trees, Physical Database Design	1	26-10-26		TLM1,2	
6.	Introduction to NoSQL Databases	1	28-10-26		TLM1,2	
7.	Types of NoSQL Databases and Applications	1	31-10-26		TLM1,2	
No. of classes required to complete UNIT-II: 7				**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 (R20 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):

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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of 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 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.
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):

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.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Ms. P. Sarala**	**Ms. P. Sarala**	**Dr. Y. V Bhaskar Reddy**	**Dr. S. Nagarjuna Reddy**
Signature				

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Department of Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.T.Anil Raju/ Dr K. Ravi Kumar/Mr.M.S.SankaraRao

Course Name & Code : Digital Signal and Image Processing Lab & 23ECS3
L-T-P Structure : 0-1-2 Credits: 2
Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- A
A.Y :2026-27

Pre-Requisites: Digital Signal Processing, MATLAB fundamentals

Course Objectives: This course introduces the basics of images and the fundamentals operations that can be performed on them. This course provides practical knowledge about design of IIR filters and FIR filters. It provides an exposure to Code composer studio towards working with DSP processors.

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

CO1: Perform operations on discrete time signals.

CO2: Design IIR and FIR Filters and obtain their frequency response

CO3: Perform Image filtering in spatial domain and image Segmentation

CO4: Adapt effective communication, presentation and report writing.

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

TEXTBOOKS:

1. Rafel. C. Gonzalez and Richard. E. Woods, "Digital Image Processing", Pearson Education, 4nd Edition, 2018.
2. Rudra Pratap, *"Getting started with MATLAB*", Oxford University Press, 2010.

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.	Introduction to the course, Course outcomes	**1**	04.07.2026		TLM1	
2.	Introduction to digital image and its representation	**1**	11.07.2026		TLM1	
3.	Fundamental steps in image processing	**1**	18.07.2026		TLM1	
4.	Applications of Image Processing	**2**	25.07.2026 01.08.2026		TLM2	
No. of classes required to complete UNIT-I		**5**	**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
1.	Image enhancement introduction, point processing	**1**	08.08.2026		TLM1	
2.	Intensity transformation functions	**1**	22.08.2026		TLM1	
3.	Histogram Equalization	**1**	05.09.2026		TLM1	
4.	Spatial filtering – Introduction, Smoothing filter: Linear filters	**1**	12.09.2026		TLM1	
5.	Smoothing filters: Order statistics filters	**1**	19.09.2026		TLM1	
6.	Sharpening filters: Gradient, Laplacian	**1**	26.09.2026		TLM1	
7.	Sharpening filters: Laplacian function	**1**	03.10.2026		TLM1	
8.	Image segmentation: Need, Classification	**1**	10.10.2026		TLM1	
9.	Discontinuity based segmentation	**1**	17.10.2026		TLM1	
10.	Region based segmentation	**1**	24.10.2026		TLM1	
11.	Applications of segmentation	**1**	31.10.2026		TLM2	
No. of classes required to complete UNIT-II:		**11**		**No. of Classes taken**		

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

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, Course outcomes	3	03.07.2026		TLM4	
2.	Linear convolution	3	10.07.2026		TLM4	
3.	Circular convolution	3	17.07.2026		TLM4	
4.	Computation of DFT and IDFT	3	24.07.2026		TLM4	
5.	Design and Implementation of IIR filters	3	31.07.2026		TLM4	
6.	Design and Implementation of FIR filters	3	07.08.2026		TLM4	
7.	Perform spatial transformations on images	3	14.08.2026		TLM4	
8.	Generation of Histogram Equalization. Image de-noising using spatial filtering	3	21.08.2026		TLM4	
9.	Image segmentation using Prewitt, Sobel and Laplacian of Gaussian operators	3	04.08.2026		TLM4	
10.	Linear convolution (Using Code Composer Studio)	3	11.09.2026		TLM4	
11.	Circular convolution Using Code Composer Studio)	3	18.09.2026		TLM4	
12.	Computation of DFT and IDFT (Using Code Composer Studio)	3	25.09.2026		TLM4	
13.	Case study/Mini project Content beyond syllabus	3	09.09.2026		TLM 6	
14.	Case study/Mini project Content beyond syllabus	3	16.10.2026		TLM 6	
15.	Internal Exam	3	30.10.2026		TLM 4	
No. of classes required to complete Laboratory :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):

Day to Day work	**10**
Record	**5**
Internal Exam	**15**
Total CIE(A)	**30**
Total SEE(B)	**70**
Total(A+B)	**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 team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

PSO2 Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools

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

Date: 29-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
T.Anil Raju	Dr.G.L.N.Murthy	Dr.G.L.N.Murthy	Dr. G. Srinivasulu

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NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr T. Anil Raju

Course Name & Code : Constitution of India

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

Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- A A.Y : 2026-27

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

CO 1	Understand history and philosophy of constitution with reference to preamble, Fundamental Rights and Duties.
CO 2	Understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
CO 3	Understand the structure of the state government, Secretariat, Governor and Chief Minister and their functions.
CO 4	Learn local administration viz. Panchayat, Block, Municipality and Corporation.
CO 5	Learn about Election Commission and the process and about SC,ST,OBC and women.

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

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

TEXT BOOKS:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950.
2. Framing of Indian Constitution, 1 st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015.

REFERENCE BOOKS:

1. Indian Constitution Law, 7 th Edition, M. P. Jain, Lexis Nexis, 2014

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section A

UNIT-I: History of Making of the Indian Constitution

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction and Co-Po and Syllabus	1	30-06-2026		TLM1/TLM2	
2.	Constitution meaning and the term	1	03-07-2026		TLM1/TLM2	
3.	Sources and History of Indian Constitution	1	07-07-2026		TLM1/TLM2	
4.	Drafting Committee	1	10-07-2026		TLM1/TLM2	
5.	Composition & Working	1	14-07-2026		TLM1/TLM2	
6.	Philosophy of the Indian Constitution	1	17-07-2026		TLM1/TLM2	
7.	Preamble, Salient Features	1	21-07-2026		TLM1/TLM2	
No of classes required		**07**	No. of classes taken:			

UNIT-II: Contours of Constitutional Rights & Duties:

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.	Fundamental Rights	1	24-07-2026		TLM1/TLM2	
2.	Right to Equality	1	28-07-2026		TLM1/TLM2	
3.	Right to Freedom	1	31-07-2026		TLM1/TLM2	
4.	Right against Exploitation	1	04-08-2026		TLM1/TLM2	
5.	Right to Freedom of Religion	1	07-08-2026		TLM1/TLM2	
6.	Cultural and Educational Rights	1	11-08-2026		TLM1/TLM2	
7.	Right to Constitutional Remedies	1	14-08-2026		TLM1/TLM2	
8.	Directive Principles of State Policy	1	18-08-2026		TLM1/TLM2	
9.	Fundamental Duties	1	21-08-2026		TLM1/TLM2	
No of classes required		**09**	No. of classes taken:			

UNIT-III: Organs of Governance:

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.	Parliament, Composition	1	01-09-2026		TLM1/TLM2	
2.	Qualifications and Disqualifications	1	08-09-2026		TLM1/TLM2	
3.	Powers and Functions	1	11-09-2026		TLM1/TLM2	
4.	Executive- President, Governor, Council of Ministers, Judiciary	1	15-09-2026		TLM1/TLM2	
5.	Appointment &Transfer of Judges, Qualifications, Powers & Functions	1	18-09-2026		TLM1/TLM2	
	No. of classes	**05**	No. of classes taken:			

UNIT-IV: Local Administration:

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.	District's Administration head: Role and Importance	1	22-09-2026		TLM1/TLM2	
2.	Municipalities: Introduction, Mayor and role of Elected Representative,	1	25-09-2026		TLM1/TLM2	

	CEO of Municipal Corporation					
3.	Panchayati Raj: Introduction, PRI: Zila Panchayat Elected officials and their roles	1	29-09-2026		TLM1/TLM2	
4.	CEO Zila Pachayat: Position and role	1	06-10-2026		TLM1/TLM2	
5.	Block level: Organizational Hierarchy (Different departments)	1	09-10-2026		TLM1/TLM2	
6.	Village level: Role of Elected and Appointed officials	1	13-10-2026		TLM1/TLM2	
No. of classes required:		**06**	No. of classes taken:			

UNIT-V: Election Commission:

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.	Election Commission: Role and Functioning	1	16-10-2026		TLM1/TLM2	
2.	Chief Election Commissioner and Election Commissioners	1	16-10-2026		TLM1/TLM2	
3.	State Election Commission: Role and Functioning	1	27-10-2026		TLM1/TLM2	
4.	Institutes and Bodies for the welfare of SC/ST/OBC and women	1	30-10-2026		TLM1/TLM2	
No. of classes required		**04**	No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case Study	1	30-10-2026		TLM1/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**: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Mr. T Anil Raju	Mr. T Anil Raju	Dr.Ch Rajendra Babu	Dr. G Srinivasulu

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor:Y.Padma , Assistant Professor

Course Name & Code	**: VLSI Signal Processing** & **23ECH2**	**Regulation**: R23
L-T-P Structure	**: 3-0-0**	**Credits:** 03
Program/Sem/Sec	: B.Tech, ECE VII Sem (A)	**A.Y.:** 2026-27

PREREQUISITE: Nil

COURSE OBJECTIVES (COs): The main objectives of the course are to

1.To understand the fundamentals of VLSI architecture for digital signal processing systems.

2.To study pipelining, parallel processing and retiming techniques for improving the performance of DSP architectures.

3.To learn unfolding, folding and systolic architecture design for efficient hardware implementation

4.To analyze area, power and throughput trade-offs in VLSI DSP systems.

5.To design and optimize VLSI architectures for DSP applications using modern design techniques.

COURSE OUTCOMES (COs): Upon successful completion of this course, the student should be able to

CO1	Understand Pipelining, parallel processing and digital filters.
CO2	Optimize VLSI architectures for basic DSP algorithms
CO3	Analyze various parallel processing algorithms
CO4	Implement basic architectures for DSP using CAD tools

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

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

T1 VLSI Digital Signal Processing- System Design and Implementation – Keshab K. Parhi, 1998, Wiley Inter Science.

REFERENCE BOOKS:

R1 Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall
R2 VLSI Digital Signal Processing – Medisetti V. K, 1995, IEEE Press (NY), USA.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DSP

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Outcomes,Introduction to subject, Typical DSP algorithms,benefits	2	03-07-2026		**TLM1/TLM2**	
2.	Representation of DSP algorithms	2	04-07-2026		**TLM1/TLM2**	
3.	Pipelining of FIR Digital filters	2	10-07-2026		**TLM1/TLM2**	
4.	Parallel Processing, Pipelining and Parallel Processing for Low Power	2	11-07-2026		**TLM1/TLM2**	
5.	**Retiming:** Introduction, Definitions and Properties, Solving System of Inequalities	2	17-07-2026		**TLM1/TLM2**	
6.	Retiming Techniques	2	18-07-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Folding& Unfolding

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
7	**Folding** :Introduction -Folding Transform	2	24-07-2026		**TLM1/TLM2**	
8	Register minimizationTechniques-Register minimization in folded architectures	2	25-07-2026		**TLM1/TLM2**	
9	folding in multi rate systems **Unfolding:** Introduction	2	31-07-2026		**TLM1/TLM2**	
10	An Algorithm for Unfolding – Properties of Unfolding	2	01-08-2026		**TLM1/TLM2**	
11	critical Path	2	07-08-2026		**TLM1/TLM2**	
12	Unfolding, Retiming – Applications of Unfolding	2	08-08-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: Systolic Architecture Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Dateof Completion	Actual Date of Completion	TeachIng Learning Methods	HOD Sign Weekly
13	Introduction – Systolic Array Design Methodology	2	14-08-2026		**TLM1/TLM2**	

14	FIR Systolic Arrays – Selection of Scheduling Vector	2	21-08-2026		**TLM1/TLM2**	
15	Matrix Multiplication	2	22-08-2026		**TLM1/TLM2**	
16	2D Systolic Array	2	05-09-2026		**TLM1/TLM2**	
17	Design Systolic Design for Space Representations contain Delays	2	11-09-2026		**TLM1/TLM2**	
No of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Fast Convolution

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18	Introduction – Cook-Toom Algorithm	2	12-09-2026		**TLM1/TLM2**	
19	Winogard algorithm	2	18-09-2026		**TLM1/TLM2**	
20	Iterated Convolution	2	19-09-2026		**TLM1/TLM2**	
21	Cyclic Convolution	2	25-09-2026		**TLM1/TLM2**	
22	Design of Fast Convolution algorithm by Inspection	2	26-09-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Low Power Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	Scaling Vs Power Consumption –Power Analysis	2	03-10-2026		**TLM1/TLM2**	
	Power Reduction techniques	2	09-10-2026		**TLM1/TLM2**	
	Power Estimation Approaches Programmable DSP	2	10-10-2026		**TLM1/TLM2**	
	Evaluation of Programmable Digital Signal Processors	2	16-10-2026		**TLM1/TLM2**	
	DSP Processors for Mobile and Wireless Communications	2	17-10-2026		**TLM1/TLM2**	
	Processors for Multimedia Signal Processing	2	30-10-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-V: 12				**No. of classes taken:**		

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

Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	29-06-2026	22-08-2026	8

I MID Examinations	24-08-2026	29-08-2026	1
II Phase of Instructions	31-08-2026	17-10-2026	7
II Phase of Instructions contd..	26-10-2026	31-10-2026	1
II MID Examinations	02-11-2026	07-11-2026	1
Preparation and Practicals	09-11-2026	14-11-2026	1
Semester End Examinations	16-11-2026	28-11-2026	2

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):	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Apply the principles of analog and digital VLSI design to analyze, design, simulate, and implement integrated circuits using modern Electronic Design Automation (EDA) tools
PSO 2	Design and develop semiconductor-based systems by integrating VLSI concepts with embedded systems, FPGA, ASIC, and System-on-Chip (SoC) technologies to meet industrial requirements
PSO 3	Demonstrate proficiency in VLSI verification, testing, timing analysis, and physical design to develop reliable, efficient, and manufacturable integrated circuits

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mrs.Y.Padma	Mrs.Y.Padma	Dr.P.Lachi Reddy	Dr.G.Srinivasulu
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs V SOWJANYA
Course Name & Code : Fundamentals of Deep Learning (23AMM3)
L-T-P Structure : 3-1-0 **Credits:** 3
Program/Sem/Sec :IV B.Tech /I Sem/ Minor **A.Y.:** 2026-27

PREREQUISITE: Probability and Statistics, LATT, Machine Learning.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to make students learn the frameworks of deep learning and their application

COURSE OUTCOMES (CO's): After successful completion of the course the students are able to

CO1	Apply the fundamentals of linear algebra to machine learning algorithms. **(Apply- L3)**
CO2	Understand the fundamental building blocks of deep learning **(Understand- L2)**
CO3	Apply the concepts of Convolutional Neural Networks to computer vision applications. **(Apply- L3)**
CO4	Apply the concepts of Recurrent Neural Networks to Natural Language Processing. **(Apply- L3)**
CO5	Apply the regularization techniques to improve the model performance. **(Apply- L3)**

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

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

TEXTBOOKS:

T1 Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016

T2 Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.

T2 Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn,Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821

T4 Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

REFERENCE BOOKS:

R1 Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009

R2 Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.

