LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with 'A' Grade
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
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING (AI&ML)

COURSEHANDOUT

PART-A

NameofCourseInstructor :**Dr Shaik Salma Asiya Begum**
CourseName &Code :INFORMATION RETRIEVAL SYSTEMS & 23AM02
L-T-PStructure : 3-0-0 **Credits:**3
Program/Sem/Sec :B.Tech/ V/A **A.Y.:**2025-2026

PREREQUISITE: Data Structures, Data Mining.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The Objective of this course is to know about the fundamental concepts and components of Information Retrieval (IR), understand the design and use of inverted files and signature files in information retrieval applications .

COURSEOUTCOMES(COs): At theend ofthecourse,studentwillbeableto

CO1	Understand the fundamental concepts of Information Retrieval Systems and the associated data structures and algorithms. (**Understand-L2**)
CO2	Analyse inverted and signature file structures for efficient information retrieval. (**Understand-L2**)
CO3	Apply PAT Trees, lexical analysis techniques, and stop lists for developing new text indices. (**Apply-L3**)
CO4	Apply stemming algorithms and construct thesauri from textual data. (**Apply-L3**)
CO5	Apply and compare string searching algorithms for efficient text processing and pattern matching. (**Apply-L3**)

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs, POs&PSOs):

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

TEXTBOOKS:

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA,2007.

2.Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.

REFERENCEBOOKS:

1. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler, Trevor Strohman, Pearson, 2015.
2. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, HinrichSchütze, Cambridge University Press, 2008.
3. Information Retrieval: Algorithms and Heuristics, David A. Grossman, Ophir Frieder, Springer, 2nd Edition, 2004.

E-resources:

1.https://www.pearson.com/store/p/search-engines-information-retrieval-in-practice/P100000676406
2.https://nlp.stanford.edu/IR-book/information-retrieval-book.html
3.https://mitpress.mit.edu/9780262026512/information-retrieval/

PART-B

COURSEDELIVERYPLAN(LESSONPLAN):

UNIT-I:Introduction to Information storage and retrieval systems

S. No.	Topicsto becovered	No. ofClasses Required	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD SignWeekly
1.	CEOs and Cos discussion, **Introduction:** Domain Analysis of IR systems	1	29-06-2026		1&2	
2.	IR and other types of Information Systems	1	30-06-2026		1&2	
3.	IR System Evaluation	1	03-07-2026		1&2	
4.	Introduction to Data structures	1	04-07-2026		1&2	
5.	algorithms related to Information Retrieval	1	06-07-2026		1&2	
6.	Basic Concepts	1	07-07-2026		1&2	
7.	TUTORIAL	1	10-07-2026		1&2	
8.	Basic Concepts Continuation	1	11-07-2026		1&2	
9.	Data structures	1	13-07-2026		1&2	
10	Algorithms	1	14-07-2026		1&2	
11.	Algorithms continuation	1	17-07-2026		1&2	
12.	TUTORIAL	1	18-07-2026		1&2	
13.	Revision	1	20-07-2026		1&2	
No. of classes required to complete UNIT-I:13				**No. of classes taken:**		

UNIT-II:Inverted Files and Signature Files

S. No.	Topicsto becovered	No. ofClasses Required	Tentative Dateof Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction	1	21-07-2026		1&2	
14.	Structures used in Inverted Files	1	24-07-2026		1&2	
15.	building an Inverted file using a sorted array.	1	25-07-2026		1&2	
16.	TUTORIAL	1	27-07-2026		1&2	
17.	Modifications to the Basic Techniques	1	28-07-2026		1&2	
18.	Signature Files	1	31-07-2026		1&2	
19.	Concepts of Signature files	1	01-08-2026		1&2	
20.	Compression	1	03-08-2026		1&2	
21.	Vertical Partitioning,	1	04-08-2026		1&2	
22.	Horizontal Partitioning	1	07-08-2026		1&2	
23.	TUTORIAL	1	08-08-2026		1&2	
24.	Revision	1	10-08-2026		1&2	
I MID EXAMINATIONS(24-08-2026 to 29-08-2026)						
No. of classes required to complete UNIT-II:12				**No.of classes taken:**		

UNIT-III:New Indices for Text, Lexical Analysis and Stop lists: PAT Trees and PAT Arrays

S. No.	Topicsto becovered	No. ofClasses Required	Tentative Dateof Completio n	ActualDa teof Completi on	Teaching Learning Methods	HOD SignWe ekly
23.	Introduction	1	11-08-2026		1&2	
24.	PAT Tree structure	2	14-08-2026 17-08-2026		1&2	
25.	Algorithms on the PAT Trees	1	18-08-2026		1&2	
26.	Building PAT Trees as PATRICA Trees	2	21-08-2026 22-08-2026		1&2	
27.	PAT representation as Arrays	1	31-08-2026		1&2	
28.	TUTORIAL	1	01-09-2026		1&2	
29.	Stop lists	2	05-09-2026 07-09-2026		1&2	
30.	Revision	1	08-09-2026		1&2	
No.ofclassesrequiredtocompleteUNIT-III:11				**No.ofclassestaken:**		

UNIT-IV: Stemming Algorithms and Thesaurus Construction

S. No.	Topicsto becovered	No. ofClasses Required	TentativeDa te ofCompletio n	Actual Dateo f Completio n	Teaching Learning Methods	HOD SignWe ekly
30.	Types of Stemming algorithms	1	11-09-2026		1&2	
31.	Experimental Evaluations of Stemming	2	12-09-2026 15-09-2026		1&2	
32.	TUTORIAL	1	18-09-2026		1&2	
33.	Experimental Evaluations of Stemming continuation	2	19-09-2026 21-09-2026		1&2	
34.	stemming to Compress Inverted Files	2	22-09-2026 25-09-2026		1&2	
35.	Thesaurus Construction	1	26-09-2026		1&2	
36.	Features of Thesauri	2	28-09-2026 29-09-2026		1&2	
37.	Thesaurus Construction	1	03-10-2026		1&2	
38.	Thesaurus construction from Texts	1	05-10-2026		1&2	
39.	Merging existing Thesauri	1	06-10-2026		1&2	
40.	Merging existing Thesauri continuation	1	09-10-2026		1&2	
41.	TUTORIAL	1	10-10-2026		1&2	
No.ofclassesrequiredtocomplete UNIT-IV:16				**No.ofclassestaken:**		

UNIT-V: String Searching Algorithms

S. No.	Topics to be covered	No. of ClassesRequired	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD SignWeekly
42.	Introduction.	1	12-10-2026		1&2	
43.	Preliminaries.	1	13-10-2026		1&2	
44.	The Naive Algorithm.	1	16-10-2026		1&2	
45.	The Knutt-Morris-Pratt Algorithm.	1	17-10-2026		1&2	
46.	The Boyer-Moore Algorithm	1	26-10-2026		1&2	
47.	The Shift-Or Algorithm.	1	27-10-2026		1&2	
48.	The Shift-Or Algorithm continuation	1	28-10-2026		1&2	
49.	The Karp-Rabin Algorithm	1	29-10-2026		1&2	
50.	Revision of Algorithms	1	30-10-2026		1&2	
II MID EXAMINATIONS(02-11-2026 to 07-11-2026)						
No.of classes required to complete UNIT-V:09				**No.ofclassestaken:**		

TeachingLearningMethods			
TLM1	Chalkand Talk	**TLM4**	Demonstration(Lab/FieldVisit)
TLM2	PPT	**TLM5**	ICT(NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	GroupDiscussion/Project

PART-C

EVALUATIONPROCESS (R23Regulation):

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

PART-D

PROGRAMMEOUTCOMES(POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using firstprinciples of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural,societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member orleader 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 multidisciplinaryenvironments.
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 technologicalchange.

PROGRAMMESPECIFICOUTCOMES(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	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr. S. JAYAPRADA**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade
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.
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

PROGRAM/SEM/SEC : B.Tech./V/A

ACADEMIC YEAR : 2026-2027

COURSE NAME & CODE : Computer Networks & 23CS07

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : Mrs.Razeena Begum

COURSE COORDINATOR : Dr.B.Sivaramakrishna

PRE-REQUISITE : Fundamentals of Computers, Knowledge on Programming Languages

COURSE OBJECTIVE: The main objectives of the course is to make students

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

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

- **CO1**: Understand various network types, topologies, reference models, and transmission media (Understand-L2)
- **CO2**: Examine data link layer design issues, framing techniques, error control, and flow control mechanisms. (Analyze-L4)
- **CO3**: Apply multiple media access control techniques and evaluate Ethernet standards for network communication. (Apply-L3)
- **CO4:** Implement routing algorithms, congestion control techniques, and IP addressing schemes for efficient network communication. (Apply-L3)
- **CO5:** Utilize transport layer protocols (UDP & TCP) and application layer services (HTTP, DNS, Email) to enable secure and reliable data communication. (Apply-L3)

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

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	0	0	1	0	0	0	0	0	0	2	3	0	0
CO2	3	3	1	0	2	0	0	0	0	0	0	2	3	2	0
CO3	3	3	2	2	3	0	0	0	0	0	0	3	3	3	2
CO4	3	2	1	2	3	0	0	0	0	0	0	2	3	3	3
CO5	3	3	2	2	3	0	0	0	0	0	2	3	3	3	2
CO6	3	2	2	0	3	0	0	0	1	2	2	2	3	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.Computer Networksm, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI

2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

REFERENCE BOOKS:

1.Data Communications and Networks- Achut S Godbole, AtulKahate

2. Computer Networks, Mayank Dave, CENGAGE

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I:

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	1	29.06.2026		TLM2	CO1	T1	
2.	Network Types, LAN, MAN, WAN	1	02.07.2026		TLM2	CO1	T1	
3	Network Topologies	1	03.07.2026		TLM2	CO1	T1	
4.	Reference models- The OSI Reference Model	2	03.07.2026 & 06.07.2026		TLM2	CO1	T1	
5.	the TCP/IP Reference Model	1	09.06.2026		TLM2	CO1	T1	
6	A Comparison of the OSI and TCP/IP Reference Models	1	10.06.2026		TLM2	CO1	T1	
7	Physical Layer –Introduction to Guided Media	1	10.06.2026		TLM2	CO1	T1	
8	Twisted-pair cable	1	13.06.2026		TLM2	CO1	T1	
9	Coaxial cable and Fiber optic cable	1	16.06.2026		TLM2	CO1	T1	
10	introduction about unguided media.	2	17.06.2026		TLM2	CO1	T2	
No. of classes requiredto complete UNIT-I		12			No. of classes taken:			

UNIT-II

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
11	Data link layer: Design issues	1	20.07.2026		TLM2	CO2	T1	
12	Framing: fixed size framing	1	23.07.2026		TLM2	CO2	T1	
13	variable size framing	1	24.07.2026		TLM2	CO2	T1	
14	flow control, error control	2	24.07.2026 & 27.07.2026		TLM2	CO2	T1	
15	error detection and correction codes	2	30.07.2026 & 31.07.2026		TLM2	CO2	T1	
16	CRC	2	31.07.2026 & 03.08.2026		TLM2	CO2	T1	
17	Checksum: idea	1	06.08.2026		TLM2	CO2	T1	
18	one's complement internet checksum	1	07.08.2026		TLM2	CO2	T1	
19	services provided to Network Layer	1	07.08.2026		TLM2	CO2	T1	
20	Elementary Data Link Layer protocols: simplex protocol	2	10.08.2026 & 13.08.2026		TLM2	CO2	T1	
21	Simplex stop and wait, Simplex protocol for Noisy Channel	2	14.08.2026		TLM2	CO2	T1	
22	Sliding window protocol: One bit, Go back N	2	17.08.2026 & 20.08.2026		TLM2	CO2	T1	
23	Selective repeat-Stop and wait protocol	1	21.08.2026		TLM2	CO2	T1	
No. of classes required to complete UNIT-II		**19**			No.of classes taken:			
MID EXAMINATIONS (24-08-2026 TO 29-08-2026)								

UNIT-III:

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
24	Media Access Control: Random Access: ALOHA	2	31.08.2026 & 03.09.2026		TLM 2	CO3	T1	
25	Carrier sense multiple access (CSMA)	1	07.09.2026		TLM 2	CO3	T1	
26	CSMA with Collision Detection	1	10.09.2026		TLM 2	CO3	T1	
27	CSMA with Collision Avoidance.	1	11.09.2026		TLM 2	CO3	T1	
28	Channelization: frequency division multiple Access(FDMA)	1	11.09.2026		TLM 2	CO3	T1	
29	time division multiple access(TDMA), code division multiple access(CDMA)	2	17.09.2026 & 18.09.2026		TLM 2	CO3	T1	
30	Wired LANs: Ethernet, Ethernet Protocol	1	18.09.2026		TLM 2	CO3	T1	
31	Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.	2	21.09.2026 & 24.09.2026		TLM 2	CO3	T1	
No. of classes requiredto complete UNIT-III		**11**			No.of classes taken:			

UNIT-IV:

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
32	The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer	1	25.09.2026		TLM 2	CO4	T1	
33	Implementation of Connectionless Service-Implementation of Connection Oriented Service	2	25.09.2026 & 28.09.2026		TLM 2	CO4	T1	
34	Comparison of Virtual Circuit and Datagram Networks	1	01.10.2026		TLM 2	CO4	T1	
35	**RoutingAlgorithms** - The Optimality principle-Shortest path, Flooding, Distance vector	2	05.10.2026 & 08.10.2026		TLM 2	CO4	T1	
36	Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control	1	09.10.2026		TLM 2	CO4	T1	
37	Congestion prevention polices, Traffic Control Algorithm-Leaky bucket & Token bucket.	1	09.10.2026		TLM 2	CO4	T1	
38	**Internet Working:** Network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format	2	12.10.2026 & 15.10.2026		TLM 2	CO4	T1	
39	IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison		16.10.2026		TLM2	CO4	T1	

40	of IPV4 & IPV6.	2			TLM2	CO4	T1	
No. of classes requiredto complete UNIT-IV		**11**			No.of classes taken:			

UNIT-V:

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
41	The Transport Layer: Transport layer protocols: Introduction-services- port number	2	26.10.2026		TLM2	CO5	T1	
42	User data gram protocol-User datagram-UDP services-UDP applications	2	28.10.2026		TLM2	CO5	T1	
43	Transmission control protocol: TCP services-TCP features- Segment-A TCP connection	1	29.10.2026		TLM2	CO5	T1	
44	Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture	1	29.10.2026		TLM2	CO5	T1	
45	web based mail- email security	1	30.10.2026		TLM2	CO5	T1	
46	TELENET-local versus remote Logging-Domain Name System	1	30.10.2026		TLM2	CO5	T1	
No. of classes requiredto complete UNIT-V		**8**			**No.of classes taken:**			
MID – II EXAMINATIONS(02-11-2026 to 07-11-2025)								

TeachingLearningMethods					
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

EVALUATION PROCESS:

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

PROGRAM OUTCOMES (Pos)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andanengineeringspecializationtothesolutionofcomplexengineeringproblems.
PO2	Problem analysis: Identify, formulate ,review research literature, and analyze complex Engineering problemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics, 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 healthand 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 toprovide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering andIT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttotheprofessional 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 theengineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams,and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering communityand with society at large, such as, being able to comprehend and write effective reportsanddesigndocumentation,makeeffectivepresentations,andgiveand 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 manageprojects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independentand life-long learning in the broadest context of technological change

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mrs. Razeena Begum	Dr.B.Siva Rama Krishna	Dr.K.V.Pandu Ranga Rao	Dr.S.Jayaprada

Signature				

LAKIREDDYBALIREDDYCOLLEGEOFENGINEERING

(An Autonomous Institution since 2010)
AccreditedbyNAACwith'A'Grade&NBA(UnderTier-I),
AnISO21001:2018,14001:2015,50001:2018CertifiedInstitution Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.REDDYNAGAR,MYLAVARAM,NTRDIST.,A.P.-521230.
hodcse@lbrce.ac.in,cseoffice@lbrce.ac.in,Phone:08659-222933,Fax:08659-222931

DEPARTMENTOFCOMPUTERSCIENCE&ENGINEERING (AI & ML)

COURSEHANDOUT

PART-A

Name of Course Instructor	: **Mr.K.Ravi Kumar**	
Course Name & Code	: **Operating Systems (23CS06)**	
L-T-P Structure	: 3-0-0	Credits: 3
Program/Sem/Sec	: **B.Tech., CSE(AI&ML), V-Sem., Sec-A**	**A.Y: 2026-27**

PREREQUISITE: KnowledgeofComputerfundamentals,Datastructures&Algorithms

COURSEEDUCATIONALOBJECTIVES(CEOs): Themainobjectiveofthecourseistomake student:

- Understandthebasicconceptsandprinciplesofoperatingsystems,includingprocess management, memory management, file systems, and Protection
- Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachievebetter performance of a computer system.
- Illustratedifferent conditionsfordeadlockandtheirpossiblesolutions.

COURSEOUTCOMES(COs): Attheendofthecourse,studentwillbeableto

CO1	Understandthefundamentalconcepts,functions,andstructuresofoperatingsystems, including their design, implementation, and the various types of system calls and services. **(Understand-L2)**
CO2	Understandprocessconcepts,multithreading models,andCPUschedulingalgorithmsto effectivelymanageoperationsonprocesses, inter-processcommunication, andthreading issues in operating systems. **(Understand-L2)**
CO3	Analyze synchronization tools, deadlock-handling methods to solve critical section problemsandensureefficientprocesssynchronizationinoperatingsystems.**(Apply-L3)**
CO4	Analyze different memory management techniques paging and segmentation to understandtheirsuitabilityforvariousmemoryallocationscenarios.**(Apply-L3)**
CO5	Applyknowledgeoffilesystemstructuresandprotectionmechanismstodesignand implement secure file management systems. **(Apply-L3**)

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs,POs&PSOs):

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

TEXTBOOKS:

1. OperatingSystemConcepts,SilberschatzA,GalvinPB,GagneG,10thEdition,Wiley,2018.
2. ModernOperatingSystems,TanenbaumAS,4thEdition,Pearson, 2016

ReferenceBooks:

1. OperatingSystems-InternalsandDesignPrinciples,StallingsW,9thedition,Pearson,2018
2. Operating Systems:A ConceptBased Approach,D.M Dhamdhere,3rd Edition,McGrawHill, 2013

OnlineLearningResources:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:IntroductiontoOperatingSystems

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	IntroductiontoOperating systems	1	30-06-2026		TLM1 TLM2	
2.	operating system functions,operating systems operations	1	01-07-2026		TLM1 TLM2	
3.	Computingenvironments	1	02-07-2026		TLM1 TLM2	
4.	Free and Open-Source OperatingSystems	1	04-07-2026		TLM1 TLM2	
5.	System Structures: Operating System Services	1	07-07-2026		TLM1 TLM2	
6.	System programs,System calls	1	08-07-2026		TLM1 TLM2	
7.	Tutorial	1	09-07-2026		TLM3	
8.	TypesofSystemCalls, system programs	2	14-07-2026 15-07-2026		TLM1 TLM2	
9.	operatingsystemDesign and Implementation	1	16-07-2026		TLM1 TLM2	
10.	BuildingandBootingan Operating System	2	18-07-2026 21-07-2026		TLM1 TLM2	
11.	Operatingsystem debugging	1	22-07-2026		TLM1 TLM2	
12.	Tutorial	2	23-07-2026 25-07-2026		TLM3	
No.ofclassesrequiredtocompleteUNIT-I:15				**No.ofclasses taken:**		

UNIT-II:ProcessManagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Processes:Process Concept,	2	28-07-2026 29-07-2026		TLM1 TLM2	
14.	Processscheduling	2	30-07-2026 01-08-2026		TLM1 TLM2	
15.	Operations on processes	1	05-08-2026		TLM1 TLM2	
16.	Inter-process communication systems	1	06-08-2026		TLM1 TLM2	
17.	Threads and Concurrency: Multithreadingmodels	2	11-08-2026 12-08-2026		TLM1 TLM2	
18.	Threadlibrariesand Thread issues	1	13-08-2026		TLM1 TLM2	
19.	CPUScheduling:Basic concepts	1	18-08-2026		TLM1 TLM2	
20.	SchedulingCriteria	1	19-08-2026		TLM1 TLM2	
21.	Schedulingalgorithms	1	20-08-2026		TLM1 TLM2	
22.	Multipleprocessor scheduling	1	22-08-2026		TLM1 TLM2	
No.ofclassesrequiredtocompleteUNIT-II:13				**No.ofclasses taken:**		

I MID Examinations (24-08-2026 to 29-08-2026)

UNIT-III:SynchronizationTools

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
23.	SynchronizationTools:The Critical section problem, Peterson'ssolutions	1	01-09-2026		TLM1 TLM2	
24.	MutexLocks	1	02-09-2026		TLM1 TLM2	
25	Semaphores	2	03-09-2026 05-09-2026		TLM1 TLM2	
26.	Monitors	2	08-09-2026 09-09-2026		TLM1 TLM2	
27	Classicproblemsof Synchronization	1	10-09-2026		TLM1 TLM2	
28	Synchronizationexamples	1	15-09-2026		TLM1 TLM2	
20	Deadlocks:Systemmodeland deadlock characterization	1	16-09-2026		TLM1 TLM2	
30.	MethodsforHandlingdeadlocks and deadlock prevention	1	17-09-2026		TLM1 TLM2	

31.	DeadlockAvoidance	1	19-09-2026		TLM1 TLM2	
32	Deadlockdetection	1	22-09-202		TLM1 TLM2	
33	Recoveryfromdeadlock	1	23-09-2026		TLM1 TLM2	
No.ofclasses requiredtocompleteUNIT-III:15				**No.ofclasses taken:**		

UNIT-IV:Memorymanagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
34.	Memory-Management Strategies:Introduction, ContiguousMemory Allocation	1	24-09-2026		TLM1 TLM2	
35	Pagingandstructureofa page table	1	26-09-2026		TLM1 TLM2	
36	Swapping	1	29-09-2026		TLM1 TLM2	
37	Virtual Memory Management: Introduction,Demand pagingandCopy-on-write	1	30-09-2026		TLM1 TLM2	
38.	Page replacement	1	01-10-2026		TLM1 TLM2	
39	Allocationof frames	1	03-10-2026		TLM1 TLM2	
40	Thrashing	1	06-10-2026		TLM1 TLM2	
No.ofclassesrequiredtocompleteUNIT-IV:8				**No.ofclasses taken:**		

UNIT-V:FileSystemManagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
41.	FileSystem:FileSystem Interface: File concept, Accessmethodsand Directory Structure	1	07-10-2026		TLM1 TLM2	
42	File system Implementation:File-systemstructure	1	08-10-2026		TLM1 TLM2	
43	File-systemOperations	1	10-10-2026		TLM1 TLM2	
44.	Allocationmethod,Free space management	1	13-10-2026		TLM1 TLM2	
45	File-SystemInternals: File-SystemMounting	1	14-10-2026		TLM1 TLM2	
46	PartitionsandMounting and File Sharing	1	15-10-2026		TLM1 TLM2	
47	Protection:Goalsof protection	1	17-10-2026		TLM1 TLM2	
48	Principlesofprotection	1	27-10-2026		TLM1 TLM2	
49	ProtectionRings	1	28-10-2026		TLM1 TLM2	
50.	Domainofprotectionand Access matrix	1	29-10-2026		TLM1 TLM2	
51	Tutorial	1	31-10-2026		TLM2	
No.ofclassesrequiredtocompleteUNIT-V:10				**No.ofclasses taken:**		

II MID Examinations (02-11-2026 to 07-11-2026)

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

PART-C
EVALUATION PROCESS (R23 Regulation)

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

PART-D

PROGRAMMEOUTCOMES(POs):

PO1	**Engineeringknowledge**:Applytheknowledgeofmathematics,science,engineeringfundamentals,andanengineering specializationtothesolutionofcomplexengineeringproblems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics,naturalsciences, andengineeringsciences.
PO3	**Design/developmentofsolutions**:Designsolutionsforcomplexengineeringproblemsanddesignsystemcomponentsorprocessesthatmeetthespecifiedneedswithappropriateconsiderationfor thepublichealth andsafety,andthecultural,societal,andenvironmentalconsiderations.
PO4	**Conductinvestigationsofcomplexproblems**:Useresearch-basedknowledgeandresearch methodsincludingdesignofexperiments,analysisandinterpretationofdata,andsynthesisoftheinformationtoprovidevalidconclusions.
PO5	**Moderntoolusage**:Create,select,andapplyappropriatetechniques,resources,andmodern engineeringandITtoolsincludingpredictionandmodelingtocomplexengineeringactivitieswithanunderstandingofthelimitations.

PO6	**Theengineerandsociety**:Applyreasoninginformed bythecontextualknowledgetoassesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttothe professionalengineeringpractice.
PO7	**Environmentandsustainability**:Understandtheimpactoftheprofessionalengineeringsolutionsinsocietaland environmentalcontexts,and demonstratetheknowledgeof,andneedforsustainable development.
PO8	**Ethics**:Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnorms oftheengineeringpractice.
PO9	**Individualandteamwork**:Functioneffectivelyasanindividual,andasamemberorleaderin diverseteams,andinmultidisciplinarysettings.
PO10	**Communication**:Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehendandwriteeffectivereports anddesigndocumentation,makeeffectivepresentations,andgiveandreceiveclearinstructions.
PO11	**Projectmanagementandfinance**:Demonstrateknowledgeandunderstandingoftheengineering andmanagementprinciplesandapplythesetoone'sownwork,asamemberandleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
PO12	**Life-longlearning**:Recognizetheneedfor, andhavethepreparationandabilitytoengageinindependentandlife-longlearninginthebroadestcontextoftechnologicalchange

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO 1	Design and develop sophisticated software systems, leveraging expertise in data structures, algorithm analysis, web design, and proficiency in machine learning techniques.
PSO 2	Possess the strong data analysis and interpretation skills, enabling them to extract meaningful insights and patterns from large datasets using AI & ML methodologies.

Title	**CourseInstructor**	**Course Coordinator**	**ModuleCoordinator**	**Head of theDepartment**
Name of the Faculty	**Mr.K.Ravi Kumar**	**Mr.K.Ravi Kumar**	**Mr.K.Ravi Kumar**	**Dr.S. Jayaprada**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade
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.
hodcsm@lbrce.ac.in,csmoffice@lbrce.ac.inPhone:08659-222 933,Fax:08659-2931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr M PRUTHVI RAJ

Course Name & Code : CLOUD COMPUTING 23CS11
L-T-P Structure :3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech/V SEM /A **A.Y.:** 2026-27
Regulations : R23

PREREQUISITE: Computer Networks, Operating System, Parallel and Distributed Computing.