R3 Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

e-Resources:

1. Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs22

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Mathematical foundations of Deep 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
1.	Introduction to Syllabus, CEOs, COs, CO-PO mapping	1	3.7.2026		TLM 1&2	
2.	Mathematical foundations of Deep Learning	1	3.7.2026		TLM 1&2	
3.	Multiplying Matrices and Vectors	1	4.7.2026		TLM 1&2	
4.	Identity and Inverse Matrices	1	4.7.2026		TLM 1&2	
5.	Linear dependence and Span	1	10.7.2026		TLM 1&2	
6.	Norms	1	10.7.2026		TLM 1&2	
7.	Special kinds of matrices and vectors	1	11.7.2026		TLM 1&2	
8.	Trace operations	1	11.7.2026		TLM 1&2	
9.	Eigen Decomposition	1	17.7.2026		TLM 1&2	
10.	**UNIT CASE STUDY:** Reconstructing image matrices via top-k Eigenvalues	1	17.7.2026		TLM 1&2	
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: Fundamentals of Deep 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
11.	Anatomy of Neural Networks: Artificial Neuron vs Biological Neuron	1	18.7.2026		TLM 1&2	
12.	Network Layers: Input, Hidden, Output configurations	1	18.7.2026		TLM 1&2	
13.	Deep Models & Feedforward Propagation mathematics	1	24.7.2026		TLM 1&2	
14.	Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU.	1	24.7.2026		TLM 1&2	
15.	Loss Functions: MSE, Cross-Entropy, Hinge Loss	1	25.7.2026		TLM 1&2	
16.	**Training Deep Networks: Empirical Risk Minimization**	1	25.7.2026		TLM 1&2	
17.	Backpropagation & Gradient Descent computation loops.	1	31.7.2026		TLM 1&2	
18.	Optimizers: Stochastic Gradient Descent (SGD), Momentum, Adam.	1	31.7.2026		TLM 1&2	

19.	Types of Deep Neural Networks: Brief architectural taxonomy.	1	1.8.2026		TLM 1&2	
20.	**UNIT CASE STUDY:** Building a multi-layer perceptron using custom Adam settings	1	1.8.2026		TLM 1&2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Convolutional Neural Networks

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.	Motivation for CNNs: Locality, Stationarity, Parameter Sharing	1	7.8.2026		TLM 1&2	
22.	Convolution Operation: Kernels, Stride, Padding math	1	7.8.2026		TLM 1&2	
23.	Types of Convolutional Layers (Standard, Dilated)	1	8.8.2026		TLM 1&2	
24.	Pooling Operations: Max Pooling, Average Pooling boundaries	1	8.8.2026		TLM 1&2	
25.	Fully Connected (FC) Layer integration requirements	2	14.8.2026		TLM 1&2	
26.	**Classical Architectures: Introduction to LENET5 structural map**	1	21.8.2026		TLM 1&2	
27.	LENET5 Parameter calculations (Weights, Biases per layer)	1	21.8.2026		TLM 1&2	
28.	**UNIT CASE STUDY:** Training a modified LENET5 to classify medical imaging patches	2	22.8.2026		TLM 1&2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Recurrent Neural Networks

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29.	Architecture of traditional RNN	2	5.9.2026		TLM 1&2	
30.	Types and applications of RNN	2	11.9.2026		TLM 1&2	
31.	Variants of RNNs	2	12.9.2026		TLM 1&2	
32.	Word Embeddingusing Word2vec	4	18.9.2026 19.9.2026		TLM 1&2	
No. of classes required to complete UNIT-IV: 16				**No. of classes taken:**		

UNIT-V: Regularization and Autoencoders

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Introduction to Regularization for Deep Learning	1	25.9.2026		TLM 1&2	
34.	L1 and L2 Regularizations.	1	25.9.2026		TLM 1&2	
35.	Dropout implementation mechanics during training vs inference	1	26.9.2026		TLM 1&2	
36.	Data Augmentation strategies for image and text sets	1	26.9.2026		TLM 1&2	
37.	Early Stopping criteria and validation monitoring systems	1	3.10.2026		TLM 1&2	
38.	**UNIT CASE STUDY PART A:** Improving baseline CNN test accuracy on MNIST	1	3.10.2026		TLM 1&2	
39.	Autoencoders Architecture: Bottleneck, Encoder, Decoder pathways	1	9.10.2026		TLM 1&2	
40.	Implementation details of Vanilla Autoencoders	1	9.10.2026		TLM 1&2	
41.	Denoising Autoencoders: Reconstruction objective functions	1	10.10.2026		TLM 1&2	
42.	Sparse Autoencoders: L1 Activity constraints and KL-Divergence	1	10.10.2026		TLM 1&2	
43.	Industry Use cases: Anomaly detection, data synthesis	2	16.10.2026		TLM 1&2	
No. of classes required to complete UNIT-V: 12				**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
44.	Denoising heavily corrupted MNIST pixels using autoencoders	2	30.10.2026		TLM 1&2	

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

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME 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	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	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.
PO10	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.
PO11	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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs V Sowjanya**	**Mrs V Sowjanya**	**Dr. O. Rama Devi**	**Dr. P. Bhagath**
Signature				

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 ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **G.Sravani**
Course Name & Code : Operating Systems -23CS06
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : IV B.tech/VII-sem **A.Y.:** 2026-27

PREREQUISITE: Knowledge of Computer fundamentals & Data structures & algorithms

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of the course is to make student:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

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

CO1	Demonstrate the underlying principles and techniques of operating system **(Understand-L2)**
CO2	Interpret scheduling and communication methods of processes handled by operating Systems (Understand-L2)
CO3	Distinguish the process synchronization methods and deadlock handling approaches employed in Operating Systems (Understand-L2)
CO4	Classify memory management techniques and virtual memory mechanisms **(Understand-L2)**.
CO5	Interpret the strategies of disk scheduling algorithms and file system architecture **(Understand-L2)**.

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

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

TEXT BOOKS:

. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007

Reference Books:

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, "Unix and shell Programming", Thomson, New Delhi, 1st Edition, 2003.
3. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Operating Systems Structure

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System services	2	03-07-2026		TLM2	
2.	User Operating system Interface	2	04-07-2026		TLM2	
3.	System calls	2	10-07-2026		TLM2	
4.	System programs	1	11-07-2026		TLM2	
5.	Operating System design and Implementation	2	11-07-2025		TLM2	
6.	Operatin System Structure	1	17-07-2026		TLM2	
7.	Virtual Machines	1	17-07-2026		TLM2	
8.	operating system Generation	1	18-07-2026		TLM2	
9.	Booting an Operating System	1	18-07-2026		TLM2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Processes and Process Scheduling

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Processes: Process Concept,	1	24-07-2026		TLM2	
11.	Inter-process communication system	2	24-07-2026		TLM2	
12.	Process Scheduling:Scheduling Crieteria	1	25-07-2026		TLM2	
13.	Scheduling Algorithms:FCFS	1	25-12-2025		TLM2	
14.	SJF	1	31-07-2026		TLM2	
15.	Priority Scheduling	1	31-07-2026		TLM2	
16.	Round Robin Scheduling	1	01-08-2026		TLM2	

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

UNIT-III: Process Synchronization

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Synchronization Tools: The Critical section problem, Peterson's solutions	1	01-08-2026		TLM1	
18.	Peterson's solution	1	07-08-2026		TLM1	
19.	Synchronization Hardware	2	07-08-2026		TLM1	
20.	Semaphores	2	08-08-2026		TLM1	
21.	Monitors	2	14-08-2026		TLM1	
No. of classes required to complete:8 UNIT-111				NO. Of classes taken:		

UNIT-IV: DeadLocks and Memory management Strategies

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
22.	System Model	1	21-08-2026		TLM1	
23.	Deadlock characterization	1	21-08-2026		TLM1	
24.	Methods for handling Deadlocks	1	22-08-2026		TLM1	
25.	Deadlock Prevention,Avoidance,Detection	1	22-08-2026		TLM1	
26.	Recovery from Deadlock	1	05-09-2026		TLM1	
27.	Swapping	1	05-09-2026		TLM1	
28.	Contiguous memory Allocation	1	11-09-2026		TLM1	
29.	Paging	2	12-09-2026		TLM1	
30.	Structure of the Page Table	1	18-09-2026		TLM1	
31.	Segmentation	1	18-09-2026		TLM1	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Virtual Memory Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Demand Paging	1	25-09-2026		TLM2	
33.	Page Replacement	2	26-09-2026		TLM2	
34.	Allocation of Frames	1	03-10-2026		TLM2	
35.	Thrashing	1	09-10-2026		TLM2	
36.	Revision Unit_V	2	10-10-2026 & 16-10-2026		TLM2	
37.	Revision Unit_I & II	2	17-10-2026		TLM2	
38.	Revision Unit_III&IV	2	30-10-2026 & 31-10-2026		TLM1	
No. of classes required to complete UNIT-V: 10				**No. of classes taken:**		

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

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 (Units-III, IV & V)	A2=5
II- Descriptive Examination (UNITS-III, IV & V)	M2=15
II-Quiz Examination (UNITS-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 modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs.G.Sravani**	**Mrs.G.Sravani**	**Dr. D. Venkata Subbaiah**	**Dr. S. Nagarjuna Reddy**
Signature				

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor:B.Lakshmi Thirupathamma , Assistant Professor

Course Name & Code	**: VLSI Signal Processing** & **23ECH2**	**Regulation**: R23
L-T-P Structure	**: 3-0-0**	**Credits:** 03
Program/Sem/Sec	: B.Tech, ECE VII Sem (C)	**A.Y.:** 2026-27

PREREQUISITE: Nil

COURSE OBJECTIVES (COs): The main objectives of the course are to

1.To understand the fundamentals of VLSI architecture for digital signal processing systems.

2.To study pipelining, parallel processing and retiming techniques for improving the performance of DSP architectures.

3.To learn unfolding, folding and systolic architecture design for efficient hardware implementation

4.To analyze area, power and throughput trade-offs in VLSI DSP systems.

5.To design and optimize VLSI architectures for DSP applications using modern design techniques.

COURSE OUTCOMES (COs): Upon successful completion of this course, the student should be able to

CO1	Understand Pipelining, parallel processing and digital filters.
CO2	Optimize VLSI architectures for basic DSP algorithms
CO3	Analyze various parallel processing algorithms
CO4	mplement basic architectures for DSP using CAD tools

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

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

T1 VLSI Digital Signal Processing- System Design and Implementation – Keshab K. Parhi, 1998, Wiley Inter Science.

REFERENCE BOOKS:

R1 Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall
R2 VLSI Digital Signal Processing – Medisetti V. K, 1995, IEEE Press (NY), USA.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DSP

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Outcomes,Introduction to subject, Typical DSP algorithms,benefits	2	03-07-2026		**TLM1/TLM2**	
2.	Representation of DSP algorithms	2	04-07-2026		**TLM1/TLM2**	
3.	Pipelining of FIR Digital filters	2	10-07-2026		**TLM1/TLM2**	
4.	Parallel Processing, Pipelining and Parallel Processing for Low Power	2	11-07-2026		**TLM1/TLM2**	
5.	**Retiming:** Introduction, Definitions and Properties, Solving System of Inequalities	2	17-07-2026		**TLM1/TLM2**	
6.	Retiming Techniques	2	18-07-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Folding& Unfolding

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
7	**Folding** :Introduction -Folding Transform	2	24-07-2026		**TLM1/TLM2**	
8	Register minimizationTechniques-Register minimization in folded architectures	2	25-07-2026		**TLM1/TLM2**	
9	folding in multi rate systems **Unfolding:** Introduction	2	31-07-2026		**TLM1/TLM2**	
10	An Algorithm for Unfolding – Properties of Unfolding	2	01-08-2026			
11	critical Path	2	07-08-2026		**TLM1/TLM2**	
12	Unfolding, Retiming – Applications of Unfolding	2	08-08-2026			
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: Systolic Architecture Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Dateof Completion	Actual Date of Completion	TeachIng Learning Methods	HOD Sign Weekly
13	Introduction – Systolic Array Design Methodology	2	14-08-2026		**TLM1/TLM2**	

14	FIR Systolic Arrays – Selection of Scheduling Vector	2	21-08-2026		**TLM1/TLM2**	
15	Matrix Multiplication	2	22-08-2026		**TLM1/TLM2**	
16	2D Systolic Array	2	05-09-2026			
17	Design Systolic Design for Space Representations contain Delays	2	11-09-2026		**TLM1/TLM2**	
No of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Fast Convolution

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18	Introduction – Cook-Toom Algorithm	2	12-09-2026		**TLM1/TLM2**	
19	Winogard algorithm	2	18-09-2026		**TLM1/TLM2**	
20	Iterated Convolution	2	19-09-2026		**TLM1/TLM2**	
21	Cyclic Convolution	2	25-09-2026		**TLM1/TLM2**	
22	Design of Fast Convolution algorithm by Inspection	2	26-09-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Low Power Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	Scaling Vs Power Consumption –Power Analysis	2	03-10-2026		**TLM1/TLM2**	
	Power Reduction techniques	2	09-10-2026		**TLM1/TLM2**	
	Power Estimation Approaches Programmable DSP	2	10-10-2026		**TLM1/TLM2**	
	Evaluation of Programmable Digital Signal Processors	2	16-10-2026		**TLM1/TLM2**	
	DSP Processors for Mobile and Wireless Communications	2	17-10-2026		**TLM1/TLM2**	
	Processors for Multimedia Signal Processing	2	30-10-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-V: 12				**No. of classes taken:**		

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

Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	29-06-2026	22-08-2026	8

I MID Examinations	24-08-2026	29-08-2026	1
II Phase of Instructions	31-08-2026	17-10-2026	7
II Phase of Instructions contd..	26-10-2026	31-10-2026	1
II MID Examinations	02-11-2026	07-11-2026	1
Preparation and Practicals	09-11-2026	14-11-2026	1
Semester End Examinations	16-11-2026	28-11-2026	2

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):	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Apply the principles of analog and digital VLSI design to analyze, design, simulate, and implement integrated circuits using modern Electronic Design Automation (EDA) tools
PSO 2	Design and develop semiconductor-based systems by integrating VLSI concepts with embedded systems, FPGA, ASIC, and System-on-Chip (SoC) technologies to meet industrial requirements
PSO 3	Demonstrate proficiency in VLSI verification, testing, timing analysis, and physical design to develop reliable, efficient, and manufacturable integrated circuits

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Ms.B.Lakshmi Thirupathamma	Mrs.Y.Padma	Dr.P.Lachi Reddy	Dr.G.Srinivasulu
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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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

Name of Course Instructor : Dr. B. Siva Hari Prasad

Course Name & Code : Constitution of India

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

Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- B A.Y : 2026-27

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

CO 1	Understand history and philosophy of constitution with reference to preamble, Fundamental Rights and Duties.
CO 2	Understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
CO 3	Understand the structure of the state government, Secretariat, Governor and Chief Minister and their functions.
CO 4	Learn local administration viz. Panchayat, Block, Municipality and Corporation.
CO 5	Learn about Election Commission and the process and about SC,ST,OBC and women.

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

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

TEXT BOOKS:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950.
2. Framing of Indian Constitution, 1 st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015.

REFERENCE BOOKS:

1. Indian Constitution Law, 7 th Edition, M. P. Jain, Lexis Nexis, 2014

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section B

UNIT-I: History of Making of the Indian Constitution

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction and Co-Po and Syllabus	1	01-07-2026		TLM1/TLM2	
2.	Constitution meaning and the term	1	03-07-2026		TLM1/TLM2	
3.	Sources and History of Indian Constitution	1	08-07-2026		TLM1/TLM2	
4.	Drafting Committee	1	10-07-2026		TLM1/TLM2	
5.	Composition & Working	1	15-07-2026		TLM1/TLM2	
6.	Philosophy of the Indian Constitution	1	17-07-2026		TLM1/TLM2	
7.	Preamble, Salient Features	1	22-07-2026		TLM1/TLM2	
No of classes required		**07**	No. of classes taken:			

UNIT-II: Contours of Constitutional Rights & Duties:

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.	Fundamental Rights	1	24-07-2026		TLM1/TLM2	
2.	Right to Equality	1	29-07-2026		TLM1/TLM2	
3.	Right to Freedom	1	31-07-2026		TLM1/TLM2	
4.	Right against Exploitation	1	05-08-2026		TLM1/TLM2	
5.	Right to Freedom of Religion	1	07-08-2026		TLM1/TLM2	
6.	Cultural and Educational Rights	1	12-08-2026		TLM1/TLM2	
7.	Right to Constitutional Remedies	1	14-08-2026		TLM1/TLM2	
8.	Directive Principles of State Policy	1	19-08-2026		TLM1/TLM2	
9.	Fundamental Duties	1	21-08-2026		TLM1/TLM2	
No of classes required		**09**	No. of classes taken:			

UNIT-III: Organs of Governance:

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.	Parliament, Composition	1	02-09-2026		TLM1/TLM2	
2.	Qualifications and Disqualifications	1	09-09-2026		TLM1/TLM2	
3.	Powers and Functions	1	11-09-2026		TLM1/TLM2	
4.	Executive- President, Governor, Council of Ministers, Judiciary	1	16-09-2026		TLM1/TLM2	
5.	Appointment &Transfer of Judges, Qualifications, Powers & Functions	1	18-09-2026		TLM1/TLM2	
	No. of classes	**05**	No. of classes taken:			

UNIT-IV: Local Administration:

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.	District's Administration head: Role and Importance	1	23-09-2026		TLM1/TLM2	
2.	Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation	1	25-09-2026		TLM1/TLM2	
3.	Panchayati Raj: Introduction, PRI: Zila Panchayat Elected officials and their roles	1	30-09-2026		TLM1/TLM2	
4.	CEO Zila Pachayat: Position and role	1	07-10-2026		TLM1/TLM2	
5.	Block level: Organizational Hierarchy (Different departments)	1	09-10-2026		TLM1/TLM2	
6.	Village level: Role of Elected and Appointed officials	1	14-10-2026		TLM1/TLM2	
No. of classes required:		**06**	No. of classes taken:			

UNIT-V: Election Commission:

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.	Election Commission: Role and Functioning	1	16-10-2026		TLM1/TLM2	
2.	Chief Election Commissioner and Election Commissioners	1	16-10-2026		TLM1/TLM2	
3.	State Election Commission: Role and Functioning	1	27-10-2026		TLM1/TLM2	
4.	Institutes and Bodies for the welfare of SC/ST/OBC and women	1	30-10-2026		TLM1/TLM2	
No. of classes required		**04**	No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case Study	1	30-10-2026		TLM1/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

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Dr. B. Siva Hari Prasad	Mr. T Anil Raju	Dr.Ch Rajendra Babu	Dr. G Srinivasulu

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NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A

Program/Sem/Sec : **B.Tech., ECE., VII-Semester, B-Section**

Course Instructor : **Dr. P. Lachi Reddy, Professor**

Course Name & Code : **Design for Testability – 23EC31**

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

Academic Year : **2026 – 27**

Pre-requisites: STLD, VLSI Design

Course Educational Objective:

1. To understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts.
2. To analyze logic and fault simulation techniques for design verification.
3. To learn and apply testability measures and design-for-testability (DFT) techniques.
4. To evaluate advanced testing methodologies including Built-In Self-Test (BIST) and boundary scan techniques.

Course Outcomes: Upon completing this course, the student will be able to

CO1: Understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts and the impact of technology trends on testing methodologies. **(Understand-L2)**

CO2: Apply logic and fault simulation techniques for circuit verification by utilizing true-value simulation, fault simulation algorithms, and ATPG. **(Apply-L3)**

CO3: Evaluate the testability of VLSI circuits using controllability and observability measures (SCOAP) and implement the DFT techniques. **(Apply-L3)**

CO4: Analyze the advanced testing strategies by implementing Built-In Self-Test (BIST), boundary scan techniques and BSDL-based system testing. **(Analyze-L4)**

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

Prescribed Syllabus:

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

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

UNIT – V:

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Testing						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Discussion of Syllabus and Course Outcomes	1	29-06-2026			
2.	Testing Philosophy	1	02-07-2026			
3.	Role of Testing	1	03-07-2026			
4.	Digital and Analog VLSI Testing	1	04-07-2026			
5.	VLSI Technology Trends affecting Testing	1	06-07-2026			
6.	Types of Testing	1	09-07-2026			
7.	Fault Modeling: Defects, Errors and Faults	1	10-07-2026			
8.	Functional Versus Structural Testing	1	13-07-2026			
9.	Levels of Fault Models	1	16-07-2026			
10.	Single Stuck-at Fault	1	17-07-2026			
11.	**Activity: Students Presentation on Faults**	1	18-07-2026			
12.	**Revision / Tutorial / Assignment**	1	20-07-2026			
	Number of hours required for UNIT-I	**12**	**No. of Hours Conducted**			

UNIT- II: Logic and Fault Simulation						
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.	Simulation for Design Verification	1	23-07-2026			
14.	Simulation for Test Evaluation	1	24-07-2026			
15.	Modeling Circuits for Simulation	1	25-07-2026			
16.	Algorithms for True-value Simulation	1	27-07-2026			
17.	Algorithms for Fault Simulation	1	30-07-2026			
18.	ATPG	1	31-07-2026			
19.	D-Algorithm	1	01-08-2026			
20.	PODEM Algorithm	1	03-08-2026			
21.	FAN Algorithm	1	06-08-2026			
22.	**Activity: Students Presentation on Algorithms**	1	07-08-2026			
23.	**Revision / Tutorial / Assignment**	1	10-08-2026			
	Number of hours required for UNIT-II	**11**	**No. of Hours Conducted**			

UNIT – III: Testability Measures						
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.	SCOAP Controllability and Observability	2	13-08-2026, 14-08-2026			
25.	High Level Testability Measures	1	17-08-2026			
26.	Digital DFT and Scan Design	1	20-08-2026			
27.	Ad-Hoc DFT Methods	1	21-08-2026			
28.	Scan Design, Partial-Scan Design	1	22-08-2026			
29.	Variations of Scan	1	31-08-2026			
30.	**Activity: Group discussion on Controllability and Observability**	1	03-09-2026			
31.	**Revision / Tutorial / Assignment**	1	05-09-2026			
	Number of hours required for UNIT-III	**09**	**No. of Hours Conducted**			

UNIT – IV: Built-In Self-Test						
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.	The Economic Case for BIST	1	07-09-2026			
33.	Random Logic BIST: Definitions	1	10-09-2026			
34.	BIST Process	1	11-09-2026			
35.	Pattern Generation	1	17-09-2026			
36.	Response Compaction	1	18-09-2026			
37.	Built-In Logic Block Observers	1	19-09-2026			
38.	Test-Per- Clock, Test-Per-Scan BIST Systems	1	21-09-2026			
39.	Circular Self-Test Path System	1	24-09-2026			
40.	Memory BIST	1	25-09-2026			
41.	Memory BIST	1	26-09-2026			
42.	Delay Fault BIST	1	28-09-2026			
43.	**Activity: Students Presentation on BIST**	1	01-10-2026			
44.	**Revision / Tutorial / Assignment**	1	03-10-2026			
	Number of hours required for UNIT-IV	**13**	**No. of Hours Conducted**			

UNIT – V: Boundary Scan Standard						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Motivation	1	05-10-2026			
46.	System Configuration with Boundary Scan	1	08-10-2026			
47.	TAP Controller and Port	1	09-10-2026			
48.	Boundary Scan Test Instructions	1	12-10-2026			
49.	Pin Constraints of the Standard	1	15-10-2026			
50.	Boundary Scan Description Language	1	16-10-2026			
51.	BDSL Description Components	1	17-10-2026			
52.	Pin Descriptions	1	26-10-2026			
53.	**Activity: Students Presentation/Quiz on Boundary Scan**	1	29-10-2026			
54.	**Revision / Tutorial / Assignment**	1	30-10-2026			
	Number of hours required for UNIT-V	**10**	**No. of Hours Conducted**			

BEYOND THE SYLLABUS & REVISION						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
55.	Hardware/software co-verification	1	30-10-2026			
	Number of hours required	**01**	**No. of Hours Conducted**			

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

PART – C

Academic Calendar: 2026 – 27 (VII Semester)

B. Tech VII Semester - 2023 Admitted Batch			
Class work Commence From	**29-06-2026**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	29-06-2026	22-08-2026	8 Weeks
I Mid Examinations	**24-08-2026**	**29-08-2026**	**1 Week**
II Phase of Instructions	31-08-2026	17-10-2026	7 Weeks
Dasara Holidays	19-10-2026	24-10-2026	1 Week
II Phase of Instructions Contd.	26-10-2026	31-10-2026	1 Week
II Mid Examinations	**02-11-2026**	**07-11-2026**	**1 Week**
Preparation & Practicals	09-11-2026	14-11-2026	1 Week
Semester End Examinations	**16-11-2026**	**28-11-2026**	**2 Weeks**

EVALUATION PROCESS:

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

PART – D

PROGRAMME OUTCOMES (POs):

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

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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: 27-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Dr. P. Lachi Reddy]	[Mrs. K. Balavani]	[Dr. P. Lachi Reddy]	[Dr. G. Srinivasulu]

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Department of Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.G.L.N.Murthy /Mr.T.Anil Raju/ Mr.M.S.SankaraRao

Course Name & Code : Digital Signal and Image Processing Lab & 23ECS3
L-T-P Structure : 0-1-2 Credits: 2
Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- B
A.Y :2026-27

Pre-Requisites: Digital Signal Processing, MATLAB fundamentals

Course Objectives: This course introduces the basics of images and the fundamentals operations that can be performed on them. This course provides practical knowledge about design of IIR filters and FIR filters. It provides an exposure to Code composer studio towards working with DSP processors.

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

CO1: Perform operations on discrete time signals.

CO2: Design IIR and FIR Filters and obtain their frequency response

CO3: Perform Image filtering in spatial domain and image Segmentation

CO4: Adapt effective communication, presentation and report writing.

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

TEXTBOOKS:

1. Rafel. C. Gonzalez and Richard. E. Woods, "Digital Image Processing", Pearson Education, 4nd Edition, 2018.
2. Rudra Pratap, *"Getting started with MATLAB*", Oxford University Press, 2010.

PART-B (Theory)

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

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.	Introduction to the course , Course outcomes	**1**	01.07.2026		TLM1	
2.	Introduction to digital image and it's representation	**1**	08.07.2026		TLM1	
3.	Fundamental steps in image processing	**1**	15.07.2026		TLM1	
4.	Applications of Image Processing	**2**	22.07.2026 29.07.2026		TLM2	
No. of classes required to complete UNIT-I		**5**	**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
1.	Image enhancement introduction, point processing	**1**	05.08.2026		TLM1	
2.	Intensity transformation functions	**1**	12.08.2026		TLM1	
3.	Histogram Equalization	**1**	19.08.2026		TLM1	
4.	Spatial filtering – Introduction, Smoothing filter: Linear filters	**1**	02.09.2026		TLM1	
5.	Smoothing filters: Order statistics filters	**1**	09.09.2026		TLM1	
6.	Sharpening filters: Gradient, Laplacian	**1**	16.09.2026		TLM1	
7.	Sharpening filters: Laplacian function	**1**	23.09.2026		TLM1	
8.	Image segmentation: Need, Classification	**1**	30.09.2026		TLM1	
9.	Discontinuity based segmentation	**1**	07.09.2026		TLM1	
10.	Region based segmentation	**1**	14.09.2026		TLM1	
11.	Applications of segmentation	**1**	21.09.2026		TLM2	
No. of classes required to complete UNIT-II:		**11**		**No. of Classes taken**		

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

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, Course outcomes	3	30.06.2026		TLM4	
2.	Linear convolution	3	07.07.2026		TLM4	
3.	Circular convolution	3	14.07.2026		TLM4	
4.	Computation of DFT and IDFT	3	21.07.2026		TLM4	
5.	Design and Implementation of IIR filters	3	28.07.2026		TLM4	
6.	Design and Implementation of FIR filters	3	04.08.2026		TLM4	
7.	Perform spatial transformations on images	3	11.08.2026		TLM4	
8.	Generation of Histogram Equalization of an Image	3	18.08.2026		TLM4	
9.	Image de-noising using spatial filtering	3	01.09.2026		TLM4	
10.	Image segmentation using Prewitt, Sobel and Laplacian of Gaussian operators	3	08.09.2026		TLM4	
11.	Linear convolution (Using Code Composer Studio)	3	15.09.2026		TLM4	
12.	Circular convolution Using Code Composer Studio)	3	22.09.2026		TLM4	
13.	Computation of DFT and IDFT (Using Code Composer Studio)	3	29.09.2026		TLM4	
14.	Case study/Mini project Content beyond syllabus	3	06.10.2026		TLM 6	
15.	Case study/Mini project Content beyond syllabus	3	13.10.2026		TLM 6	
16.	Internal Exam	3	27.10.2026		TLM 4	
No. of classes required to complete Laboratory :48				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):

Day to Day work	**10**
Record	**5**
Internal Exam	**15**
Total CIE(A)	**30**
Total SEE(B)	**70**
Total(A+B)	**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 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

PSO2 Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools

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

Date: 29-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.G.L.N.Murthy	Dr.G.L.N.Murthy	Dr.G.L.N.Murthy	Dr. G. Srinivasulu

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

COURSE HANDOUT

PART-A:

Program : B.Tech. VII-Sem., ECE., Section–B
Academic Year : 2026-27
Course Name & Code : Cellular &Mobile Communications -23EC26
L-T-P-Cr : 3-0-0-3
Course Instructure : Dr. M. V. Sudhakar
Course Objective:

The course enables students to understand the principles of cellular mobile communication systems, radio propagation characteristics, interference, frequency management, and handoff mechanisms. It develops the ability to analyze cellular network design aspects such as coverage, capacity, antenna systems, and channel assignment techniques. The course also introduces modern digital cellular technologies including GSM, CDMA, LTE, MIMO, OFDM, and emerging 5G wireless systems.

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

CO 1	Summarize the fundamental concepts of cellular mobile communication systems, including limitations of conventional systems, frequency reuse, propagation effects, and fading. **(Understand-L2)**
CO 2	Apply knowledge of interference mechanisms and implement appropriate antenna configurations and diversity techniques to improve system performance. **(Apply-L3)**
CO 3	Implement principles of frequency management, channel assignment, and cell coverage analysis for efficient cellular network design. **(Apply-L3)**
CO 4	Describe cellular system components, including antennas and handoff mechanisms, and modern digital communication technologies such as GSM, multiple access schemes, LTE, OFDM, MIMO, and 5G. (**Understand-L2**)

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

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

Textbooks (T) and References (R):

T1: Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
T2: Wireless Communications–Principles and Practice, T.S. Rappaport, Pearson, 2nd edition, 2010, ISBN 9788131731864

R1: Principles of Mobile Communications–Gordon L.Stuber, Springer International 2nd Edition, 2001.
R2: Modern Wireless Communication – Symon Haykin Michael Moher, Pearson Education, 2005.
R3: Wireless Communication theory and Techniques, Asrar U.H.Sheikh,Springer,2004.
R4: Wireless Communications, A.Goldsmith, Cambridge Univ Press,2005
R5: Fundamentals of Wireless Communications, D.Tse and P.Viswanath, Cambridge Univ Press, 2005

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Cellular Systems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	CO &POs, Introduction to the course	1	29-06-2026			
2.	Limitations of Conventional System,	1	02-07-2026			
3.	Basic Cellular Mobile System,	1	03-07-2026			
4.	First, second, third and fourth and Generation cellular wireless systems.	1	04-07-2026			
5.	Operation of Cellular System.	1	06-07-2026			
6.	Uniqueness of Mobile Radio Environment	1	09-07-2026			
7.	Fading, coherence bandwidth	1	10-07-2026			
8.	Doppler Spread.		11-07-2026			
9.	**Fundamentals of cellular Radio System Design: concept of frequency reuse channels; Activity : Flipped class.**	1	13-07-2026			
10.	Co-channel Interference,	1	16-07-2026			
11.	Co-channel Interference Reduction Factor;	1	17-07-2026			
12.	Desired C/I from a normal case in a Omni directional Antenna system.	1	18-07-2026			
13.	Trunking and grade of service	1	20-07-2026			
14.	Revision	1	23-07-2026			
No. of classes required to complete UNIT-I: 14			**No. of classes taken:**			

UNIT-II: Co-Channel & Non-Co-Channel Interference

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.	Co-Channel Interference Fundamentals	1	24-07-2026			
2.	Measurement of Real Time Co-Channel Interference,	1	25-07-2026			
3.	Design of Antenna system,	1	27-07-2026			
4.	Antenna parameters and their effects,	1	30-07-2026			
5.	Diversity techniques: Space Diversity , Polarization diversity	1	31-07-2026			
6.	Frequency diversity and time diversity.	1	01-08-2026			
7.	Non-co channel interference-adjacent channel interference,	1	03-08-2026			
8.	Near End far end interference,	1	06-08-2026			
9.	**Effect on coverage and interference by power decrease, antenna height decrease;**	1	07-08-2026			

	Activity : Case study.					
10.	Revision	1	08-08-2026			
No. of classes required to complete UNIT-II: 10			**No. of classes taken:**			

UNIT-III: Frequency Management And Channel Assignment, Cell Coverage For Signal And Traffic

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 Frequency Management And Channel Assignment.	1	10-08-2026			
2.	Numbering and grouping,	1	13-08-2026			
3.	setup access and paging channels	1	14-08-2026			
4.	channel assignments to cell sites and mobile units	1	17-08-2026			
5.	Channel sharing and borrowing, sectorization, overlaid cells	1	20-08-2026			
6.	non fixed channel assignment.	1	21-08-2026			
7.	Introduction to Cell Coverage For Signal And Traffic	1	22-08-2026			
8.	Signal reflections in flat and hilly terrain, effect of human made structures	1	31-08-2026			
9.	, phase difference between direct and reflected paths, straight line path loss slope,	1	03-09-2026			
10.	**General formula for mobile propagation over water and flat open area;** **Activity : Problem Based Learning**	1	05-09-2026			
11.	Near and long distance propagation, antenna height gain,	1	07-09-2026			
12.	Form of a point to point model.	1	10-09-2026			
13.	Revision	1	11-09-2026			
No. of classes required to complete UNIT-III: 13			**No. of classes taken:**			

UNIT-IV: Cell site and Mobile Antennas, Handoffs

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.	Cellsite And Mobile Antennas: Sum and difference patterns and their synthesis	1	12-09-2026			
2.	Omni-directional antennas, directional antennas for interference reduction	1	17-09-2026			
3.	space diversity antennas, umbrella pattern antennas,	1	18-09-2026			
4.	Minimum separation of cell site antennas, high gain antennas.	1	19-09-2026			
5.	Handoffs: Handoff Initiation, types of handoff, delaying handoff,	1	21-09-2026			
6.	advantages of Handoff, power difference handoff,	1	24-09-2026			
7.	forced handoff,	1	25-09-2026			
8.	Mobile assisted and soft and Hard handoffs.	1	26-09-2026			
9.	**Inter system and Intra system handoffs,**	1	28-09-2026			

	Activity : Group discussion					
10.	Dropped call rates and their evaluation.	1	01-10-2026			
11.	Revision	1	03-10-2026			
No. of classes required to complete UNIT-IV: 11			**No. of classes taken:**			

UNIT-V: Digital cellular networks And Multiple Access Schemes

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 Digital Cellular Networks And Multiple Access Schemes	1	05-10-2026			
2.	GSM architecture, GSM channels,	1	08-10-2026			
3.	TDMA,	1	09-10-2026			
4.	FDMA, and CDMA.	1	10-10-2026			
5.	Introduction to MIMO systems **Activity : Think pair share**	1	12-10-2026			
6.	Principles of CDMA cellular systems,	1	15-10-2026			
7.	Principles of OFDM based broadband wireless systems,	1	16-10-2026			
8.	4G LTE basics – OFDM, and OFDMA,	1	17-10-2026			
9.	Generalized framework for Filtered OFDM and FBMC,	1	26-10-2026			
10.	Introduction of 5G.	1	29-10-2026			
11.	Revision	1	30-10-2026			
No. of classes required to complete UNIT-V: 11			**No. of classes taken**			

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Optimizing Mobility Management in a 5G Smart City Network	1	31-10-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	**TLM 6**	Assignment or Quiz
TLM 2	PPT	**TLM 7**	Seminar or GD
TLM 3	Tutorial	**TLM 8**	Lab
TLM 4	Problem Solving	**TLM 9**	Case Study
TLM 5	Programming	**TLM 10**	Others

PART-C:

Evaluation Process (R23)

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

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes (POs):

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

Program Specific Outcomes (PSOs):

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

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

Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. M.V.Sudhakar	Mr.T.Bala Krishna	Dr.V.Ravi Sekhara Reddy	Dr. G. Srinivasulu

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs V SOWJANYA
Course Name & Code : Fundamentals of Deep Learning (23AMM3)
L-T-P Structure : 3-1-0 **Credits:** 3
Program/Sem/Sec :IV B.Tech /I Sem/ Minor **A.Y.:** 2026-27

PREREQUISITE: Probability and Statistics, LATT, Machine Learning.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to make students learn the frameworks of deep learning and their application

COURSE OUTCOMES (CO's): After successful completion of the course the students are able to

CO1	Apply the fundamentals of linear algebra to machine learning algorithms. **(Apply- L3)**
CO2	Understand the fundamental building blocks of deep learning **(Understand- L2)**
CO3	Apply the concepts of Convolutional Neural Networks to computer vision applications. **(Apply- L3)**
CO4	Apply the concepts of Recurrent Neural Networks to Natural Language Processing. **(Apply- L3)**
CO5	Apply the regularization techniques to improve the model performance. **(Apply- L3)**

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

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

TEXTBOOKS:

T1 Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016

T2 Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.