COURSE EDUCATIONAL OBJECTIVES (CEOs)

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

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

CO1	Understand the concept of cloud computing reference models, Services, Deployment models and cloud service providers. **(Understand-L2)**
CO2	Understand the cloud enabling technologies for Parallel and distributed computing, Service-Oriented Architecture and Web services. **(Understand-L2)**
CO3	Implement the levels of virtualization tools and containers for resource provisioning and the orchestration tools. **(Apply-L3)**
CO4	Understand the challenges of cloud computing and know the security issues in cloud computing. **(Understand-L2)**
CO5	Analyze the advanced concepts of cloud computing for server-less-computing, fog, edge and quantum computing. (**Analyze-L4)**

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

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

TEXTBOOKS:

T1	Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
T2	Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

REFERENCE BOOKS:

R1	Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
R2	Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
R3	https://www.ibm.com/cloud/learn/cloud-computing
R4	https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpa
	BD5bKOloWx9J NPTEL Cloud Computing
R5	https://www.youtube.com/watch?v=10jm7Waan8M&list=PLdpzxOOAlwvIcxgCUyB
	HVOcWs0Krjx9xR Azure Course Videos
R6	https://www.youtube.com/watch?v=Rzzi CGMIHc Cloud Computing Videos
R7	https://www.youtube.com/watch?v=GkKNxyLp_V0&list=PLdpzxOOAlwvLNOxX0
	RfndiYSt1Le9azze Aws Course Videos
R8	https://www.youtube.com/watch?v=RzziCloud Computing Videos
	https://www.youtube.com/watch?v=jVE7qKWg8mc GCP Course Videos

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Cloud Computing Fundamentals

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 CO's & PO'S	1	01/07/26		TLM1, 2	
2.	Cloud computing at a glance, defining a cloud	1	02/07/26		TLM1, 2	
3.	cloud computing reference model	1	02/07/26		TLM1, 2	
4.	Types of services (IaaS PaaS SaaS)	1	04/07/26		TLM1, 2	
5.	Cloud Deployment models (Public, private, hybrid)	1	08/07/26		TLM1,2	
6.	utility computing	1	09/07/26		TLM1, 2	
7.	cloud computing characteristics and benefits	1	09/07/26		TLM1, 2	
8.	Cloud service providers Amazon Web Services	1	11/07/26		TLM1,2	
9.	Microsoft Azure	1	15/07/26		TLM1, 2	
10.	Google App Engine	1	16/07/26		TLM 1, 2	
11.	Tutorial / Activity	1	16/07/26		TLM 3/7	
No. of classes required to complete UNIT-I: 11				**No. of classes taken:**		

UNIT-II: Cloud Enabling Technologies

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
12.	Ubiquitous Internet	1	18/07/26		TLM1,2	
13.	parallel and distributed computing	1	22/07/26		TLM1,2	
14.	elements of parallel computing,	1	23/07/26		TLM1,2	
15.	hardware architectures for parallel computing (SISD SIMD, MISD, MIMD)	3	23/07/26 25/07/26 29/07/26		TLM1,2	
16.	elements of distributed computing	1	30/07/26		TLM1,2	
17.	Inter-process communication	1	30/07/26		TLM1,2	
18.	technologies for distributed computing	1	01/08/26		TLM1,2	
19.	remote procedure calls (RPC), service-oriented architecture (SOA),	1	05/08/26		TLM1,2	
20.	Web services	1	06/08/26		TLM1,2	
21.	virtualization.	1	06/08/26		TLM1,2	
22.	Tutorial / Activity/ Assignment	1	08/08/26		TLM 3 /7	
No. of classes required to complete UNIT-II: 13				**No. of classes taken:**		

UNIT-III: Virtualization and Containers

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Characteristics of virtualized environments	1	12/08/26		TLM1,2	
24.	Taxonomy of virtualization techniques	1	13/08/26		TLM1,2	
25.	Virtualization and cloud Computing	1	13/08/26		TLM1,2	
26.	Pros and cons of virtualization technology examples (XEN, VMware)	1	19/08/26		TLM1,2	
27.	building blocks of containers,	1	20/08/26		TLM1,2	
28.	Container platforms (LXC, Docker)	1	20/08/26		TLM1,2	
29.	container orchestration,	1	22/08/26		TLM1,2	
30.	Docker Swarm and Kubernetes	1	02/09/26		TLM1,2	
31.	Public cloud VM (e.g. Amazon EC2)	1	03/09/26		TLM1,2	
32.	Container (e.g. Amazon Elastic Container Service) offerings.	1	03/09/26		TLM1,2	
33.	Tutorial/ Activity / Assignment	1	05/09/26		TLM 3/7	
No. of classes required to complete UNIT-III: 11				**No. of classes taken:**		

UNIT-IV: Cloud computing challenges

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
34.	Economics of the cloud	1	09/09/26		TLM1,2	
35.	Cloud interoperability and standards.	1	10/09/26		TLM1,2	
36.	Scalability and fault tolerance	1	10/09/26		TLM1,2	
37.	Energy efficiency in clouds	1	12/09/26		TLM1,2	

38.	federated clouds	1	16/09/26		TLM1,2	
39.	Cloud computing security	1	17/09/26		TLM1,2	
40.	Fundamentals of computer security	1	17/09/26		TLM1,2	
41.	Cloud security architecture,	1	19/09/26		TLM1,2	
42.	Cloud shared responsibility model	1	23/09/26		TLM1,2	
43.	Security in cloud deployment models.	1	24/09/26		TLM1,2	
44.	Tutorial /Activity / Assignment	1	24/09/26		TLM 3/7	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Advanced concepts in cloud computing

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.	Server less computing	1	26/09/26		TLM1,2	
46.	Function-as-a Service	1	30/09/26		TLM1,2	
47.	Server less computing architecture	1	01/10/26		TLM1,2	
48.	Public cloud (e.g. AWS Lambda) and open source (e.g. Open FaaS) server less platforms	2	01/10/26 03/10/26		TLM1,2	
49.	Internet of Things (IoT applications,	1	07/10/26		TLM1,2	
50.	Cloud centric IoT and layers	1	08/10/26		TLM1,2	
51.	Edge and fog computing, DevOps,	1	08/10/26		TLM1,2	
52.	Infrastructure-as-code	1	10/10/26		TLM1,2	
53.	Quantum cloud computing	1	14/10/26		TLM1,2	
54.	Tutorial / Activity / Assignment	1	15/10/26		TLM 3/7	
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.	**Hosting a EC2 Instance machine by using AWS Cloud**	1	15/10/2026		TLM1,2	
2.	**Hosting a simple cloud application using Microsoft Azure Web services**	1	17/10/2026		TLM1,2	
3.	**Build a sample docker container**	**1**	28/10/2026		TLM1,2	

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 (R23 Regulation):

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

PART-D PROGRAMME OUTCOMES (POs):

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 teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using 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 M PRUTHVI RAJ**			**Dr. S Jayaprada**
Signature				

LAKIREDDY BALIREDDYCOLLEGE OFENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier-I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. And Affiliated to JNTUK, Kakinada
L.B.REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521230.
Phone: 08659-222933, Fax: 08659-222931
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AIML)

COURSE HANDOUT

PART-A

Name of Course Instructor :Dr.S.Rami Reddy, Sr. Assistant Professor

Course Name & Code : Sustainable Energy Technologies- 23ME81 **Regulation**: R23

L-T-P Structure : **3-0-0** **Credits:** 03

Program/Sem/Sec : B.Tech- CSE(AIML)/V Sem A/S **A.Y.:** 2026-27

PREREQUISITE : **Nil**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

To provide the insights on different sustainable energy sources, potential, salient features and utilization of solar, wind, geothermal, ocean thermal energy, bio energy and fuel cell systems.

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

CO 1	Demonstrate the importance, the impact of solar radiation. **(Understanding-L2)**
CO 2	Understand the principles of solar PV modules and storage in PV systems. **(Understanding-L2)**
CO 3	Discuss solar energy storage systems and their applications. **(Understanding-L2)**
CO 4	Describe power extraction from wind and bio-mass. **(Understanding-L2)**
CO5	Illustrate the working of geothermal, ocean energy and fuel cells. **(Understanding-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	-	-	-	3	3	-	-	-	-	2	3	-	-
CO2	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO3	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO4	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO5	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-

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

TEXT BOOKS:

T1 Renewable Energy Technologies -Ramesh & Kumar /Narosa

T2 Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

REFERENCE BOOKS:

R1. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.