T2 Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn,Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821

T4 Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

REFERENCE BOOKS:

R1 Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009

R2 Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.

R3 Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

e-Resources:

1. Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs22

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Mathematical foundations of Deep 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
1.	Introduction to Syllabus, CEOs, COs, CO-PO mapping	1	3.7.2026		TLM 1&2	
2.	Mathematical foundations of Deep Learning	1	3.7.2026		TLM 1&2	
3.	Multiplying Matrices and Vectors	1	4.7.2026		TLM 1&2	
4.	Identity and Inverse Matrices	1	4.7.2026		TLM 1&2	
5.	Linear dependence and Span	1	10.7.2026		TLM 1&2	
6.	Norms	1	10.7.2026		TLM 1&2	
7.	Special kinds of matrices and vectors	1	11.7.2026		TLM 1&2	
8.	Trace operations	1	11.7.2026		TLM 1&2	
9.	Eigen Decomposition	1	17.7.2026		TLM 1&2	
10.	**UNIT CASE STUDY:** Reconstructing image matrices via top-k Eigenvalues	1	17.7.2026		TLM 1&2	
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: Fundamentals of Deep 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
11.	Anatomy of Neural Networks: Artificial Neuron vs Biological Neuron	1	18.7.2026		TLM 1&2	
12.	Network Layers: Input, Hidden, Output configurations	1	18.7.2026		TLM 1&2	
13.	Deep Models & Feedforward Propagation mathematics	1	24.7.2026		TLM 1&2	
14.	Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU.	1	24.7.2026		TLM 1&2	
15.	Loss Functions: MSE, Cross-Entropy, Hinge Loss	1	25.7.2026		TLM 1&2	
16.	**Training Deep Networks: Empirical Risk Minimization**	1	25.7.2026		TLM 1&2	
17.	Backpropagation & Gradient Descent computation loops.	1	31.7.2026		TLM 1&2	
18.	Optimizers: Stochastic Gradient Descent (SGD), Momentum, Adam.	1	31.7.2026		TLM 1&2	

19.	Types of Deep Neural Networks: Brief architectural taxonomy.	1	1.8.2026		TLM 1&2	
20.	**UNIT CASE STUDY:** Building a multi-layer perceptron using custom Adam settings	1	1.8.2026		TLM 1&2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Convolutional Neural Networks

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.	Motivation for CNNs: Locality, Stationarity, Parameter Sharing	1	7.8.2026		TLM 1&2	
22.	Convolution Operation: Kernels, Stride, Padding math	1	7.8.2026		TLM 1&2	
23.	Types of Convolutional Layers (Standard, Dilated)	1	8.8.2026		TLM 1&2	
24.	Pooling Operations: Max Pooling, Average Pooling boundaries	1	8.8.2026		TLM 1&2	
25.	Fully Connected (FC) Layer integration requirements	2	14.8.2026		TLM 1&2	
26.	**Classical Architectures: Introduction to LENET5 structural map**	1	21.8.2026		TLM 1&2	
27.	LENET5 Parameter calculations (Weights, Biases per layer)	1	21.8.2026		TLM 1&2	
28.	**UNIT CASE STUDY:** Training a modified LENET5 to classify medical imaging patches	2	22.8.2026		TLM 1&2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Recurrent Neural Networks

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29.	Architecture of traditional RNN	2	5.9.2026		TLM 1&2	
30.	Types and applications of RNN	2	11.9.2026		TLM 1&2	
31.	Variants of RNNs	2	12.9.2026		TLM 1&2	
32.	Word Embeddingusing Word2vec	4	18.9.2026 19.9.2026		TLM 1&2	
No. of classes required to complete UNIT-IV: 16				**No. of classes taken:**		

UNIT-V: Regularization and Autoencoders

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Introduction to Regularization for Deep Learning	1	25.9.2026		TLM 1&2	
34.	L1 and L2 Regularizations.	1	25.9.2026		TLM 1&2	
35.	Dropout implementation mechanics during training vs inference	1	26.9.2026		TLM 1&2	
36.	Data Augmentation strategies for image and text sets	1	26.9.2026		TLM 1&2	
37.	Early Stopping criteria and validation monitoring systems	1	3.10.2026		TLM 1&2	
38.	**UNIT CASE STUDY PART A:** Improving baseline CNN test accuracy on MNIST	1	3.10.2026		TLM 1&2	
39.	Autoencoders Architecture: Bottleneck, Encoder, Decoder pathways	1	9.10.2026		TLM 1&2	
40.	Implementation details of Vanilla Autoencoders	1	9.10.2026		TLM 1&2	
41.	Denoising Autoencoders: Reconstruction objective functions	1	10.10.2026		TLM 1&2	
42.	Sparse Autoencoders: L1 Activity constraints and KL-Divergence	1	10.10.2026		TLM 1&2	
43.	Industry Use cases: Anomaly detection, data synthesis	2	16.10.2026		TLM 1&2	
No. of classes required to complete UNIT-V: 12				**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
44.	Denoising heavily corrupted MNIST pixels using autoencoders	2	30.10.2026		TLM 1&2	

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

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME 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	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	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.
PO10	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.
PO11	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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs V Sowjanya**	**Mrs V Sowjanya**	**Dr. O. Rama Devi**	**Dr. P. Bhagath**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. S. Uma Maheswara Reddy, Assistant Professor

Course Name & Code	**:** MANAGEMENT SCIENCE & 23HS04	**Regulation**: R23
L-T-P Structure	**: 2-0-0**	**Credits:** 02
Program/Sem/Sec	: B.Tech, ECE VII Sem (B)	**A.Y.:** 2026-27

PREREQUISITE: Nil

COURSE OBJECTIVES (COs): The main objectives of the course are to

1. To make students understand how to manage a business organization effectively.
2. To explore the different locations-layouts of plant, work study procedures to ensure optimization of resources.
3. To explain quality control mechanism for better process of manufacturing.
4. To study role of materials manager for smooth function of different operations.
5. To present various networking methods/techniques for a business plan/project execution with optimum resources.
6. To create awareness on different stages of HRM.

COURSE OUTCOMES (COs): Upon successful completion of this course, the student should be able to

CO1	Understand different theories/principles which helps them to manage business activities by facing present challenges. (L2)
CO2	Capable of choosing good location, layout and easiest and best method of work for optimization of resources to get maximum output in business. (L2)
CO3	Apply quality control techniques to test the qualities of manufacturing and ensure good output to customer. (L3)
CO4	Acquire knowledge on how effectively stores/material can be planned, organized and controlled in the company at economical budget.(L2)
CO5	Explain the concepts of HR planning, development and controlling to meet organizational goals. (L2)

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

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

TEXTBOOKS:

T1 O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi.

REFERENCE BOOKS:

R1 Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.

R2 Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.

R3 Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons.

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.	Course Outcomes, Introduction to Subject	1	29-06-2026		**TLM1/TLM2**	
2.	Functions of management	1	01-07-2026		**TLM1/TLM2**	
3.	Evolution of management	1	03-07-2026		**TLM1/TLM2**	
4.	Taylor's scientific management	1	06-07-2026		**TLM1/TLM2**	
5.	Fayal's Principles of management	1	08-07-2026		**TLM1/TLM2**	
6.	Hertzberg's Maslow's hierarchy of human needs ,Theory x and y	1	10-07-2026		**TLM1/TLM2**	
7.	Hawthorne experiment, morale, motivation	1	13-07-2026		**TLM1/TLM2**	
8.	Basic Concepts related to Organization	1	15-07-2026		**TLM1/TLM2**	
9.	Departmentation and decentralization	1	17-07-2026		**TLM1/TLM2**	
10.	Types of organization structures	1	20-07-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: PLANT LOCATION & WORK STUDY

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.	Plant location	1	22-07-2026		**TLM1/TLM2**	
12.	Factors affecting the plant location & Comparison of rural and urban sites	1	24-07-2026		**TLM1/TLM2**	
13.	Methods for selection of plant-matrix approach	1	27-07-2026		**TLM1/TLM2**	
14.	Plant layouts, Various data analyzing forms travel chart	1	29-07-2026		**TLM1/TLM2**	
15.	Work study & method study objectives,	1	31-07-2026		**TLM1/TLM2**	
16.	Steps involved various types of associated charts	1	03-07-2026		**TLM1/TLM2**	
17.	Work measurement	1	05-08-2026		**TLM1/TLM2**	

18.	Different methods of performance rating	1	07-08-2026		**TLM1/TLM2**	
19.	Allowances, standard time calculation	1	10-08-2026		**TLM1/TLM2**	
20.	Work Sampling - definition, steps	1	12-08-2026		**TLM1/TLM2**	
21.	Standard time calculations & differences with time study	1	14-08-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-II: 11				**No. of classes taken:**		

UNIT-III: INTRODUCTION TO PERT / CPM

S. No.	Topics to be covered	No. of Classes Required	Tentative Dateof Completion	Actual Date of Completion	TeachIng Learning Methods	HOD Sign Weekly
22.	Introduction : PERT & PM	1	17-08-2026		**TLM1/TLM2**	
23.	Network modelling-probabilistic model	1	19-08-2026		**TLM1/TLM2**	
24.	Types of activity times estimation	1	21-08-2026		**TLM1/TLM2**	
25.	Programme evaluation review techniques & CPM	1	31-08-2026		**TLM1/TLM2**	
26.	Deterministic model & critical path calculation & Crashing of simple of networks	1	02-09-2026		**TLM1/TLM2**	
27.	Inspection and Quality control Introduction & Types	1	07-09-2026		**TLM1/TLM2**	
28.	Statistical quality control, techniques, variables and attributes	1	09-09-2026		**TLM1/TLM2**	
29.	Assignable and non-assignable causes, control charts, R Chart& C Charts	1	11-09-2026		**TLM1/TLM2**	
30.	P Charts & Acceptance sampling	1	16-09-2026		**TLM1/TLM2**	
31.	Sampling plans & OC curves	1	18-09-2026		**TLM1/TLM2**	
32.	Introduction to TQM - quality circles, ISO 9000 series procedures.	1	21-09-2026		**TLM1/TLM2**	
No of classes required to complete UNIT-III: 13				**No. of classes taken:**		

UNIT-IV: MATERIALS MANAGEMENT

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Materials management and objectives	1	23-09-2026		**TLM1/TLM2**	
34.	Inventory functions, types, associated costs & classification techniques	1	25-09-2026		**TLM1/TLM2**	
35.	ABC and VED analysis	1	28-09-2026		**TLM1/TLM2**	

36.	Inventory control systems, continuous review system, periodical review system	1	30-09-2026		**TLM1/TLM2**	
37.	Stores management and stores records.	1	05-10-2026		**TLM1/TLM2**	
38.	Purchase management, duties of purchase of manager, associated forms	1	07-10-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-IV: 06				**No. of classes taken:**		

UNIT-V: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT (HRM)

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.	Functions of HRM	1	09-10-2026		**TLM1/TLM2**	
40.	Job evaluation and types of methods	1	12-10-2026		**TLM1/TLM2**	
41.	Job description, merit rating	1	14-10-2026		**TLM1/TLM2**	
42.	Different methods of merit ratings	1	16-10-2026		**TLM1/TLM2**	
43.	Wage incentives & different types of wage incentive schemes	1	26-10-2026		**TLM1/TLM2**	
44.	Marketing, selling	1	28-10-2026		**TLM1/TLM2**	
45.	Marketing mix, product life cycle	1	30-10-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-V: 05				**No. of classes taken:**		

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

Academic Calendar

Description	From	To	Weeks
I Phase of Instructions	29-06-2026	22-08-2026	8
I MID Examinations	24-08-2026	29-08-2026	1
II Phase of Instructions	31-08-2026	17-10-2026	7
II Phase of Instructions contd..	26-10-2026	31-10-2026	1
II MID Examinations	02-11-2026	07-11-2026	1
Preparation and Practicals	09-11-2026	14-11-2026	1
Semester End Examinations	16-11-2026	28-11-2026	2

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

PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mr.S.Uma Maheswara Reddy	Mr.J.Subba Reddy	Mr.J.Subba Reddy	Dr.M.B.S.Sreekara Reddy
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **G.Sravani**
Course Name & Code : Operating Systems -23CS06
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : IV B.tech/VII-sem **A.Y.:** 2026-27

PREREQUISITE: Knowledge of Computer fundamentals & Data structures & algorithms

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of the course is to make student:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

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

CO1	Understand the fundamental concepts, functions, and structures of operating systems, including their design, implementation, and the various types of system calls and services. (Understand-L2)
CO2	Understand process concepts, multithreading models, and CPU scheduling algorithms to effectively manage operations on processes, inter-process communication, and threading issues in operating systems. (Understand-L2)
CO3	Analyze synchronization tools, deadlock-handling methods to solve critical section problems and ensure efficient process synchronization in operating systems. (Apply-L3)
CO4	Analyze different memory management techniques paging and segmentation to understand their suitability for various memory allocation scenarios. (Apply-L3)
CO5	Apply knowledge of file system structures and protection mechanisms to design and implement secure file management systems. (Apply-L3)

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

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

TEXT BOOKS:

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9 th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGrawHill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Operating Systems Structure

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System services	2	03-07-2026		TLM2	
2.	User Operating system Interface	2	04-07-2026		TLM2	
3.	System calls	2	10-07-2026		TLM2	
4.	System programs	1	11-07-2026		TLM2	
5.	Operating System design and Implementation	2	11-07-2025		TLM2	
6.	Operatin System Structure	1	17-07-2026		TLM2	
7.	Virtual Machines	1	17-07-2026		TLM2	
8.	operating system Generation	1	18-07-2026		TLM2	
9.	Booting an Operating System	1	18-07-2026		TLM2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Processes and Process Scheduling

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Processes: Process Concept,	1	24-07-2026		TLM2	
11.	Inter-process communication system	2	24-07-2026		TLM2	
12.	Process Scheduling:Scheduling Crieteria	1	25-07-2026		TLM2	
13.	Scheduling Algorithms:FCFS	1	25-12-2025		TLM2	
14.	SJF	1	31-07-2026		TLM2	
15.	Priority Scheduling	1	31-07-2026		TLM2	
16.	Round Robin Scheduling	1	01-08-2026		TLM2	
No. of classes required to complete UNIT-II: 8				**No. of classes taken:**		

UNIT-III: Process Synchronization

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Synchronization Tools: The Critical section problem, Peterson's solutions	1	01-08-2026		TLM1	
18.	Peterson's solution	1	07-08-2026		TLM1	
19.	Synchronization Hardware	2	07-08-2026		TLM1	
20.	Semaphores	2	08-08-2026		TLM1	
21.	Monitors	2	14-08-2026		TLM1	
No. of classes required to complete:8 UNIT-111				NO. Of classes taken:		

UNIT-IV: DeadLocks and Memory management Strategies

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
22.	System Model	1	21-08-2026		TLM1	
23.	Deadlock characterization	1	21-08-2026		TLM1	
24.	Methods for handling Deadlocks	1	22-08-2026		TLM1	
25.	Deadlock Prevention,Avoidance,Detection	1	22-08-2026		TLM1	
26.	Recovery from Deadlock	1	05-09-2026		TLM1	
27.	Swapping	1	05-09-2026		TLM1	
28.	Contiguous memory Allocation	1	11-09-2026		TLM1	
29.	Paging	2	12-09-2026		TLM1	
30.	Structure of the Page Table	1	18-09-2026		TLM1	
31.	Segmentation	1	18-09-2026		TLM1	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Virtual Memory Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Demand Paging	1	25-09-2026		TLM2	
33.	Page Replacement	2	26-09-2026		TLM2	
34.	Allocation of Frames	1	03-10-2026		TLM2	
35.	Thrashing	1	09-10-2026		TLM2	
36.	Revision Unit_V	2	10-10-2026 & 16-10-2026		TLM2	
37.	Revision Unit_I & II	2	17-10-2026		TLM2	
38.	Revision Unit_III&IV	2	30-10-2026 & 31-10-2026		TLM1	
No. of classes required to complete UNIT-V: 10				**No. of classes taken:**		

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

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 (Units-III, IV & V)	A2=5
II- Descriptive Examination (UNITS-III, IV & V)	M2=15
II-Quiz Examination (UNITS-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 modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs.G.Sravani**	**Mrs.G.Sravani**	**Dr. D. Venkata Subbaiah**	**Dr. S. Nagarjuna Reddy**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
An ISO 21001:2018,14001:2015,50001:2018 Certified Institution
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
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 : Principles of Database Management Systems & 23CS83
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B. Tech/VII/ECE-B **A.Y.:** 2026-27
PREREQUISITES : **Data Structures**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing and Indexing.

COURSE OUTCOMES (COs): After successful completion of the course the students are able to

CO1	State the basic components of Database Management System and data modelling using ER diagrams. L2 – Understand
CO2	Examine the relational model using Structured Query Language (SQL). L3 – Apply
CO3	Employ principles of normalization for effective database design. L3 – Apply
CO4	Demonstrate transaction processing, concurrency control mechanisms and recovery strategies in DBMS. L2 – Understand
CO5	Describe file organization, indexing techniques and selecting NoSQL databases. L2 – Understand

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	2	3
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
1 - Low **2 –**Medium **3 -** High															

TEXTBOOKS:

T1	Henry F. Korth, Abraham Silberschatz, S. Sudarshan – Database System Concepts, McGraw Hill, 6th Edition, 2009.
T2	Shashank Tiwari – Professional NoSQL, John Wiley & Sons, 2011.

REFERENCE BOOKS:

R1	Raghu Ramakrishnan, Johannes Gehrke – Database Management Systems, McGraw Hill, 3rd Edition, 2000.
R2	C.J. Date – An Introduction to Database System, Pearson Education, 8th Edition, 2003.
R3	Ramez Elmasri, Shamkant B. Navathe – Fundamentals of Database Systems, Addison Wesley, 6th Edition, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DBMS & ER Model

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	1-7-26		TLM1,2	
2.	Database System Applications	1	2-7-26		TLM1,2	
3.	Characteristics of Database Approach	1	4-7-26		TLM1,2	
4.	Advantages of DBMS over File System	1	8-7-26		TLM1,2	
5.	Database Users and Administrators	1	9-7-26		TLM1,2	
6.	Three Schema Architecture	1	11-7-26		TLM1,2	
7.	Data Models	1	15-7-26		TLM1,2	
8.	Database Languages (DDL, DML, DCL, TCL)	1	16-7-26		TLM1,2	
9.	Entity Relationship (ER) Model	1	18-7-26		TLM1,2	
10.	ER Diagram Notations	1	22-7-26		TLM1,2	
11.	Mapping Constraints	1	23-7-26		TLM1,2	
12.	Keys in DBMS	1	25-7-26		TLM1,2	
13.	Generalization and Aggregation	1	29-7-26		TLM1,2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Relational Model & SQL

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.	Relational Data Model Concepts	1	30-7-26		TLM1,2	
2.	Relational Integrity Constraints	1	1-8-26		TLM1,2	
3.	Relational Algebra Basics	1	5-8-26		TLM1,2	
4.	SQL Fundamentals	1	6-8-26		TLM1,2	
5.	Data Types and Literals	1	8-8-26		TLM1,2	
6.	Table Creation and Constraints	1	12-8-26		TLM1,2	
7.	Insert, Update and Delete Commands	1	13-8-26		TLM1,2	
8.	Queries using SELECT Statement	1	19-8-26		TLM1,2	
9.	Aggregate Functions, Joins and Nested Queries	1	20-8-26		TLM1,2	
10.	Views and Indexes	1	22-8-26		TLM1,2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Database Design & Normalization

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.	Database Design Guidelines	1	2-9-26		TLM1,2	
2.	Functional Dependencies	1	3-9-26		TLM1,2	
3.	Armstrong's Axioms	1	5-9-26		TLM1,2	
4.	Normalization Concepts	1	9-9-26		TLM1,2	
5.	First Normal Form (1NF), Second Normal Form (2NF)	1	10-9-26		TLM1,2	
6.	Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF)	1	12-9-26		TLM1,2	
7.	Fourth Normal Form (4NF), Fifth Normal Form (5NF)	1	16-9-26		TLM1,2	
8.	Lossless Join Decomposition, Join Dependencies	1	17-9-26		TLM1,2	
No. of classes required to complete UNIT-III: 8			**No. of classes taken:**			

UNIT-IV: Transaction Processing & Concurrency Control

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.	Transaction Concepts	1	19-9-26		TLM1,2	
2.	ACID Properties	1	23-9-26		TLM1,2	
3.	Transaction States	1	24-9-26		TLM1,2	
4.	Serializability, Recoverability	1	26-9-26		TLM1,2	
5.	Concurrency Control Techniques	1	30-9-26		TLM1,2	
6.	Lock Based Protocols, Time Stamping Protocols	1	1-10-26		TLM1,2	
7.	Deadlock Handling	1	3-10-26		TLM1,2	
8.	Deadlock Prevention and Recovery	1	7-10-26		TLM1,2	
No. of classes required to complete UNIT-IV: 8			**No. of classes taken:**			

UNIT-V: Recovery, Indexing & NoSQL Databases

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.	Crash Recovery Techniques	1	8-10-206		TLM1,2	
2.	Log Based Recovery, Checkpoints	1	10-10-26		TLM1,2	
3.	Storage and File Structure, File Organization Methods	1	14-10-26		TLM1,2	

4.	Indexed Files, Hashed Files	1	15-10-26		TLM1,2	
5.	B+ Trees	1	17-10-26		TLM1,2	
6.	Physical Database Design	1	28-10-26		TLM1,2	
7.	Introduction to NoSQL Databases	1	29-10-26		TLM1,2	
8.	Types of NoSQL Databases and Applications	1	31-10-26		TLM1,2	
No. of classes required to complete UNIT-II: 8				**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 (R20 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):

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 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 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.
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):

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.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Mr. P Rajasekhar**	**Ms. P. Sarala**	**Dr. Y. V Bhaskar Reddy**	**Dr. S. Nagarjuna Reddy**
Signature				

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

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section - B

Course Instructor : Mrs. K. Pavani , Sr. Asst. Professor, ECE

Course Name & Code : LOW POWER VLSI DESIGN – 23EC27

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

Academic Year **:** 2026 - 27

Pre requisite: Digital Electronic Circuits and VLSI Design

Course Educational Objective: This course provides knowledge on fundamentals of low power VLSI design concepts, circuits and subsystems.

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

CO 1	Understand the fundamentals of low power VLSI design by analyzing the sources of power dissipation and short channel effects on circuit performance (Understand – L2)
CO 2	Apply Low Power Design techniques including voltage scaling (VTCMO, MTCMOS), pipelinig, parallel processing at system, circuit and mask levels. (Apply – L3)
CO 3	Design the low voltage low power arithmetic circuits by comparing various adder and multiplier architectures in terms of power, delay and area trade offs. (Apply – L3)
CO 4	Analyze the low power memory architectures of ROM, SRAM and DRAM. (Analyze – L4)

CO's	Co-Po Attainment Table														
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2										2		3	
CO2	3	3	3		2		2					2		3	
CO3	3	3		2	3							2		3	2
CO4	3	3	3	2	3		2		1	1	1	2		3	2

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Fundamentals of Low Power CMOS VLSI Design [11 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 to COs	1	29.6.2026			
2.	Introduction	1	1.07.2026			
3.	Sources of Power Dissipation	1	2.7.2026			
4.	Static Power Dissipation	1	3.7.2026			
5.	Short Circuit Power Dissipation	1	4.7.2026			
6.	Leakage Power Dissipation, Glitch Power Dissipation	1	6.7.2026			
7.	Short Channel Effects –Drain Induced Barrier Lowering, Body Effect	1	8.7.2026			
8.	**Flipped Class on Low Power Techniques in VLSI**	1	9.7.2026			
9.	Gate-induced Drain Leakage	1	11.7.2026			
10.	Active power dissipation.	1	13.7.2026			
11.	**Tutorial/Assignment**	1	10.7.2026			

UNIT- II: Circuit techniques for Low-Power Reduction [11 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
12.	Concepts of leakage power	1	15.7.2026			
13.	Circuit techniques for Leakage power reduction	2	16.7.2026 & 18.7.2026			
14.	Power Gating, Body Biasing Techniques	1	20.7.2026			
15.	Standby leakage control	1	22.7.2026			
16.	Multi-Vth technique	1	23.7.2026			
17.	Supply voltage scaling	1	25.7.2026			
18.	VTMOS circuits, DTMOS circuits	1	27.7.2026			
19.	**Collaborative Learning on MOS circuits**	1	29.7.2026			
20.	Dynamic-Vth technique	1	30.7.2026			
21.	**Tutorial /Assignment**	1	31.7.2026			

UNIT – III: Low-Voltage Low-Power Adders [12 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
22.	Introduction,	1	1.8.2026			
23.	Standard Adder Cells	1	3.8.2026			
24.	CMOS Adder's Architectures	1	5.8.2026			
25.	Carry Look-Ahead Adder	1	6.8.2026			
26.	Ripple Carry Adders	1	8.8.2026			
27.	Carry Select Adders- **Experimental Learning**	1	10.8.2026			
28.	Mid-1 Review	1	12.8.2026			
29.	Carry Save Adders	1	13.8.2026			
30.	Performance evaluation of various adder architectures	1	17.8.2026			

31.	Performance evaluation of various adder architectures	1	19.8.2026			
32.	**Tutorial/Assignment**	1	14.8.2026			

UNIT – IV: Low-Voltage Low-Power Multipliers [12 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**
33.	Review of Multiplication	1	2.9.2026			
34.	Multiplier Architectures	1	3.9.2026			
35.	Multiplier Architectures	1	5.9.2026			
36.	Braun Multiplier	1	7.9.2026			
37.	Braun Multiplier	1	9.9.2026			
38.	Baugh-Wooley Multiplier	1	10.9.2026			
39.	**Peer Teaching on Multipliers**	1	12.9.2026			
40.	Booth Multiplier	1	16.9.2026			
41.	Booth Multiplier	1	17.9.2026			
42.	Introduction to Wallace Tree Multiplier.	1	19.9.2026			
43.	Wallace Tree Multiplier.	1	21.9.2026			
44.	**Tutorial/Assignment**	1	25.9.2026			

UNIT – V: Low-Voltage Low-Power Memories [14 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Basics of ROM	1	23.9.2026			
46.	Low-Power ROM Technology	1	24.9.2026			
47.	Future Trend and Development of ROMs	1	26.9.2026			
48.	Future Trend and Development of ROMs	1	28.9.2026			
49.	Basics of SRAM, Memory cell	1	30.9.2026			
50.	**Quiz**	1	1.10.2026			
51.	Precharge and Equalization Circuit	1	3.10.2026			
52.	Precharge and Equalization Circuit	1	5.10.2026			
53.	Low-Power SRAM Technologies	1	7.10.2026			
54.	Basics of DRAM	2	8.10.2026			
55.	Self-Refresh Circuit	1	10.10.2026			
56.	Future Trend and Development of DRAM.	1	12.10.2026			
57.	**Tutorial/Assignment**	1	16.10.2026			

BEYOND THE SYLLABUS & REVISION [3 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
58.	Advanced Power Reduction Techniques	1	14.10.2026			
59.	Sub-threshold and Near-threshold Logic	1	15.10.2026			
60.	Low Power Design Metrics	1	17.10.2026			

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

PART – C

EVALUATION 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): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work	30-06-2025		
I Phase of Instructions	30-06-2025	23-08-2025	8W
Technical Training	25-08-2025	06-09-2025	2W
I Mid Examinations	08-09-2025	13-09-2025	1W
II Phase of Instructions	15-09-2025	15-11-2025	9W
II Mid Examinations	17-11-2025	22-11-2025	1W
Preparation and Practical's	24-11-2025	29-11-2025	1W
Semester End Examinations	01-12-2025	13-12-2025	2W

PART – D

PROGRAMME OUTCOMES (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
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PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mrs.K.Balavani]	[Mrs.M.Ramya Harika]	[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

Name of Course Instructor : Mr T. Anil Raju

Course Name & Code : Constitution of India

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

Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- C A.Y : 2026-27

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

CO 1	Understand history and philosophy of constitution with reference to preamble, Fundamental Rights and Duties.
CO 2	Understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
CO 3	Understand the structure of the state government, Secretariat, Governor and Chief Minister and their functions.
CO 4	Learn local administration viz. Panchayat, Block, Municipality and Corporation.
CO 5	Learn about Election Commission and the process and about SC,ST,OBC and women.

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

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

TEXT BOOKS:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950.
2. Framing of Indian Constitution, 1 st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015.

REFERENCE BOOKS:

1. Indian Constitution Law, 7 th Edition, M. P. Jain, Lexis Nexis, 2014

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section C

UNIT-I: History of Making of the Indian Constitution

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction and Co-Po and Syllabus	1	29-06-2026		TLM1/TLM2	
2.	Constitution meaning and the term	1	01-07-2026		TLM1/TLM2	
3.	Sources and History of Indian Constitution	1	06-07-2026		TLM1/TLM2	
4.	Drafting Committee	1	08-07-2026		TLM1/TLM2	
5.	Composition & Working	1	13-07-2026		TLM1/TLM2	
6.	Philosophy of the Indian Constitution	1	15-07-2026		TLM1/TLM2	
7.	Preamble, Salient Features	1	20-07-2026		TLM1/TLM2	
No of classes required		**07**	No. of classes taken:			

UNIT-II: Contours of Constitutional Rights & Duties:

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.	Fundamental Rights	1	22-07-2026		TLM1/TLM2	
2.	Right to Equality	1	27-07-2026		TLM1/TLM2	
3.	Right to Freedom	1	29-07-2026		TLM1/TLM2	
4.	Right against Exploitation	1	03-08-2026		TLM1/TLM2	
5.	Right to Freedom of Religion	1	05-08-2026		TLM1/TLM2	
6.	Cultural and Educational Rights	1	10-08-2026		TLM1/TLM2	
7.	Right to Constitutional Remedies	1	12-08-2026		TLM1/TLM2	
8.	Directive Principles of State Policy	1	17-08-2026		TLM1/TLM2	
9.	Fundamental Duties	1	19-08-2026		TLM1/TLM2	
No of classes required		**09**	No. of classes taken:			

UNIT-III: Organs of Governance:

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.	Parliament, Composition	1	31-08-2026		TLM1/TLM2	
2.	Qualifications and Disqualifications	1	02-09-2026		TLM1/TLM2	
3.	Powers and Functions	1	07-09-2026		TLM1/TLM2	
4.	Executive- President, Governor, Council of Ministers, Judiciary	1	09-09-2026		TLM1/TLM2	
5.	Appointment &Transfer of Judges, Qualifications, Powers & Functions	1	16-09-2026		TLM1/TLM2	
	No. of classes	**05**	No. of classes taken:			

UNIT-IV: Local Administration:

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.	District's Administration head: Role and Importance	1	21-09-2026		TLM1/TLM2	
2.	Municipalities: Introduction, Mayor and role of Elected Representative,	1	23-09-2026		TLM1/TLM2	

	CEO of Municipal Corporation					
3.	Panchayati Raj: Introduction, PRI: Zila Panchayat Elected officials and their roles	1	28-09-2026		TLM1/TLM2	
4.	CEO Zila Pachayat: Position and role	1	30-09-2026		TLM1/TLM2	
5.	Block level: Organizational Hierarchy (Different departments)	1	05-10-2026		TLM1/TLM2	
6.	Village level: Role of Elected and Appointed officials	1	07-10-2026		TLM1/TLM2	
No. of classes required:		**06**	No. of classes taken:			

UNIT-V: Election Commission:

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.	Election Commission: Role and Functioning	1	12-10-2026		TLM1/TLM2	
2.	Chief Election Commissioner and Election Commissioners	1	14-10-2026		TLM1/TLM2	
3.	State Election Commission: Role and Functioning	1	26-10-2026		TLM1/TLM2	
4.	Institutes and Bodies for the welfare of SC/ST/OBC and women	1	28-10-2026		TLM1/TLM2	
No. of classes required		**04**	No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Case Study	1	28-10-2026		TLM1/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):

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PROGRAMME SPECIFIC OUTCOMES (PSOs):

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Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
Mr. T Anil Raju	Mr. T Anil Raju	Dr.Ch Rajendra Babu	Dr. G Srinivasulu

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Department of Electronics and Communication Engineering

COURSE HANDOUT

PART-A:

Program : B.Tech. VII-Sem., ECE., Section–C
Academic Year : 2026-27
Course Name & Code : Cellular &Mobile Communications -23EC26
L-T-P-Cr : 3-0-0-3
Course Instructure : Balakrishna Thammileti
Course Objective:

The course enables students to understand the principles of cellular mobile communication systems, radio propagation characteristics, interference, frequency management, and handoff mechanisms. It develops the ability to analyze cellular network design aspects such as coverage, capacity, antenna systems, and channel assignment techniques. The course also introduces modern digital cellular technologies including GSM, CDMA, LTE, MIMO, OFDM, and emerging 5G wireless systems.