R2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

R3. Non-conventional Energy Source- G S Sawhney- PHI, New Delhi, 2012

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: SOLAR RADIATION

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	1	29-06-2026		TLM2	
2.	Role and potential of new and renewable sources	1	01-07-2026		TLM2	
3.	The solar energy option	1	02-07-2027		TLM2	
4.	Environmental impact of solar power	1	03-07-2026		TLM2	
5.	Structure of the Sun	1	06-07-2026		TLM2	
6.	The solar constant	1	08-07-2026		TLM2	
7.	Sun-earth relationships	1	09-07-2026		TLM2	
8.	Coordinate systems and coordinates of the sun	1	10-07-2026		TLM2	
9.	Extraterrestrial and terrestrial solar radiation	1	13-07-2026		TLM2	
10.	Solar radiation on tilted surface	1	15-07-2026		TLM2	
11.	Instruments for measuring solar radiation and sun shine	1	16-07-2026		TLM2	
12.	Solar radiation data	1	17-07-2026		TLM2	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: SOLAR PV MODULES AND PV 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.	PV module Circuit Design	1	20-07-2026		TLM2	
2.	Module Structure	1	22-07-2026		TLM2	
3.	Packing Density	1	23-07-2026		TLM2	
4.	Interconnenctions	1	24-07-2026		TLM2	
5.	Mismatch and temperature effects	1	27-07-2026		TLM2	
6.	Electrical and Mechanical Insulation	1	29-07-2026		TLM2	
7.	Lifetime of PV modules	1	30-07-2026		TLM2	
8.	Degradation and failure	1	31-07-2026		TLM2	
9.	PV module parameters, Efficiency of PV Systems	1	03-08-2026		TLM2	
10.	Solar PV Systems	1	05-08-2026		TLM2	
11.	Battery Operation, Types of Batteries	1	06-08-2026		TLM2	
12.	Battery parameters, Applications,	1	07-08-2026		TLM2	
13.	Selection of batteries for Solar PV System	1	13-08-2026		TLM2	
No. of classes required to complete UNIT-II: 13				No. of classes taken:		

UNIT-III: SOLAR ENERGY COLLECTION, SOLAR ENERGY STORAGE AND APPLICATIONS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Solar Energy Collection: Flat plate and concentrating collectors	1	10-08-2026		TLM2	
2.	Classification of concentrating collectors	1	12-08-2026		TLM2	
3.	Solar Energy Storage and Applications: Different methods	1	13-08-2026		TLM2	
4.	Sensible latent heat and stratified storage	1	14-08-2026		TLM2	
5.	Solar ponds	1	17-08-2026		TLM2	
6.	Solar Applications	1	19-08-2026		TLM2	
7.	solar heating cooling technique	1	20-08-2026		TLM2	
8.	Solar distillation	1	21-08-2026		TLM2	
9.	Solar drying	1	31-08-2026		TLM2	
10.	Solar cookers	1	02-09-2026		TLM2	
11.	Central power tower concept	1	03-09-2026		TLM2	
12.	Solar chimney	1	04-09-2026		TLM2	
No. of classes required to complete UNIT-III: 12				No. of classes taken:		

UNIT-IV : WIND ENERGY, BIO-MASS

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.	Wind energy: Sources and potential	1	07-09-2026		TLM2	
2.	Horizontal axis wind mill	1	09-09-2026		TLM2	
3.	Vertical Axis wind mill	1	10-09-2026		TLM2	
4.	Performance characteristics	1	11-09-2026		TLM2	
5.	Betz criteria	1	16-09-2026		TLM2	
6.	Types of winds	1	17-09-2026		TLM2	
7.	Wind data measurement	1	18-09-2026		TLM2	
8.	Bio-mass: Principles of bio-conversion	1	21-09-2026		TLM2	
9.	Anaerobic/aerobic digestion	1	23-09-2026		TLM2	
10.	Types of biogas digesters	1	24-09-2026		TLM2	
11.	Gas yield, Gasifiers	1	25-09-2026		TLM2	
12.	Applications	1	28-09-2026		TLM2	
No. of classes required to complete UNIT-IV:12				No. of classes taken:		

UNIT-V : GEOTHERMAL ENERGY, OCEAN ENERGY, FUEL CELLS

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.	Geothermal Energy: Origin, Applications	1	30-09-2026		TLM2	
2.	Types of Geothermal Resources	1	01-10-2026		TLM2	
3.	Geothermal power generation, Relative merits and demerits	1	05-10-2026		TLM2	
4.	Ocean Energy: Ocean Thermal energy	1	07-10-2026		TLM2	
5.	Open cycle OTEC plants, Environmental impacts	1	08-10-2026		TLM2	
6.	Closed cycle OTEC plants, Environmental impacts	1	09-10-2026		TLM2	
7.	Challenges and applications	1	12-10-2026		TLM2	
8.	Fuel Cells: Introduction	1	14-10-2026		TLM2	
9.	Applications of fuel cells	1	15-10-2026		TL M2	
10.	Classification, Different types of Fuel Cells	1	16-10-2026		TLM2	
11.	Phosphoric Acid fuel cell	1	26-10-2026		TLM2	
12.	Alkaline fuel cell, PEM fuel cell	1	28-10-2026		TLM2	
13.	MC fuel cell	1	30-10-2026		TLM2	
No. of classes required to complete UNIT-V: 13				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..Continued	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 OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.S.Rami Reddy	Dr. P. Ravindra Kumar	Dr. P.Vijay Kumar	Dr. M B S Sreekara Reddy

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with 'A' Grade
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
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT
PART-A

Name of Course Instructor: Dr Shaik Salma Asiya Begum
Course Name & Code : Information Retrieval Systems Lab (23AM52)
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : III B.Tech /V/A **A.Y:** 2025-2026

PRE-REQUISITE : Python / R.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this lab is to introduce practical concepts and methods used in Information Retrieval (IR), such as vector space modelling and similarity computation and provide hands-on experience in preprocessing text data, including techniques like stop-word removal and stemming.

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

CO 1	Compute the similarity bet ween text documents (**Apply-L3**)
CO 2	Apply all pre-processing steps for text-data (**Apply-L3**)
CO 3	Implement classification of text documents. (**Apply-L3**)
CO 4	Improve individual/teamwork skills, communication & report writing skills with ethical values.

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

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Topics to be covered	No. of ClassesRequired	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Information Retrieval	3	30-06-2026		TLM4	
2	Experiment – 01 Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.	6	07-07-2026 14-07-2026		TLM4	
3	Experiment – 02 Pre-processing of a Text Document: stop word removal and stemming	6	21-07-2026 28-07-2026		TLM4	
4	Experiment – 03 Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.	6	04-08-2026 11-08-2026		TLM4	
5	Experiment – 04 Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.	3	18-08-2026		TLM4	
6	Experiment – 05 Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.	3	01-09-2026		TLM4	
7	Experiment – 06 Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.	3	08-09-2026		TLM4	
8	Experiment – 07 To parse XML text, generate Web graph and compute topic specific page rank	3	15-09-2026		TLM4	
9	Experiment – 08 Implement Matrix Decomposition and LSI for a standard dataset.	3	22-09-2026		TLM4	
10	Experiment – 09 Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.	3	29-09-2026		TLM4	
11	Experiment – 10 Implementation of Page Rank on Scholarly Citation Network.	3	06-10-2026		TLM4	
12	Virtual Lab	3	13-10-2026		TLM4	
13	Internal Exam	3	27-10-2026		TLM4	

Teaching Learning Methods

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

PART-C

EVALUATION PROCESS (R23 Regulations):

According to Academic Regulations of R23 Distribution and Weightage of Marks For Laboratory Courses is as follows

(a) Continuous Internal Evaluation (CIE): The Continuous Internal Evaluation (CIE) is based on the following parameters:

Parameter	**Marks**
Day to Day work	10
Record	05
Internal Test	15
Total	30

(b) Semester End Examinations (SEE: The Semester End examinations (SEE) for laboratory courses shall be jointly conducted by internal and external examiners with 3 hours duration and evaluated for 70 marks.

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 engineeringproblems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using firstprinciples of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineeringproblems 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 andresearch 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 complexengineering 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 consequentresponsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professionalengineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member orleader 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 theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.
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 technologicalchange.

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	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr. S. JAYAPRADA**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with'A' Grade
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.
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING(AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.Razeena Begum Shaik
Course Name & Code : **COMPUTER NETWORKS LAB** & 23CS58
L-T-P Structure : 0-0-3 Credits: 1.5
Program/Sem/Sec : B.Tech/V-Sem/Section-**A** **A.Y: 2026-27**

PRE-REQUISITES: C-Programming

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of this course are to introduce

- Understand fundamental concepts of computer networking, including network types, topologies, and layered architectures (OSI and TCP/IP models).
- Gain detailed knowledge of core networking protocols, with an emphasis on the TCP/IP protocol suite.
- Learn how data is transmitted over Ethernet and Internet networks through hands-on lab experiments.
- Develop practical skills in assembling and configuring small-scale networks using real or simulated network devices.
- Analyze and troubleshoot network communication using protocol analyzers to observe how key protocols function across layers.

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

- CO1: Apply fundamental networking concepts by configuring network devices, analyzing protocols, and implementing data link layer techniques. (Apply – L3)
- CO2: Implement various network algorithms, including error detection, congestion control, routing, and shortest path computation. (Apply – L3)
- CO3: Analyze network traffic, security vulnerabilities, and performance metrics using tools like Wireshark, Nmap, and NS2 Simulator. (Apply – L3)
- CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Lab Experiments

CO \ PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	0	0	0	1	2	1	1	3	2	2
CO2	3	3	3	3	3	0	0	0	1	2	1	1	3	3	3
CO3	3	3	2	3	3	2	1	1	2	2	2	2	3	3	3
CO4	1	1	1	1	2	3	3	3	3	3	3	2	2	2	1

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - A

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign
1.	Study of Network devices in detail and connect the computers in Local Area Network.	6	29.06.2026 & 06.07.2026		
2.	Write a Program to implement the data link layer framing methods such as i)Character stuffing ii) bit stuffing.	3	13.07.2026		
3.	Write a Program to implement data link layer farming method checksum.	3	20.07.2026		
4.	Write a program for Hamming Code generation for error detection and correction.	3	27.07.2026		
5.	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16.	3	03.08.2026		
6.	Write a Program to implement Sliding window protocol for Goback N.	3	10.08.2026		
7.	Write a Program to implement Sliding window protocol for Selective repeat.	3	17.08.2026		
8.	Write a Program to implement Stop and Wait Protocol.	3	31.08.2026		
9.	Write a program for congestion control using leaky bucket algorithm	3	07.09.2026		
10.	Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).	3	21.09.2026		
11.	Wireshark Packet Capture Using Wire shark Starting Wire shark Viewing Captured Traffic Analysis and Statistics & Filters.	3	28.09.2026		

12.	Do the following using NS3 Simulator i)NS3 Simulator-Introduction ii)Simulate to Find the Number of Packets Dropped iii)Simulate to Find the Number of Packets Dropped by TCP/UDP iv)Simulate to Find the Number of Packets Dropped due to Congestion v)Simulate to Compare Data Rate& Throughput.	3	05.10.2026		
13.	Virtual Lab	3	12.10.2026		
14	Lab Internal	3	26.10.2026		

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringfundamentals, 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 anddesign 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 ofthe 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 activitieswith 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 tothe professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineeringsolutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of theengineering 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	Programming Paradigms: To inculcate algorithmic thinking, formulation techniques and visualization, leading to problem solving skills using different programming paradigms. 2. DataEngineering: To inculcate an ability to Analyze, Design and implement data driven applicationsinto the students. 3. Software Engineering: Develop an ability to implement various processes /methodologies /practices employed in design, validation, testing and maintenance of software products.
PSO 2	Data Engineering: To inculcate an ability to Analyze, Design and implement data drivenapplications into the students.
PSO 3	Software Engineering: Develop an ability to implement various processes / methodologies /practices employed in design, validation, testing and maintenance of software products.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mrs.Razeena Begum	Dr.B.Siva Rama Krishna	Dr.K.V.Pandu Ranga Rao	Dr. S.Jayaprada
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

Accredited by NAAC with 'A' Grade

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

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

DEPARTMENT OF CSE(Artificial Intelligence & Machine Learning)

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. Johnwesily Chappidi
Course Name & Code : FULL STACK DEVELOPMENT-II (23CSS3)
L-T-P Structure : 0-1-2 **Credits:** 2
Program/Sem/Sec : B.Tech. – CSE/V/A **A.Y.:** 2026-27

PREREQUISITE: Object oriented programming, Full stack development-I

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to equip students with hands-on skills in developing full stack web applications using Java, Node.js, and React. It focuses on building backend services using JDBC, Servlets, and Express.js, along with frontend development using React.js. Students will learn to integrate databases like MySQL and MongoDB for real-time data handling. The course emphasizes applying MVC architecture, REST APIs, and deployment practices for complete web solutions.

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

CO1	Apply JDBC and Servlet technologies to develop web applications that interact with relational databases. **(Apply-L3)**
CO2	Apply the MVC architecture using JSP, Servlets, and JavaBeans to design structured and maintainable web applications**. (Apply-L3)**
CO3	Apply Node.js and Express.js to create RESTful services and perform backend operations with MongoDB. **(Apply-L3)**
CO4	Apply React.js to develop dynamic user interfaces and integrate them with backend APIs for full stack web solutions. **(Apply-L4)**

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

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

REFERENCE BOOKS:

R1	"Head First Servlets and JSP" By: Bryan Basham, Kathy Sierra, Bert Bates Publisher: O'Reilly Media
R2	"Learning Node.js Development" By: Andrew Mead Publisher: Packt Publishing
R3	"MongoDB: The Definitive Guide" By: Kristina Chodorow Publisher: O'Reilly Media
R4	"Learning React: Modern Patterns for Developing React Apps" By: Alex Banks and Eve Porcello Publisher: O'Reilly Media

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	FSD-II & JDBC Introduction	3	01-07-2025		**DM5**	
2.	JDBC Programs	3	08-07-2025		**DM5**	
3.	Servlet Programs	3	15-07-2025		**DM5**	
4.	JSP Introduction	3	22-07-2025		**DM5**	
5.	JSP MVC programs	6	29-07-2025 05-08-2025		**DM5**	
6.	Node JS Introduction	3	12-08-2025		**DM5**	
7.	Express JS Framework	3	19-08-2025		**DM5**	
8.	Node JS & Express JS Programs	6	02-09-2025 09-09-2025		**DM5**	
9.	MangoDB	3	16-09-2025		**DM5**	
10.	MangoDB with Express JS	3	23-09-2025		**DM5**	
11.	React JS	3	30-09-2025		**DM5**	
12.	React JS and Full stack Integration	3	07-10-2025		**DM5**	
13.	Web Application Development	3	14-10-2025		**DM5**	
14.	Virtual lab	3	28-10-2025		**DM6**	
15.	Internal Test	3	12-10-2025		**DM4**	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	**Marks**
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using 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	Dr. Johnwesily Chappidi	Dr. K. Devi Priya		Dr. S. Jayaprada
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.
hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. K RAVI KUMAR
Course Name & Code : User Interface Design using Flutter LAB & 23IT53
L-T-P Structure : **0-0-3** **Credits:** 1.5
Program/Sem/Sec : B.Tech/CSE/III/A **A.Y.:** 2026-27

COURSE EDUCATIONAL OBJECTIVE:
The objectives of the course are to introduce

- Learns to implements Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on widgets and customize widgets for specific UI elements, themes
- Understand to include animation apart from fetching data

COURSE OUTCOMES (CO):
At the end of the course student will be able to
• CO1: Apply Flutter and Dart fundamentals to design and develop interactive user interfaces. (ApplyL3)
• CO2: Implement UI layouts, navigation, state management, and responsive design principles for mobile applications. (Apply-L3)
• CO3: Integrate animations, API data fetching, form validation, and debugging techniques to enhance application performance and usability. (Apply-L3)
• CO4: Improve individual / teamwork skills, communication & report writing skills with ethical value

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

Note: 1- Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

PART-B:

COURSE DELIVERY PLAN (LESSON PLAN):

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign
1.	a) Install Flutter and Dart SDK. b) Write a simple Dart program to understand the language basics.	03	04-07-2026		
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.).	03	18-07-2026		

	b) Implement different layout structures using Row, Column, and Stack widgets.				
3.	a) Design a responsive UI that adapts to different screen sizes. b) Implement media queries and breakpoints for responsiveness.	03	18-07-2026		
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.	03	01-08-2026		
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider	03	22-08-2026		
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.	03	05-09-2026		
7.	a) Design a form with various input fields. b) Implement form validation and error handling.	03	19-09-2026		
8.	a) Create a scrollable List Widget in Form & Add items to it. b) Implement the List View & Display the selected item in the prompt window	03	26-09-2026		
9.	a) Add animations to UI elements using Flutter's animation framework. b) Experimen	03	03-10-2026		
10.	a) Fetch data from a REST APL b) Display the fetched data in a meaningful way in the UI.	03	17-10-2026		

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with 'A' Grade
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
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING (AI&ML)

COURSEHANDOUT

PART-A

NameofCourseInstructor :**Dr Shaik Salma Asiya Begum**
CourseName &Code :INFORMATION RETRIEVAL SYSTEMS & 23AM02
L-T-PStructure : 3-0-0 **Credits:**3
Program/Sem/Sec :B.Tech/ V/B **A.Y.:**2025-2026

PREREQUISITE: Data Structures, Data Mining.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The Objective of this course is to know about the fundamental concepts and components of Information Retrieval (IR), understand the design and use of inverted files and signature files in information retrieval applications .

COURSEOUTCOMES(COs): At theend ofthecourse,studentwillbeableto

CO1	Understand the fundamental concepts of Information Retrieval Systems and the associated data structures and algorithms. (**Understand-L2**)
CO2	Analyse inverted and signature file structures for efficient information retrieval. (**Understand-L2**)
CO3	Apply PAT Trees, lexical analysis techniques, and stop lists for developing new text indices. (**Apply-L3**)
CO4	Apply stemming algorithms and construct thesauri from textual data. (**Apply-L3**)
CO5	Apply and compare string searching algorithms for efficient text processing and pattern matching. (**Apply-L3**)

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs, POs&PSOs):

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

TEXTBOOKS:

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA,2007.

2.Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.

REFERENCEBOOKS:

1. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler, Trevor Strohman, Pearson, 2015.
2. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, HinrichSchütze, Cambridge University Press, 2008.
3. Information Retrieval: Algorithms and Heuristics, David A. Grossman, Ophir Frieder, Springer, 2nd Edition, 2004.