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

CO 1	Summarize the fundamental concepts of cellular mobile communication systems, including limitations of conventional systems, frequency reuse, propagation effects, and fading. **(Understand-L2)**
CO 2	Apply knowledge of interference mechanisms and implement appropriate antenna configurations and diversity techniques to improve system performance. **(Apply-L3)**
CO 3	Implement principles of frequency management, channel assignment, and cell coverage analysis for efficient cellular network design. **(Apply-L3)**
CO 4	Describe cellular system components, including antennas and handoff mechanisms, and modern digital communication technologies such as GSM, multiple access schemes, LTE, OFDM, MIMO, and 5G. (**Understand-L2**)

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

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

Textbooks (T) and References (R):

T1: Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
T2: Wireless Communications–Principles and Practice, T.S. Rappaport, Pearson, 2nd edition, 2010, ISBN 9788131731864

R1: Principles of Mobile Communications–Gordon L.Stuber, Springer International 2nd Edition, 2001.
R2: Modern Wireless Communication – Symon Haykin Michael Moher, Pearson Education, 2005.
R3: Wireless Communication theory and Techniques, Asrar U.H.Sheikh,Springer,2004.
R4: Wireless Communications, A.Goldsmith, Cambridge Univ Press,2005
R5: Fundamentals of Wireless Communications, D.Tse and P.Viswanath, Cambridge Univ Press, 2005

PART-B: COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Cellular Systems

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	CO &POs, Introduction to the course	1	30-06-2026			
2.	Limitations of Conventional System,	1	30-06-2026			
3.	Basic Cellular Mobile System,	1	03-07-2026			
4.	First, second, third and fourth and Generation cellular wireless systems.	1	04-07-2026			
5.	Operation of Cellular System.	1	07-07-2026			
6.	Uniqueness of Mobile Radio Environment	1	07-07-2026			
7.	Fading, coherence bandwidth	1	10-07-2026			
8.	Doppler Spread.		11-07-2026			
9.	**Fundamentals of cellular Radio System Design: concept of frequency reuse channels; Activity : Flipped class.**	1	14-07-2026			
10.	Co-channel Interference,	1	14-07-2026			
11.	Co-channel Interference Reduction Factor;	1	17-07-2026			
12.	Desired C/I from a normal case in a Omni directional Antenna system.	1	18-07-2026			
13.	Trunking and grade of service	1	21-07-2026			
14.	Revision	1	21-07-2026			
No. of classes required to complete UNIT-I: 14			**No. of classes taken:**			

UNIT-II: Co-Channel & Non-Co-Channel Interference

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.	Co-Channel Interference Fundamentals	1	24-07-2026			
2.	Measurement of Real Time Co-Channel Interference,	1	25-07-2026			
3.	Design of Antenna system,	1	27-07-2026			
4.	Antenna parameters and their effects,	1	27-07-2026			
5.	Diversity techniques: Space Diversity	1	31-07-2026			
6.	Polarization diversity	1	01-08-2026			
7.	Frequency diversity and time diversity.	1	04-08-2026			
8.	Non-co channel interference-adjacent channel interference,	1	04-08-2026			
9.	Near End far end interference,	1	07-08-2026			
10.	**Effect on coverage and interference by power decrease, antenna height decrease;**	1	08-08-2026			

	Activity : Case study.					
11.	Revision	1	11-08-2026			
No. of classes required to complete UNIT-II: 11			**No. of classes taken:**			

UNIT-III: Frequency Management And Channel Assignment, Cell Coverage For Signal And Traffic

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 Frequency Management And Channel Assignment.	1	11-08-2026			
2.	Numbering and grouping,	1	14-08-2026			
3.	setup access and paging channels	1	18-08-2026			
4.	channel assignments to cell sites and mobile units	1	18-08-2026			
5.	Channel sharing and borrowing, sectorization, overlaid cells	1	21-08-2026			
6.	non fixed channel assignment.	1	22-08-2026			
7.	Introduction to Cell Coverage For Signal And Traffic	1	01-09-2026			
8.	Signal reflections in flat and hilly terrain, effect of human made structures	1	01-09-2026			
9.	, phase difference between direct and reflected paths, straight line path loss slope,	1	05-09-2026			
10.	**General formula for mobile propagation over water and flat open area;** **Activity : Problem Based Learning**	1	08-09-2026			
11.	Near and long distance propagation, antenna height gain,	1	11-09-2026			
12.	Form of a point to point model.	1	12-09-2026			
13.	Revision	1	15-09-2026			
No. of classes required to complete UNIT-III: 13			**No. of classes taken:**			

UNIT-IV: Cell site and Mobile Antennas, Handoffs

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.	Cellsite And Mobile Antennas: Sum and difference patterns and their synthesis	1	15-09-2026			
2.	Omni-directional antennas, directional antennas for interference reduction	1	18-09-2026			
3.	space diversity antennas, umbrella pattern antennas,	1	19-09-2026			
4.	Minimum separation of cell site antennas, high gain antennas.	1	22-09-2026			
5.	Handoffs: Handoff Initiation, types of handoff, delaying handoff,	1	22-09-2026			
6.	advantages of Handoff, power difference handoff,	1	25-09-2026			
7.	forced handoff,	1	26-09-2026			
8.	Mobile assisted and soft and Hard handoffs.	1	29-09-2026			
9.	**Inter system and Intra system handoffs,**	1	29-09-2026			

	Activity : Group discussion					
10.	Dropped call rates and their evaluation.	1	03-10-2026			
11.	Revision	1	06-10-2026			
No. of classes required to complete UNIT-IV: 11			**No. of classes taken:**			

UNIT-V: Digital cellular networks And Multiple Access Schemes

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 Digital Cellular Networks And Multiple Access Schemes	1	06-10-2026			
2.	GSM architecture, GSM channels,	1	09-10-2026			
3.	TDMA,	1	10-10-2026			
4.	FDMA, and CDMA.	1	13-10-2026			
5.	Introduction to MIMO systems **Activity : Think pair share**	1	13-10-2026			
6.	Principles of CDMA cellular systems,	1	16-10-2026			
7.	Principles of OFDM based broadband wireless systems,	1	17-10-2026			
8.	4G LTE basics – OFDM, and OFDMA,	1	27-10-2026			
9.	Generalized framework for Filtered OFDM and FBMC,	1	27-10-2026			
10.	Introduction of 5G.	1	30-10-2026			
11.	Revision	1	31-10-2026			
No. of classes required to complete UNIT-V: 11			**No. of classes taken**			

Content Beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Optimizing Mobility Management in a 5G Smart City Network	1	30-10-2026			

Teaching Learning Methods

TLM 1	Chalk and Talk	**TLM 6**	Assignment or Quiz
TLM 2	PPT	**TLM 7**	Seminar or GD
TLM 3	Tutorial	**TLM 8**	Lab
TLM 4	Problem Solving	**TLM 9**	Case Study
TLM 5	Programming	**TLM 10**	Others

PART-C:

Evaluation Process (R23)

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

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

PART-D:

Program Educational Objectives (PEOs):

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

Program Outcomes (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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Date:

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.T Balakrishna	Mr.T Balakrishna	Dr.V.Ravi Sekhara Reddy	Dr. G. Srinivasulu

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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

Program/Sem/Sec : **B.Tech., ECE., VII-Semester, C-Section**

Course Instructor : **Mrs K. Balavani, Sr. Asst Professor**

Course Name & Code : **Design for Testability – 23EC31**

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

Academic Year : **2026 – 27**

Pre-requisites: STLD, VLSI Design

Course Educational Objective:

1. To understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts.
2. To analyze logic and fault simulation techniques for design verification.
3. To learn and apply testability measures and design-for-testability (DFT) techniques.
4. To evaluate advanced testing methodologies including Built-In Self-Test (BIST) and boundary scan techniques.

Course Outcomes: Upon completing this course, the student will be able to

CO1: Understand the fundamentals of VLSI testing philosophy, types of testing, fault modeling concepts and the impact of technology trends on testing methodologies. **(Understand-L2)**

CO2: Apply logic and fault simulation techniques for circuit verification by utilizing true-value simulation, fault simulation algorithms, and ATPG. **(Apply-L3)**

CO3: Evaluate the testability of VLSI circuits using controllability and observability measures (SCOAP) and implement the DFT techniques. **(Apply-L3)**

CO4: Analyze the advanced testing strategies by implementing Built-In Self-Test (BIST), boundary scan techniques and BSDL-based system testing. **(Analyze-L4)**

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

Prescribed Syllabus:

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

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

UNIT – V:

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Testing						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Discussion of Syllabus and Course Outcomes	1	29-06-2026			
2.	Testing Philosophy	1	30-06-2026			
3.	Role of Testing	1	03-07-2026			
4.	Digital and Analog VLSI Testing	1	04-07-2026			
5.	VLSI Technology Trends affecting Testing	1	06-07-2026			
6.	Types of Testing	1	07-07-2026			
7.	Fault Modeling: Defects, Errors and Faults	1	10-07-2026			
8.	Functional Versus Structural Testing	1	11-07-2026			
9.	Levels of Fault Models	1	13-07-2026			
10.	Single Stuck-at Fault	1	14-07-2026			
11.	**Activity: Students Presentation on Faults**	1	17-07-2026			
12.	**Revision / Tutorial / Assignment**	1	18-07-2026			
	Number of hours required for UNIT-I	**12**	**No. of Hours Conducted**			

UNIT- II: Logic and Fault Simulation						
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.	Simulation for Design Verification	1	20-07-2026			
14.	Simulation for Test Evaluation	1	21-07-2026			
15.	Modeling Circuits for Simulation	1	24-07-2026			
16.	Algorithms for True-value Simulation	1	25-07-2026			
17.	Algorithms for Fault Simulation	1	27-07-2026			
18.	ATPG	1	28-07-2026			
19.	D-Algorithm	1	31-07-2026			
20.	PODEM Algorithm	1	01-08-2026			
21.	FAN Algorithm	1	03-08-2026			
22.	**Activity: Students Presentation on Algorithms**	1	04-08-2026			
23.	**Revision / Tutorial / Assignment**	1	07-08-2026			
	Number of hours required for UNIT-II	**11**	**No. of Hours Conducted**			

UNIT III: Testability Measures						
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.	SCOAP Controllability and Observability	2	08-08-2026, 10-08-2026			
25.	High Level Testability Measures	1	11-08-2026			
26.	Digital DFT and Scan Design	1	14-08-2026			
27.	Ad-Hoc DFT Methods	1	17-08-2026			
28.	Scan Design, Partial-Scan Design	1	18-08-2026			
29.	Variations of Scan	1	21-08-2026			
30.	**Activity: Group discussion on Controllability and Observability**	2	22-08-2026 31-08-2026			
31.	**Revision / Tutorial / Assignment**	1	01-09-2026			
	Number of hours required for UNIT-III	**10**	**No. of Hours Conducted**			

UNIT IV: Built-In Self-Test						
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.	The Economic Case for BIST	1	05-09-2026			
33.	Random Logic BIST: Definitions	1	07-09-2026			
34.	BIST Process	2	08-09-2026 11-09-2026			
35.	Pattern Generation	1	12-09-2026			
36.	Response Compaction	1	15-09-2026			
37.	Built-In Logic Block Observers	1	18-09-2026			
38.	Test-Per- Clock, Test-Per-Scan BIST Systems	1	19-09-2026			
39.	Circular Self-Test Path System	1	21-09-2026			
40.	Memory BIST	1	22-09-2026			
41.	Memory BIST	1	25-09-2026			
42.	Delay Fault BIST	1	26-09-2026			
43.	**Activity: Students Presentation on BIST**	1	28-09-2026			
44.	**Revision / Tutorial / Assignment**	2	29-09-2026 03-10-2026			
	Number of hours required for UNIT-IV	**15**	**No. of Hours Conducted**			

UNIT V: Boundary Scan Standard						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Motivation	1	05-10-2026			
46.	System Configuration with Boundary Scan	1	06-10-2026			
47.	TAP Controller and Port	1	09-10-2026			
48.	Boundary Scan Test Instructions	1	10-10-2026			
49.	Pin Constraints of the Standard	1	12-10-2026			
50.	Boundary Scan Description Language	1	13-10-2026			
51.	BDSL Description Components	1	16-10-2026			
52.	Pin Descriptions	1	17-10-2026			
53.	**Activity: Students Presentation/Quiz on Boundary Scan**	2	26-10-2026			

			27-10-2026			
54.	**Revision / Tutorial / Assignment**	1	30-10-2026			
	Number of hours required for UNIT-V	**11**	**No. of Hours Conducted**			

BEYOND THE SYLLABUS & REVISION						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
55.	Hardware/software co-verification	1	31-10-2026			
	Number of hours required	**01**	**No. of Hours Conducted**			

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

PART – C

Academic Calendar: 2026 – 27 (VII Semester)

B. Tech VII Semester - 2023 Admitted Batch			
Class work Commence From	**29-06-2026**		
Description	**From**	**To**	**Weeks**
I Phase of Instructions	29-06-2026	22-08-2026	8 Weeks
I Mid Examinations	**24-08-2026**	**29-08-2026**	**1 Week**
II Phase of Instructions	31-08-2026	17-10-2026	7 Weeks
Dasara Holidays	19-10-2026	24-10-2026	1 Week
II Phase of Instructions Contd.	26-10-2026	31-10-2026	1 Week
II Mid Examinations	**02-11-2026**	**07-11-2026**	**1 Week**
Preparation & Practicals	09-11-2026	14-11-2026	1 Week
Semester End Examinations	**16-11-2026**	**28-11-2026**	**2 Weeks**

EVALUATION PROCESS:

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

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Date: 27-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mrs. K. Balavani]	[Mrs. K. Balavani]	[Dr. P. Lachi Reddy]	[Dr. G. Srinivasulu]

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Department of Electronics & Communication Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.T.Anil Raju/ Mr.M.S.SankaraRao/Dr K. Ravi Kumar

Course Name & Code : Digital Signal and Image Processing Lab & 23ECS3
L-T-P Structure : 0-1-2 Credits: 2
Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section- C
A.Y :2026-27

Pre-Requisites: Digital Signal Processing, MATLAB fundamentals

Course Objectives: This course introduces the basics of images and the fundamentals operations that can be performed on them. This course provides practical knowledge about design of IIR filters and FIR filters. It provides an exposure to Code composer studio towards working with DSP processors.

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

CO1: Perform operations on discrete time signals.

CO2: Design IIR and FIR Filters and obtain their frequency response

CO3: Perform Image filtering in spatial domain and image Segmentation

CO4: Adapt effective communication, presentation and report writing.

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

TEXTBOOKS:

1. Rafel. C. Gonzalez and Richard. E. Woods, "Digital Image Processing", Pearson Education, 4nd Edition, 2018.
2. Rudra Pratap, *"Getting started with MATLAB*", Oxford University Press, 2010.

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.	Introduction to the course, Course outcomes	**1**	04.07.2026		TLM1	
2.	Introduction to digital image and its representation	**1**	11.07.2026		TLM1	
3.	Fundamental steps in image processing	**1**	18.07.2026		TLM1	
4.	Applications of Image Processing	**2**	25.07.2026 01.08.2026		TLM2	
No. of classes required to complete UNIT-I		**5**	**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
1.	Image enhancement introduction, point processing	**1**	08.08.2026		TLM1	
2.	Intensity transformation functions	**1**	22.08.2026		TLM1	
3.	Histogram Equalization	**1**	05.09.2026		TLM1	
4.	Spatial filtering – Introduction, Smoothing filter: Linear filters	**1**	12.09.2026		TLM1	
5.	Smoothing filters: Order statistics filters	**1**	19.09.2026		TLM1	
6.	Sharpening filters: Gradient, Laplacian	**1**	26.09.2026		TLM1	
7.	Sharpening filters: Laplacian function	**1**	03.10.2026		TLM1	
8.	Image segmentation: Need, Classification	**1**	10.10.2026		TLM1	
9.	Discontinuity based segmentation	**1**	17.10.2026		TLM1	
10.	Region based segmentation	**1**	24.10.2026		TLM1	
11.	Applications of segmentation	**1**	31.10.2026		TLM2	
No. of classes required to complete UNIT-II:		**11**		**No. of Classes taken**		

PART-B (Lab)

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

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, Course outcomes	3	02.07.2026		TLM4	
2.	Linear convolution	3	09.07.2026		TLM4	
3.	Circular convolution	3	16.07.2026		TLM4	
4.	Computation of DFT and IDFT	3	23.07.2026		TLM4	
5.	Design and Implementation of IIR filters	3	30.07.2026		TLM4	
6.	Design and Implementation of FIR filters	3	06.08.2026		TLM4	
7.	Perform spatial transformations on images	3	13.08.2026		TLM4	
8.	Generation of Histogram Equalization. Image de-noising using spatial filtering	3	20.08.2026		TLM4	
9.	Image segmentation using Prewitt, Sobel and Laplacian of Gaussian operators	3	03.09.2026		TLM4	
10.	Linear convolution (Using Code Composer Studio)	3	10.09.2026		TLM4	
11.	Circular convolution Using Code Composer Studio)	3	17.09.2026		TLM4	
12.	Computation of DFT and IDFT (Using Code Composer Studio)	3	24.09.2026		TLM4	
13.	Case study/Mini project Content beyond syllabus	3	01.10.2026		TLM 6	
14.	Case study/Mini project Content beyond syllabus	3	08.10.2026		TLM 6	
15.	Case study/Mini project Content beyond syllabus	3	15.10.2026		TLM 6	
16.	Internal Exam	3	29.10.2026		TLM 4	
No. of classes required to complete Laboratory:48				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):

Day to Day work	**10**
Record	**5**
Internal Exam	**15**
Total CIE(A)	**30**
Total SEE(B)	**70**
Total(A+B)	**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 team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

PSO2 Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools

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

Date: 29-06-2026

Course Instructor	Course Coordinator	Module Coordinator	HOD
T.Anil Raju	Dr.G.L.N.Murthy	Dr.G.L.N.Murthy	Dr. G. Srinivasulu

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs V SOWJANYA
Course Name & Code : Fundamentals of Deep Learning (23AMM3)
L-T-P Structure : 3-1-0 **Credits:** 3
Program/Sem/Sec :IV B.Tech /I Sem/ Minor **A.Y.:** 2026-27

PREREQUISITE: Probability and Statistics, LATT, Machine Learning.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to make students learn the frameworks of deep learning and their application

COURSE OUTCOMES (CO's): After successful completion of the course the students are able to

CO1	Apply the fundamentals of linear algebra to machine learning algorithms. **(Apply- L3)**
CO2	Understand the fundamental building blocks of deep learning **(Understand- L2)**
CO3	Apply the concepts of Convolutional Neural Networks to computer vision applications. **(Apply- L3)**
CO4	Apply the concepts of Recurrent Neural Networks to Natural Language Processing. **(Apply- L3)**
CO5	Apply the regularization techniques to improve the model performance. **(Apply- L3)**

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

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

TEXTBOOKS:

T1 Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016

T2 Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.