E-resources:

1.https://www.pearson.com/store/p/search-engines-information-retrieval-in-practice/P100000676406
2.https://nlp.stanford.edu/IR-book/information-retrieval-book.html
3.https://mitpress.mit.edu/9780262026512/information-retrieval/

PART-B

COURSEDELIVERYPLAN(LESSONPLAN):

UNIT-I:Introduction to Information storage and retrieval systems

S. No.	Topicsto becovered	No. ofClasses Required	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD SignWeekly
1.	CEOs and Cos discussion, **Introduction:** Domain Analysis of IR systems	1	29-06-2026		1&2	
2.	IR and other types of Information Systems	1	01-07-2026		1&2	
3.	IR System Evaluation	1	03-07-2026		1&2	
4.	Introduction to Data structures	1	04-07-2026		1&2	
5.	algorithms related to Information Retrieval	1	06-07-2026		1&2	
6.	Basic Concepts	1	08-07-2026		1&2	
7.	TUTORIAL	1	10-07-2026		1&2	
8.	Basic Concepts Continuation	1	11-07-2026		1&2	
9.	Data structures	1	13-07-2026		1&2	
10	Algorithms	1	15-07-2026		1&2	
11.	Algorithms continuation	1	17-07-2026		1&2	
12.	TUTORIAL	1	18-07-2026		1&2	
13.	Revision	1	20-07-2026		1&2	
No. of classes required to complete UNIT-I:13				**No. of classes taken:**		

UNIT-II:Inverted Files and Signature Files

S. No.	Topicsto becovered	No. ofClasses Required	Tentative Dateof Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction	1	22-07-2026		1&2	
14.	Structures used in Inverted Files	1	24-07-2026		1&2	
15.	building an Inverted file using a sorted array.	1	25-07-2026		1&2	
16.	TUTORIAL	1	27-07-2026		1&2	
17.	Modifications to the Basic Techniques	1	29-07-2026		1&2	
18.	Signature Files	1	31-07-2026		1&2	
19.	Concepts of Signature files	1	01-08-2026		1&2	
20.	Compression	1	03-08-2026		1&2	
21.	Vertical Partitioning,	1	05-08-2026		1&2	
22.	Horizontal Partitioning	1	07-08-2026		1&2	
23.	TUTORIAL	1	08-08-2026		1&2	
24.	Revision	1	10-08-2026		1&2	
I MID EXAMINATIONS(24-08-2026 to 29-08-2026)						
No. of classes required to complete UNIT-II:12				**No.of classes taken:**		

UNIT-III:New Indices for Text, Lexical Analysis and Stop lists: PAT Trees and PAT Arrays

S. No.	Topicsto becovered	No. ofClasses Required	Tentative Dateof Completion	ActualDateof Completion	Teaching Learning Methods	HOD SignWeekly
23.	Introduction	1	12-08-2026		1&2	
24.	PAT Tree structure	2	14-08-2026 17-08-2026		1&2	
25.	Algorithms on the PAT Trees	1	19-08-2026		1&2	
26.	Building PAT Trees as PATRICA Trees	2	21-08-2026 22-08-2026		1&2	
27.	PAT representation as Arrays	1	31-08-2026		1&2	
28.	TUTORIAL	1	02-09-2026		1&2	
29.	Stop lists	2	05-09-2026 07-09-2026		1&2	
30.	Revision	1	09-09-2026		1&2	
No.ofclassesrequiredtocompleteUNIT-III:11				**No.ofclassestaken:**		

UNIT-IV: Stemming Algorithms and Thesaurus Construction

S. No.	Topicsto becovered	No. ofClasses Required	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD SignWeekly
30.	Types of Stemming algorithms	1	11-09-2026		1&2	
31.	Experimental Evaluations of Stemming	2	12-09-2026 16-09-2026		1&2	
32.	TUTORIAL	1	18-09-2026		1&2	
33.	Experimental Evaluations of Stemming continuation	2	19-09-2026 21-09-2026		1&2	
34.	stemming to Compress Inverted Files	2	23-09-2026 25-09-2026		1&2	
35.	Thesaurus Construction	1	26-09-2026		1&2	
36.	Features of Thesauri	2	28-09-2026 30-09-2026		1&2	
37.	Thesaurus Construction	1	03-10-2026		1&2	
38.	Thesaurus construction from Texts	1	05-10-2026		1&2	
39.	Merging existing Thesauri	1	07-10-2026		1&2	
40.	Merging existing Thesauri continuation	1	09-10-2026		1&2	
41.	TUTORIAL	1	10-10-2026		1&2	
No.ofclassesrequiredtocomplete UNIT-IV:16				**No.ofclassestaken:**		

UNIT-V: String Searching Algorithms

S. No.	Topics to be covered	No. of ClassesRequired	TentativeDate ofCompletion	Actual Dateof Completion	Teaching Learning Methods	HOD SignWeekly
42.	Introduction.	1	12-10-2026		1&2	
43.	Preliminaries.	1	14-10-2026		1&2	
44.	The Naive Algorithm.	1	16-10-2026		1&2	
45.	The Knutt-Morris-Pratt Algorithm.	1	17-10-2026		1&2	
46.	The Boyer-Moore Algorithm	1	26-10-2026		1&2	
47.	The Shift-Or Algorithm.	1	28-10-2026		1&2	
48.	The Shift-Or Algorithm continuation	1	30-10-2026		1&2	
49.	The Karp-Rabin Algorithm	1	31-10-2026		1&2	
50.	Revision of Algorithms	1	31-10-2026		1&2	
II MID EXAMINATIONS(02-11-2026 to 07-11-2026)						
No.of classes required to complete UNIT-V:09				**No.of classes taken:**		

Teaching Learning Methods			
TLM1	Chalkand Talk	**TLM4**	Demonstration(Lab/FieldVisit)
TLM2	PPT	**TLM5**	ICT(NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	GroupDiscussion/Project

PART-C

EVALUATIONPROCESS (R23Regulation):

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

PART-D

PROGRAMMEOUTCOMES(POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using firstprinciples of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural,societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member orleader 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 multidisciplinaryenvironments.
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 technologicalchange.

PROGRAMMESPECIFICOUTCOMES(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	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr. S. JAYAPRADA**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade
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.
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

PROGRAM/SEM/SEC : B.Tech./V/B

ACADEMIC YEAR : 2026-2027

COURSE NAME & CODE : Computer Networks & 23CS07

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : Mrs.Razeena Begum

COURSE COORDINATOR : Dr.B.Sivaramakrishna

PRE-REQUISITE : Fundamentals of Computers,Knowledge on Programming Languages

COURSE OBJECTIVE: The main objectives of the course is to make students

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

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

- **CO1**: Understand various network types, topologies, reference models, and transmission media (Understand-L2)
- **CO2**: Examine data link layer design issues, framing techniques, error control, and flow control mechanisms. (Analyze-L4)
- **CO3**: Apply multiple media access control techniques and evaluate Ethernet standards for network communication. (Apply-L3)
- **CO4:** Implement routing algorithms, congestion control techniques, and IP addressing schemes for efficient network communication. (Apply-L3)
- **CO5:** Utilize transport layer protocols (UDP & TCP) and application layer services (HTTP, DNS, Email) to enable secure and reliable data communication. (Apply-L3)

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

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	0	0	1	0	0	0	0	0	0	2	3	0	0
CO2	3	3	1	0	2	0	0	0	0	0	0	2	3	2	0
CO3	3	3	2	2	3	0	0	0	0	0	0	3	3	3	2
CO4	3	2	1	2	3	0	0	0	0	0	0	2	3	3	3
CO5	3	3	2	2	3	0	0	0	0	0	2	3	3	3	2
CO6	3	2	2	0	3	0	0	0	1	2	2	2	3	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.Computer Networksm, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI

2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

REFERENCE BOOKS:

1.Data Communications and Networks- Achut S Godbole, AtulKahate

2. Computer Networks, Mayank Dave, CENGAGE

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I:

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	1	30.06.2026		TLM2	CO1	T1	
2.	Network Types, LAN, MAN, WAN	1	01.07.2026		TLM2	CO1	T1	
3	Network Topologies	1	01.07.2026		TLM2	CO1	T1	
4.	Reference models- The OSI Reference Model	2	04.07.2026 & 07.07.2026		TLM2	CO1	T1	
5.	the TCP/IP Reference Model	1	08.07.2026		TLM2	CO1	T1	
6	A Comparison of the OSI and TCP/IP Reference Models	1	08.07.2026		TLM2	CO1	T1	
7	Physical Layer – Introduction to Guided Media	1	11.07.2026		TLM2	CO1	T1	
8	Twisted-pair cable	1	14.07.2026		TLM2	CO1	T1	
9	Coaxial cable and Fiber optic cable	1	15.07.2026		TLM2	CO1	T1	
10	introduction about unguided media.	2	15.07.2026& 18.07.2026		TLM2	CO1	T2	
No. of classes required to complete UNIT-I		12			No. of classes taken:			

UNIT-II

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
11	Data link layer: Design issues	1	21.07.2026		TLM2	CO2	T1	
12	Framing: fixed size framing	1	22.07.2026		TLM2	CO2	T1	
13	variable size framing	1	22.07.2026		TLM2	CO2	T1	
14	flow control, error control	2	25.07.2026 & 28.07.2026		TLM2	CO2	T1	
15	error detection and correction codes	2	29.07.2026		TLM2	CO2	T1	
16	CRC	2	01.08.2026& 04.08.2026		TLM2	CO2	T1	
17	Checksum: idea	1	05.08.2026		TLM2	CO2	T1	
18	one's complement internet checksum	1	05.08.2026		TLM2	CO2	T1	
19	services provided to Network Layer	1	11.08.2026		TLM2	CO2	T1	
20	Elementary Data Link Layer protocols: simplex protocol	2	12.08.2026		TLM2	CO2	T1	
21	Simplex stop and wait, Simplex protocol for Noisy Channel	2	18.08.2026		TLM2	CO2	T1	
22	Sliding window protocol: One bit, Go back N	2	19.08.2026		TLM2	CO2	T1	
23	Selective repeat-Stop and wait protocol	1	22.08.2026		TLM2	CO2	T1	
No. of classes required to complete UNIT-II		**19**			No.of classes taken:			
MID EXAMINATIONS (24-08-2026 TO 29-08-2026)								