T2 Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn,Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821

T4 Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

REFERENCE BOOKS:

R1 Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009

R2 Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.

R3 Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

e-Resources:

1. Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs22

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Mathematical foundations of Deep 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
1.	Introduction to Syllabus, CEOs, COs, CO-PO mapping	1	3.7.2026		TLM 1&2	
2.	Mathematical foundations of Deep Learning	1	3.7.2026		TLM 1&2	
3.	Multiplying Matrices and Vectors	1	4.7.2026		TLM 1&2	
4.	Identity and Inverse Matrices	1	4.7.2026		TLM 1&2	
5.	Linear dependence and Span	1	10.7.2026		TLM 1&2	
6.	Norms	1	10.7.2026		TLM 1&2	
7.	Special kinds of matrices and vectors	1	11.7.2026		TLM 1&2	
8.	Trace operations	1	11.7.2026		TLM 1&2	
9.	Eigen Decomposition	1	17.7.2026		TLM 1&2	
10.	**UNIT CASE STUDY:** Reconstructing image matrices via top-k Eigenvalues	1	17.7.2026		TLM 1&2	
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: Fundamentals of Deep 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
11.	Anatomy of Neural Networks: Artificial Neuron vs Biological Neuron	1	18.7.2026		TLM 1&2	
12.	Network Layers: Input, Hidden, Output configurations	1	18.7.2026		TLM 1&2	
13.	Deep Models & Feedforward Propagation mathematics	1	24.7.2026		TLM 1&2	
14.	Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU.	1	24.7.2026		TLM 1&2	
15.	Loss Functions: MSE, Cross-Entropy, Hinge Loss	1	25.7.2026		TLM 1&2	
16.	**Training Deep Networks: Empirical Risk Minimization**	1	25.7.2026		TLM 1&2	
17.	Backpropagation & Gradient Descent computation loops.	1	31.7.2026		TLM 1&2	
18.	Optimizers: Stochastic Gradient Descent (SGD), Momentum, Adam.	1	31.7.2026		TLM 1&2	

19.	Types of Deep Neural Networks: Brief architectural taxonomy.	1	1.8.2026		TLM 1&2	
20.	**UNIT CASE STUDY:** Building a multi-layer perceptron using custom Adam settings	1	1.8.2026		TLM 1&2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Convolutional Neural Networks

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.	Motivation for CNNs: Locality, Stationarity, Parameter Sharing	1	7.8.2026		TLM 1&2	
22.	Convolution Operation: Kernels, Stride, Padding math	1	7.8.2026		TLM 1&2	
23.	Types of Convolutional Layers (Standard, Dilated)	1	8.8.2026		TLM 1&2	
24.	Pooling Operations: Max Pooling, Average Pooling boundaries	1	8.8.2026		TLM 1&2	
25.	Fully Connected (FC) Layer integration requirements	2	14.8.2026		TLM 1&2	
26.	**Classical Architectures: Introduction to LENET5 structural map**	1	21.8.2026		TLM 1&2	
27.	LENET5 Parameter calculations (Weights, Biases per layer)	1	21.8.2026		TLM 1&2	
28.	**UNIT CASE STUDY:** Training a modified LENET5 to classify medical imaging patches	2	22.8.2026		TLM 1&2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Recurrent Neural Networks

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29.	Architecture of traditional RNN	2	5.9.2026		TLM 1&2	
30.	Types and applications of RNN	2	11.9.2026		TLM 1&2	
31.	Variants of RNNs	2	12.9.2026		TLM 1&2	
32.	Word Embeddingusing Word2vec	4	18.9.2026 19.9.2026		TLM 1&2	
No. of classes required to complete UNIT-IV: 16				**No. of classes taken:**		

UNIT-V: Regularization and Autoencoders

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Introduction to Regularization for Deep Learning	1	25.9.2026		TLM 1&2	
34.	L1 and L2 Regularizations.	1	25.9.2026		TLM 1&2	
35.	Dropout implementation mechanics during training vs inference	1	26.9.2026		TLM 1&2	
36.	Data Augmentation strategies for image and text sets	1	26.9.2026		TLM 1&2	
37.	Early Stopping criteria and validation monitoring systems	1	3.10.2026		TLM 1&2	
38.	**UNIT CASE STUDY PART A:** Improving baseline CNN test accuracy on MNIST	1	3.10.2026		TLM 1&2	
39.	Autoencoders Architecture: Bottleneck, Encoder, Decoder pathways	1	9.10.2026		TLM 1&2	
40.	Implementation details of Vanilla Autoencoders	1	9.10.2026		TLM 1&2	
41.	Denoising Autoencoders: Reconstruction objective functions	1	10.10.2026		TLM 1&2	
42.	Sparse Autoencoders: L1 Activity constraints and KL-Divergence	1	10.10.2026		TLM 1&2	
43.	Industry Use cases: Anomaly detection, data synthesis	2	16.10.2026		TLM 1&2	
No. of classes required to complete UNIT-V: 12				**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
44.	Denoising heavily corrupted MNIST pixels using autoencoders	2	30.10.2026		TLM 1&2	

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

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME 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	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	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.
PO10	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.
PO11	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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs V Sowjanya**	**Mrs V Sowjanya**	**Dr. O. Rama Devi**	**Dr. P. Bhagath**
Signature				

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

COURSE HANDOUT

PART-A:

Program/Sem/Sec : B.Tech., ECE., VII-Sem., Section – A,C

Course Instructor : Mr.J DURGHA PRASAD Asst. Professor,

Course Name & Code : LOW POWER VLSI DESIGN – 23EC27

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

Academic Year **:** 2026-27

Pre requisite: Digital Electronic Circuits and VLSI Design

Course Educational Objective: This course provides knowledge on fundamentals of low power VLSI design concepts, circuits and subsystems.

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

CO 1	Summarize the Fundamental concepts of Low Power VLSI Design. (Understand – L2)
CO 2	Apply Low Power Design Approaches for IC designs. (Apply – L3)
CO 3	Analyze low voltage low power memories using mathematical models. (Analyze – L4)
CO 4	Design low voltage low power adders and multipliers. (Apply – L3)

CO's	Co-Po Attainment Table														
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2										2		3	
CO2	3	3	3		2		2					2		3	
CO3	3	3		2	3							2		3	2
CO4	3	3	3	2	3		2		1	1	1	2		3	2

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Fundamentals of Low Power CMOS VLSI Design [11 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 to COs	1	29.06.2026			
2.	Introduction	1	30.06.2026			
3.	Sources of Power Dissipation	1	01.07.2026			
4.	Static Power Dissipation	1	02.07.2026			
5.	Short Circuit Power Dissipation	1	03.07.2026			
6.	Leakage Power Dissipation, Glitch Power Dissipation	1	04.07.2026			
7.	Short Channel Effects –Drain Induced Barrier Lowering, Body Effect	1	06.07.2026			
8.	**Flipped Class on Low Power Techniques in VLSI**	1	07.07.2026			
9.	Gate-induced Drain Leakage	1	08.07.2026			
10.	Active power dissipation.	1	09.07.2026			
11.	**Tutorial/Assignment**	1	10.07.2026			

UNIT- II: Circuit techniques for Low-Power Reduction [11 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
12.	Concepts of leakage power	1	11.07.2026			
13.	Circuit techniques for Leakage power reduction	2	13.07.2026 14.07.2026			
14.	Power Gating, Body Biasing Techniques	1	15.07.2026			
15.	Standby leakage control	1	16.07.2026			
16.	Multi-Vth technique	1	17.07.2026			
17.	Supply voltage scaling	1	18.07.2026			
18.	VTMOS circuits, DTMOS circuits	1	22.07.2026			
19.	**Collaborative Learning on MOS circuits**	1	23.07.2026			
20.	Dynamic-Vth technique	1	24.07.2026			
21.	**Tutorial /Assignment**	1	27.07.2026			

UNIT – III: Low-Voltage Low-Power Adders [12 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
22.	Introduction,	1	27.07.2026			
23.	Standard Adder Cells	1	28.07.2026			
24.	CMOS Adder's Architectures	1	29.07.2026 30.07.2026			
25.	Carry Look-Ahead Adder	1	01.08.2026			
26.	Ripple Carry Adders	1	03.08.2026			
27.	Carry Select Adders- **Experimental Learning**	1	04.08.2026			
28.	Mid-1 Review	1	05.08.2026			
29.	Carry Save Adders	1	06.08.2026			
30.	Performance evaluation of various adder architectures	1	07.08.2026			

31.	Performance evaluation of various adder architectures	1	08.08.2026			
32.	**Tutorial/Assignment**	1	10.08.2026			

UNIT – IV: Low-Voltage Low-Power Multipliers [12 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**
33.	Review of Multiplication	1	11.08.2026			
34.	Multiplier Architectures	1	12.08.2026			
35.	Multiplier Architectures	1	14.08.2026			
36.	Braun Multiplier	1	17.08.2026			
37.	Braun Multiplier	1	18.08.2026			
38.	Baugh-Wooley Multiplier	1	19.08.2026			
39.	**Peer Teaching on Multipliers**	1	20.08.2026			
40.	Booth Multiplier	1	22.08.2026			
41.	Booth Multiplier	1	31.08.2026			
42.	Introduction to Wallace Tree Multiplier.	1	01.09.2026			
43.	Wallace Tree Multiplier.	1	02.09.2026			
44.	**Tutorial/Assignment**	1	03.09.2026			

UNIT – V: Low-Voltage Low-Power Memories [14 Hrs]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
45.	Basics of ROM	1	05.09.2026			
46.	Low-Power ROM Technology	1	07.09.2026			
47.	Future Trend and Development of ROMs	1	08.09.2026			
48.	Future Trend and Development of ROMs	1	09.09.2026			
49.	Basics of SRAM, Memory cell	1	10.09.2026			
50.	**Quiz**	1	11.09.2026			
51.	Precharge and Equalization Circuit	1	15.09.2026			
52.	Precharge and Equalization Circuit	1	16.09.2026			
53.	Low-Power SRAM Technologies	1	17.09.2026			
54.	Basics of DRAM	2	18.09.2026 19.09.2026			
55.	Self-Refresh Circuit	1	21.09.2026			
56.	Future Trend and Development of DRAM.	1	22.09.2026			
57.	**Tutorial/Assignment**	1	23.09.2026			

BEYOND THE SYLLABUS & REVISION [3 HRS]						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
58.	Advanced Power Reduction Techniques	1	12-10-2026			
59.	Sub-threshold and Near-threshold Logic	1	13-10-2026			
60.	Low Power Design Metrics	1	14-10-2026			

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

PART – C

EVALUATION 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): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work	29-06-2025		
I Phase of Instructions	29-06-2026	22-08-2026	8W
Technical Training	29-06-2026	22-08-2026	8W
I Mid Examinations	24-08-2026	29-08-2026	1W
II Phase of Instructions	26-10-2026	31-10-2026	9W
II Mid Examinations	02-11-2026	07-11-2026	1W
Preparation and Practical's	09-11-2026	14-11-2026	1W
Semester End Examinations	16-11-2026	28-11-2026	2W

PART – D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mr.J DURGA	[Mrs.M.Ramya Harika]	[Dr.P.Lachi Reddy]	[Dr.G.Srinivasulu]

PRASAD]

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : B.Tech. - VII-Sem. - ECE – C Section
ACADEMIC YEAR : 2026-27
COURSE NAME & CODE : Management Science – 23HS04
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 2
COURSE INSTRUCTOR : V.Sankara Rao, Sr.Assistant Professor
COURSE COORDINATOR : A.Nageswara Rao, Sr.Assistant Professor
PER-REQUISITE : NIL

COURSE EDUCATIONAL OBJECTIVES:

The main objectives of the course are to

- To make students understand how to manage a business organization effectively.
- To explore the different locations-layouts of plant, work study procedures to ensure optimization of resources.
- To explain quality control mechanism for better process of manufacturing.
- To study role of materials manager for smooth function of different operations.
- To present various networking methods/techniques for a business plan/project execution with optimum resources.
- To create awareness on different stages of HRM.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Understand different theories/principles which helps them to manage business activities by facing present challenges. (Understand-L2)

CO2: Capable of choosing good location, layout and easiest and best method of work for optimization of resources to get maximum output in business. (Understand-L2)

CO3: Apply quality control techniques to test the qualities of manufacturing and ensure good output to customer. (Apply-L3)

CO4: Acquire knowledge on how effectively stores/material can be planned, organized and controlled in the company at economical budget. (Understand-L2)

CO5: Explain the concepts of HR planning, development and controlling to meet organizational goals. (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	3	3	3	2	3				3			3		3	
CO2	3	3	1	2	1				3			3		3	
CO3	3	3	3	2	1				3			3		3	
CO4	3	2	3	2	3				1			3		3	
CO5	2	3	3	2	1				1			3		3	

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

TEXT BOOK:

1. O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi.

REFERENCE BOOKS:

1. Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.
2. Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.
3. Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: CONCEPTS OF MANAGEMENT AND ORGANISATION

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, Functions of Management	1	29.06.2026		TLM1	CO1	T1	
2.	Evolution of management thought	1	30.06.2026		TLM1	CO1	T1	
3.	Taylor's scientific management	1	03.07.2026		TLM1	CO1	T1	
4.	Fayal's principles of management	1	06.07.2026		TLM1	CO1	T1	
5.	Herzberg, Maslow hierarchy of human needs	1	07.07.2026		TLM3	CO1	T1	
6.	Theory x and y, Hawthorne experiment, morale, motivation,	1	10.07.2026		TLM1	CO1	T1	
7.	working environmental conditions, systems approach to management.	1	13.07.2026		TLM1	CO1	T1	
8.	DESIGNING ORGANISATIONAL STRUCTURES: Basic concepts related to organisation	1	14.07.2026		TLM1	CO1	T1	
9.	Departmentation and decentralization, types of organization structures.	1	17.07.2026		TLM1	CO1	T1, R1	
No. of classes required to complete UNIT-I		**9**			No. of classes taken:			

UNIT-II: PLANT LOCATION & WORK STUDY

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
10.	Definition, factors affecting the plant location	1	20.07.2026		TLM1	CO2	T1, R3	
11.	Comparison of rural and urban sites, methods for selection of plant	1	21.07.2026		TLM1	CO2	T1, R3	
12.	Matrix approach. Plant layout - definition, objectives	1	24.07.2026		TLM1	CO2	T1, R3	

13.	Types of plant layout, various data analyzing forms travel chart.	1	27.07.2026		TLM1	CO2	T1, R3	
14.	WORK STUDY: Definition, objectives	1	28.07.2026		TLM1	CO2	T1, R3	
15.	Method study definition, objectives, steps involved various types of associated charts	1	31.07.2026		TLM3	CO2	T1, R3	
16.	Difference between micro motion and memo motion studies.	1	03.08.2026		TLM1	CO2	T1	
17.	Work measurement-definition, time study, steps involved, equipment	1	04.08.2026		TLM1	CO2	T1	
18.	Different methods of performance rating, allowances, standard time calculation.	1	07.08.2026		TLM1	CO2	T1	
19.	Work Sampling - definition, steps involved, standard time calculations, and differences with time study.	1	10.08.2026					
No. of classes required to complete UNIT-II		**10**			No. of classes taken:			

UNIT-III: INTRODUCTION TO PERT / CPM

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
20.	Project management, network modelling-probabilistic model	1	11.08.2026		TLM1	CO3	T1	
21.	various types of activity times estimation, programme evaluation review techniques	1	14.08.2026		TLM1	CO3	T1, R1	
22.	critical path, probability of completing the project, deterministic model	1	17.08.2026		TLM1	CO3	T1, R1	
23.	critical path method (CPM), critical path calculation, crashing of simple of networks	1	18.08.2026		TLM1	CO3	T1	
24.	**INSPECTION AND QUALITY CONTROL:** Types of inspections	1	21.08.2026		TLM3	CO3	T1, R1	
25.	statistical quality control, techniques,	1	31.08.2026		TLM1	CO3	T1, R1	

	variables and attributes							
26.	assignable and non-assignable causes, variable control charts	1	01.09.2026		TLM1	CO3	T1	
27.	R charts, attributes control charts, p charts and c charts. Acceptance sampling plan	1	04.09.2026		TLM1	CO3	T1, R1	
28.	single sampling and double sampling plans, OC curves. Introduction to TQM - quality circles, ISO 9000 series procedures.	1	07.09.2026		TLM1	CO3	T1	
No. of classes required to complete UNIT-III		**9**			No. of classes taken:			

UNIT-IV: MATERIALS MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	Objectives, inventory functions	1	08.09.2026		**TLM1**	CO4	**T1**	
30.	Types, associated costs,	1	11.09.2023		**TLM1**	CO4	**T1**	
31.	Inventory classification techniques-ABC and VED analysis.	1	14.09.2026		**TLM1**	CO4	**T1, R2**	
32.	Inventory control systems	1	15.09.2026		**TLM3**	CO4	**T1, R2**	
33.	continuous review system, periodical review system	1	18.09.2026		**TLM1**	CO4	**T1, R2**	
34.	Stores management and stores records.	1	21.09.2026		**TLM1**	CO4	**T1, R1**	
35.	Purchase management	1	22.09.2026		**TLM1**	CO4	**T1, R1**	
36.	Duties of purchase of manager	1	25.09.2026		**TLM1**	CO4	**T1**	
37.	Associated forms	1	28.09.2026		**TLM3**	CO4	**T1, R1**	
No. of classes required to complete UNIT-IV		9			No. of classes taken:			

UNIT-V: INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
38.	Functions of HRM	1	29.09.2026		TLM1	CO5	T1,R2	
39.	job evaluation, different types of	1	05.10.2026		TLM1	CO5	T1, R2	

	evaluation methods							
40.	Job description	1	06.10.2026		TLM1	CO5	T1,R2	
41.	merit rating	1	09.10.2026		TLM1	CO5	T1,R2	
42.	different methods of merit ratings	1	12.10.2026		TLM1	CO5	T1,R2	
43.	wage incentives, different types of wage incentive schemes	1	13.10.2026		TLM1	CO5	T1, R2	
44.	Marketing	1	16.10.2026		TLM1	CO5	T1,R2	
45.	selling	1	26.10.2026		TLM1	CO5	T1,R2	
46.	marketing mix, product life cycle.	1	27.10.2026		TLM1	CO5	T1,R2	
47.	Revision	1	30.10.2026		TLM1	CO5	T1,R2	
No. of classes required to complete UNIT-V		**10**			No. of classes taken:			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	29-06-2026	22-08-2026	8W
I Mid Examinations	24-08-2026	29-08-2026	1W
II Phase of Instructions	31-08-2026	31-10-2026	7W
II Mid Examinations	02-11-2026	07-11-2026	1W
Preparation and Practicals	09-11-2026	14-11-2026	1W
Semester End Examinations	16-11-2026	28-11-2026	2W

Part – C

EVALUATION PROCESS:

Evaluation Task	**Marks**
Assignment Cycle-I	A1=5
I-Mid Examination (Units I & II)	A2=5
I-Quiz Examination (Units-I,II)	B1=15
Assignment Cycle-II	Q1=10
II-Mid Examination (Units III, IV &V)	A3=5
II-Quiz Examination (Units-III, IV, V)	A4=5
Mid Marks =80% of Max (M1, M2) +20% of Min (M1, M2)	A5=5
Quiz Marks =80% of Max (Q1, Q2) +20% of Min(Q1, Q2)	B2=15
Cumulative Internal Examination (CIE): A+B+M	Q2=10
Semester End Examinations	**SEE=70**
Total Marks: CIE+SEE	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.

PEO2: To Function professionally in the rapidly changing world with advances in technology.

PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.

PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

PO1 - Engineering Knowledge: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2 - Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3 - Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4 - Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5 - Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6 - The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7 - Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8 - Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9 - Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10 - Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11 - Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs):

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

PSO2: Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools.

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

Mr.V.Sankararao	Mr. A.Nageswara Rao	Mr.J.Subba Reddy	Dr.M.B.S.Sreekara Reddy
Course Instructor	Course Coordinator	Module Coordinator	HoD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **G.Sravani**
Course Name & Code : Operating Systems -23CS06
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : IV B.tech/VII-sem **A.Y.:** 2026-27

PREREQUISITE: Knowledge of Computer fundamentals & Data structures & algorithms

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of the course is to make student:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

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

CO1	Demonstrate the underlying principles and techniques of operating system **(Understand-L2)**
CO2	Interpret scheduling and communication methods of processes handled by operating Systems (Understand-L2)
CO3	Distinguish the process synchronization methods and deadlock handling approaches employed in Operating Systems (Understand-L2)
CO4	Classify memory management techniques and virtual memory mechanisms **(Understand-L2)**.
CO5	Interpret the strategies of disk scheduling algorithms and file system architecture **(Understand-L2)**.

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

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

TEXT BOOKS:

. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007

Reference Books:

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, "Unix and shell Programming", Thomson, New Delhi, 1st Edition, 2003.
3. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Operating Systems Structure

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Operating System services	2	03-07-2026		TLM2	
2.	User Operating system Interface	2	04-07-2026		TLM2	
3.	System calls	2	10-07-2026		TLM2	
4.	System programs	1	11-07-2026		TLM2	
5.	Operating System design and Implementation	2	11-07-2025		TLM2	
6.	Operatin System Structure	1	17-07-2026		TLM2	
7.	Virtual Machines	1	17-07-2026		TLM2	
8.	operating system Generation	1	18-07-2026		TLM2	
9.	Booting an Operating System	1	18-07-2026		TLM2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Processes and Process Scheduling

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Processes: Process Concept,	1	24-07-2026		TLM2	
11.	Inter-process communication system	2	24-07-2026		TLM2	
12.	Process Scheduling:Scheduling Crieteria	1	25-07-2026		TLM2	
13.	Scheduling Algorithms:FCFS	1	25-12-2025		TLM2	
14.	SJF	1	31-07-2026		TLM2	
15.	Priority Scheduling	1	31-07-2026		TLM2	
16.	Round Robin Scheduling	1	01-08-2026		TLM2	

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

UNIT-III: Process Synchronization

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Synchronization Tools: The Critical section problem, Peterson's solutions	1	01-08-2026		TLM1	
18.	Peterson's solution	1	07-08-2026		TLM1	
19.	Synchronization Hardware	2	07-08-2026		TLM1	
20.	Semaphores	2	08-08-2026		TLM1	
21.	Monitors	2	14-08-2026		TLM1	
No. of classes required to complete:8 UNIT-111				NO. Of classes taken:		

UNIT-IV: DeadLocks and Memory management Strategies

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
22.	System Model	1	21-08-2026		TLM1	
23.	Deadlock characterization	1	21-08-2026		TLM1	
24.	Methods for handling Deadlocks	1	22-08-2026		TLM1	
25.	Deadlock Prevention,Avoidance,Detection	1	22-08-2026		TLM1	
26.	Recovery from Deadlock	1	05-09-2026		TLM1	
27.	Swapping	1	05-09-2026		TLM1	
28.	Contiguous memory Allocation	1	11-09-2026		TLM1	
29.	Paging	2	12-09-2026		TLM1	
30.	Structure of the Page Table	1	18-09-2026		TLM1	
31.	Segmentation	1	18-09-2026		TLM1	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Virtual Memory Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Demand Paging	1	25-09-2026		TLM2	
33.	Page Replacement	2	26-09-2026		TLM2	
34.	Allocation of Frames	1	03-10-2026		TLM2	
35.	Thrashing	1	09-10-2026		TLM2	
36.	Revision Unit_V	2	10-10-2026 & 16-10-2026		TLM2	
37.	Revision Unit_I & II	2	17-10-2026		TLM2	
38.	Revision Unit_III&IV	2	30-10-2026 & 31-10-2026		TLM1	
No. of classes required to complete UNIT-V: 10				**No. of classes taken:**		

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

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 (Units-III, IV & V)	A2=5
II- Descriptive Examination (UNITS-III, IV & V)	M2=15
II-Quiz Examination (UNITS-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 modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs.G.Sravani**	**Mrs.G.Sravani**	**Dr. D. Venkata Subbaiah**	**Dr. S. Nagarjuna Reddy**
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. P Rajasekhar
Course Name & Code : Principles of Database Management Systems & 23CS83
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B. Tech/VII/ECE-C **A.Y.:** 2026-27
PREREQUISITES : **Data Structures**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing and Indexing.

COURSE OUTCOMES (COs): After successful completion of the course the students are able to

CO1	State the basic components of Database Management System and data modelling using ER diagrams. L2 – Understand
CO2	Examine the relational model using Structured Query Language (SQL). L3 – Apply
CO3	Employ principles of normalization for effective database design. L3 – Apply
CO4	Demonstrate transaction processing, concurrency control mechanisms and recovery strategies in DBMS. L2 – Understand
CO5	Describe file organization, indexing techniques and selecting NoSQL databases. L2 – Understand

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	2	3
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2	3
1 - Low **2 –**Medium **3 -** High															

TEXTBOOKS:

T1	Henry F. Korth, Abraham Silberschatz, S. Sudarshan – Database System Concepts, McGraw Hill, 6th Edition, 2009.
T2	Shashank Tiwari – Professional NoSQL, John Wiley & Sons, 2011.

REFERENCE BOOKS:

R1	Raghu Ramakrishnan, Johannes Gehrke – Database Management Systems, McGraw Hill, 3rd Edition, 2000.
R2	C.J. Date – An Introduction to Database System, Pearson Education, 8th Edition, 2003.
R3	Ramez Elmasri, Shamkant B. Navathe – Fundamentals of Database Systems, Addison Wesley, 6th Edition, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DBMS & ER Model

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	30-6-26		TLM1,2	
2.	Database System Applications	1	3-7-26		TLM1,2	
3.	Characteristics of Database Approach	1	4-7-26		TLM1,2	
4.	Advantages of DBMS over File System	1	7-7-26		TLM1,2	
5.	Database Users and Administrators	1	10-7-26		TLM1,2	
6.	Three Schema Architecture	1	11-7-26		TLM1,2	
7.	Data Models	1	14-7-26		TLM1,2	
8.	Database Languages (DDL, DML, DCL, TCL)	1	17-7-26		TLM1,2	
9.	Entity Relationship (ER) Model	1	18-7-26		TLM1,2	
10.	ER Diagram Notations	1	21-7-26		TLM1,2	
11.	Mapping Constraints	1	24-7-26		TLM1,2	
12.	Keys in DBMS	1	25-7-26		TLM1,2	
13.	Generalization and Aggregation	1	28-7-26		TLM1,2	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Relational Model & SQL

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.	Relational Data Model Concepts	1	31-7-26		TLM1,2	
2.	Relational Integrity Constraints	1	1-8-26		TLM1,2	
3.	Relational Algebra Basics	1	4-8-26		TLM1,2	
4.	SQL Fundamentals	1	7-8-26		TLM1,2	
5.	Data Types and Literals	1	8-8-26		TLM1,2	
6.	Table Creation and Constraints	1	11-8-26		TLM1,2	
7.	Insert, Update and Delete Commands	1	14-8-26		TLM1,2	
8.	Queries using SELECT Statement	1	18-8-26		TLM1,2	
9.	Aggregate Functions, Joins and Nested Queries	1	21-8-26		TLM1,2	
10.	Views and Indexes	1	22-8-26		TLM1,2	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Database Design & Normalization

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.	Database Design Guidelines	1	1-9-26		TLM1,2	
2.	Functional Dependencies	1	5-9-26		TLM1,2	
3.	Armstrong's Axioms	1	8-9-26		TLM1,2	
4.	Normalization Concepts	1	11-9-26		TLM1,2	
5.	First Normal Form (1NF), Second Normal Form (2NF)	1	12-9-26		TLM1,2	
6.	Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF)	1	15-9-26		TLM1,2	
7.	Fourth Normal Form (4NF), Fifth Normal Form (5NF)	1	18-9-26		TLM1,2	
8.	Lossless Join Decomposition, Join Dependencies	1	19-9-26		TLM1,2	
No. of classes required to complete UNIT-III: 8				**No. of classes taken:**		

UNIT-IV: Transaction Processing & Concurrency Control

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.	Transaction Concepts	1	22-9-26		TLM1,2	
2.	ACID Properties, Transaction States	1	25-9-26		TLM1,2	
3.	Serializability, Recoverability	1	26-9-26		TLM1,2	
4.	Concurrency Control Techniques	1	29-9-26		TLM1,2	
5.	Lock Based Protocols, Time Stamping Protocols	1	3-10-26		TLM1,2	
6.	Deadlock Handling	1	6-10-26		TLM1,2	
7.	Deadlock Prevention and Recovery	1	9-10-26		TLM1,2	
No. of classes required to complete UNIT-IV: 7				**No. of classes taken:**		

UNIT-V: Recovery, Indexing & NoSQL Databases

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.	Crash Recovery Techniques	1	10-10-26		TLM1,2	
2.	Log Based Recovery, Checkpoints	1	13-10-26		TLM1,2	
3.	Storage and File Structure, File Organization Methods	1	16-10-26		TLM1,2	

4.	Indexed Files, Hashed Files, B+ Trees	1	17-10-26		TLM1,2	
5.	Physical Database Design	1	27-10-26		TLM1,2	
6.	Introduction to NoSQL Databases	1	30-10-26		TLM1,2	
7.	Types of NoSQL Databases and Applications	1	31-10-26		TLM1,2	
No. of classes required to complete UNIT-II: 7				**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 (R20 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):

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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of 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 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.
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):

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.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Mr. P Rajasekhar**	**Ms. P. Sarala**	**Dr. Y. V Bhaskar Reddy**	**Dr. S. Nagarjuna Reddy**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor:B.Lakshmi Thirupathamma , Assistant Professor

Course Name & Code	**: VLSI Signal Processing** & **23ECH2**	**Regulation**: R23
L-T-P Structure	**: 3-0-0**	**Credits:** 03
Program/Sem/Sec	: B.Tech, ECE VII Sem (C)	**A.Y.:** 2026-27

PREREQUISITE: Nil

COURSE OBJECTIVES (COs): The main objectives of the course are to

1.To understand the fundamentals of VLSI architecture for digital signal processing systems.

2.To study pipelining, parallel processing and retiming techniques for improving the performance of DSP architectures.

3.To learn unfolding, folding and systolic architecture design for efficient hardware implementation

4.To analyze area, power and throughput trade-offs in VLSI DSP systems.

5.To design and optimize VLSI architectures for DSP applications using modern design techniques.

COURSE OUTCOMES (COs): Upon successful completion of this course, the student should be able to

CO1	Understand Pipelining, parallel processing and digital filters.
CO2	Optimize VLSI architectures for basic DSP algorithms
CO3	Analyze various parallel processing algorithms
CO4	Acquire knowledge on how effectively stores/material can be planned, organized and controlled in the company at economical budget.(L2)
CO5	Implement basic architectures for DSP using CAD tools

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

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

T1 VLSI Digital Signal Processing- System Design and Implementation – Keshab K. Parhi, 1998, Wiley Inter Science.

REFERENCE BOOKS:

R1 Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall

R2 VLSI Digital Signal Processing – Medisetti V. K, 1995, IEEE Press (NY), USA.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DSP

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Course Outcomes,Introduction to subject, Typical DSP algorithms,benefits	2	03-07-2026		**TLM1/TLM2**	
2.	Representation of DSP algorithms	2	04-07-2026		**TLM1/TLM2**	
3.	Pipelining of FIR Digital filters	2	10-07-2026		**TLM1/TLM2**	
4.	Parallel Processing, Pipelining and Parallel Processing for Low Power	2	11-07-2026		**TLM1/TLM2**	
5.	**Retiming:** Introduction, Definitions and Properties, Solving System of Inequalities	2	17-07-2026		**TLM1/TLM2**	
6.	Retiming Techniques	2	18-07-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Folding& Unfolding

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
7	**Folding** :Introduction -Folding Transform	2	24-07-2026		**TLM1/TLM2**	
8	Register minimizationTechniques-Register minimization in folded architectures	2	25-07-2026		**TLM1/TLM2**	
9	folding in multi rate systems **Unfolding:** Introduction	2	31-07-2026		**TLM1/TLM2**	
10	An Algorithm for Unfolding – Properties of Unfolding	2	01-08-2026			
11	critical Path	2	07-08-2026		**TLM1/TLM2**	
12	Unfolding, Retiming – Applications of Unfolding	2	08-08-2026			
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: Systolic Architecture Design

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

13	Introduction – Systolic Array Design Methodology	2	14-08-2026		**TLM1/TLM2**	
14	FIR Systolic Arrays – Selection of Scheduling Vector	2	21-08-2026		**TLM1/TLM2**	
15	Matrix Multiplication	2	22-08-2026		**TLM1/TLM2**	
16	2D Systolic Array	2	05-09-2026			
17	Design Systolic Design for Space Representations contain Delays	2	11-09-2026		**TLM1/TLM2**	
No of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Fast Convolution

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18	Introduction – Cook-Toom Algorithm	2	12-09-2026		**TLM1/TLM2**	
19	Winogard algorithm	2	18-09-2026		**TLM1/TLM2**	
20	Iterated Convolution	2	19-09-2026		**TLM1/TLM2**	
21	Cyclic Convolution	2	25-09-2026		**TLM1/TLM2**	
22	Design of Fast Convolution algorithm by Inspection	2	26-09-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Low Power Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	Scaling Vs Power Consumption –Power Analysis	2	03-10-2026		**TLM1/TLM2**	
	Power Reduction techniques	2	09-10-2026		**TLM1/TLM2**	
	Power Estimation Approaches Programmable DSP	2	10-10-2026		**TLM1/TLM2**	
	Evaluation of Programmable Digital Signal Processors	2	16-10-2026		**TLM1/TLM2**	
	DSP Processors for Mobile and Wireless Communications	2	17-10-2026		**TLM1/TLM2**	
	Processors for Multimedia Signal Processing	2	30-10-2026		**TLM1/TLM2**	
No. of classes required to complete UNIT-V: 12				**No. of classes taken:**		

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

Academic Calendar

Description	From	To	Weeks

I Phase of Instructions	29-06-2026	22-08-2026	8
I MID Examinations	24-08-2026	29-08-2026	1
II Phase of Instructions	31-08-2026	17-10-2026	7
II Phase of Instructions contd..	26-10-2026	31-10-2026	1
II MID Examinations	02-11-2026	07-11-2026	1
Preparation and Practicals	09-11-2026	14-11-2026	1
Semester End Examinations	16-11-2026	28-11-2026	2

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Apply the principles of analog and digital VLSI design to analyze, design, simulate, and implement integrated circuits using modern Electronic Design Automation (EDA) tools
PSO 2	Design and develop semiconductor-based systems by integrating VLSI concepts with embedded systems, FPGA, ASIC, and System-on-Chip (SoC) technologies to meet industrial requirements
PSO 3	Demonstrate proficiency in VLSI verification, testing, timing analysis, and physical design to develop reliable, efficient, and manufacturable integrated circuits

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Ms.B.Lakshmi Thirupathamma	Mrs.Y.Padma	Dr.P.Lachi Reddy	Dr.G.Srinivasulu
Signature				