UNIT-III:

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
24	Media Access Control: Random Access: ALOHA	2	01.09.2026 & 02.09.2026		TLM2	CO3	T1	
25	Carrier sense multiple access (CSMA)	1	02.09.2026		TLM2	CO3	T1	
26	CSMA with Collision Detection	1	05.09.2026		TLM2	CO3	T1	
27	CSMA with Collision Avoidance.	1	08.09.2026		TLM2	CO3	T1	
28	Channelization: frequency division multiple Access(FDMA)	1	09.09.2026		TLM2	CO3	T1	
29	time division multiple access(TDMA), code division multiple access(CDMA)	2	09.09.2026 & 12.09.2026		TLM2	CO3	T1	
30	Wired LANs: Ethernet, Ethernet Protocol	1	15.09.2026		TLM2	CO3	T1	
31	Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.	2	16.09.2026		TLM2	CO3	T1	
No. of classes requiredto complete UNIT-III		**11**			No.of classes taken:			

UNIT-IV:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning OutcomeCOs	Text Book followed	HOD Sign Weekly
32	The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer	1	19.09.2026		TLM 2	CO4	T1	
33	Implementation of Connectionless Service- Implementation of Connection Oriented Service	2	22.09.2026& 23.09.2026		TLM 2	CO4	T1	
34	Comparison of Virtual Circuit and Datagram Networks	1	23.09.2026		TLM 2	CO4	T1	
35	Routing Algorithms - The Optimality principle-Shortest path, Flooding, Distance vector	2	26.09.2026		TLM 2	CO4	T1	
36	Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control	1	29.06.2026		TLM 2	CO4	T1	
37	Congestion prevention polices, Traffic Control Algorithm-Leaky bucket & Token bucket.	1	30.09.2026		TLM 2	CO4	T1	
38	Internet Working: Network layer in the internet – IP protocols- IP Version 4 protocol- IPV4 Header Format	2	30.09.2026& 03.10.2026		TLM 2	CO4	T1	
39	IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6- The main IPV6 header,	2	06.10.2026& 07.10.2026		TLM2	CO4	T1	
40	Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.	2	07.10.2026& 10.10.2026		TLM2	CO4	T1	

No. of classes requiredto complete UNIT-IV	**12**			No.of classes taken:

UNIT-V:

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
41	The Transport Layer: Transport layer protocols: Introduction-services-port number	2	13.10.2026& 14.10.2026		TL M2	CO5	T1	
42	User data gram protocol-User datagram-UDP services-UDP applications	1	14.10.2026		TL M2	CO5	T1	
43	Transmission control protocol: TCP services-TCP features-Segment- A TCP connection	1	17.10.2026		TL M2	CO5	T1	
44	Application Layer –-World Wide Web: HTTP, Electronic mail-Architecture	1	27.10.2026		TLM2	CO5	T1	
45	web based mail- email security	1	28.10.2026		TLM2	CO5	T1	
46	TELENET-local versus remote Logging-Domain Name System	1	31.10.2026		TLM2	CO5	T1	
No. of classes requiredto complete UNIT-V		**7**			**No.of classes taken:**			
MID – II EXAMINATIONS(02-11-2026 – 07-11-2026)								

TeachingLearningMethods					
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

EVALUATION PROCESS:

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

PROGRAM OUTCOMES (Pos)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and anengineeringspecializationtothesolutionofcomplexengineeringproblems.
PO2	Problem analysis: Identify, formulate ,review research literature, and analyze complex Engineering problemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics, 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 healthand 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 toprovide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering andIT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttotheprofessional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams,and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering communityand with society at large, such as, being able to comprehend and write effective reportsanddesigndocumentation,makeeffectivepresentations,andgiveand 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 manageprojects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independentand life-long learning in the broadest context of technological change

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mrs. Razeena Begum	Dr.B.Siva Rama Krishna	Dr.K.V.Pandu Ranga Rao	Dr.S.Jayaprada
Signature				

LAKIREDDYBALIREDDYCOLLEGEOFENGINEERING

(An Autonomous Institution since 2010)
AccreditedbyNAACwith'A'Grade&NBA(UnderTier-I),
AnISO21001:2018,14001:2015,50001:2018CertifiedInstitution Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.REDDYNAGAR,MYLAVARAM,NTRDIST.,A.P.-521230.
hodcse@lbrce.ac.in,cseoffice@lbrce.ac.in,Phone:08659-222933,Fax:08659-222931

DEPARTMENTOFCOMPUTERSCIENCE&ENGINEERING (AI & ML)

COURSEHANDOUT

PART-A

Name of Course Instructor	: **Mr.K.Ravi Kumar**	
Course Name & Code	: **Operating Systems (23CS06)**	
L-T-P Structure	: 3-0-0	Credits: 3
Program/Sem/Sec	: **B.Tech., CSE(AI&ML), V-Sem., Sec-B**	**A.Y: 2026-27**

PREREQUISITE: KnowledgeofComputerfundamentals,Datastructures&Algorithms

COURSEEDUCATIONALOBJECTIVES(CEOs): Themainobjectiveofthecourseistomake student:

- Understandthebasicconceptsandprinciplesofoperatingsystems,includingprocess management, memory management, file systems, and Protection
- Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachievebetter performance of a computer system.
- Illustratedifferent conditionsfordeadlockandtheirpossiblesolutions.

COURSEOUTCOMES(COs): Attheendofthecourse,studentwillbeableto

CO1	Understandthefundamentalconcepts,functions,andstructuresofoperatingsystems, including their design, implementation, and the various types of system calls and services. **(Understand-L2)**
CO2	Understandprocessconcepts,multithreading models,andCPUschedulingalgorithmsto effectivelymanageoperationsonprocesses, inter-processcommunication, andthreading issues in operating systems. **(Understand-L2)**
CO3	Analyze synchronization tools, deadlock-handling methods to solve critical section problemsandensureefficientprocesssynchronizationinoperatingsystems.**(Apply-L3)**
CO4	Analyze different memory management techniques paging and segmentation to understandtheirsuitabilityforvariousmemoryallocationscenarios.**(Apply-L3)**
CO5	Applyknowledgeoffilesystemstructuresandprotectionmechanismstodesignand implement secure file management systems. **(Apply-L3**)

COURSEARTICULATIONMATRIX(CorrelationbetweenCOs,POs&PSOs):

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

TEXTBOOKS:

1. OperatingSystemConcepts,SilberschatzA,GalvinPB,GagneG,10thEdition,Wiley,2018.
2. ModernOperatingSystems,TanenbaumAS,4thEdition,Pearson, 2016

ReferenceBooks:

1. OperatingSystems-InternalsandDesignPrinciples,StallingsW,9thedition,Pearson,2018
2. Operating Systems:A ConceptBased Approach,D.M Dhamdhere,3rd Edition,McGrawHill, 2013

OnlineLearningResources:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:IntroductiontoOperatingSystems

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	IntroductiontoOperating systems	1	29-06-2026		TLM1 TLM2	
2.	operating system functions,operating systems operations	1	30-06-2026		TLM1 TLM2	
3.	Computingenvironments	1	02-07-2026		TLM1 TLM2	
4.	Free and Open-Source OperatingSystems	1	03-07-2026		TLM1 TLM2	
5.	System Structures: Operating System Services	1	06-07-2026		TLM1 TLM2	
6.	System programs,System calls	1	07-07-2026		TLM1 TLM2	
7.	Tutorial	1	09-07-2026		TLM3	
8.	TypesofSystemCalls, system programs	2	10-07-2026 13-07-2026		TLM1 TLM2	
9.	operatingsystemDesign and Implementation	1	14-07-2026		TLM1 TLM2	
10.	BuildingandBootingan Operating System	2	16-07-2026 17-07-2026		TLM1 TLM2	
11.	Operatingsystem debugging	1	20-07-2026		TLM1 TLM2	
12.	Tutorial	2	21-07-2026 23-07-2026		TLM3	
No.ofclassesrequiredtocompleteUNIT-I:15				**No.ofclasses taken:**		

UNIT-II:ProcessManagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Processes:Process Concept,	2	24-07-2026 27-07-2026		TLM1 TLM2	
14.	Processscheduling	2	28-07-2026 30-07-2026		TLM1 TLM2	
15.	Operations on processes	1	31-07-2026		TLM1 TLM2	
16.	Inter-process communication systems	1	03-08-2026		TLM1 TLM2	
17.	Threads and Concurrency: Multithreadingmodels	2	04-08-2026 06-08-2026		TLM1 TLM2	
18.	Threadlibrariesand Thread issues	2	07-08-2026 10-08-2026		TLM1 TLM2	
19.	CPUScheduling:Basic concepts	1	11-08-2026		TLM1 TLM2	
20.	SchedulingCriteria	1	14-08-2026		TLM1 TLM2	
21.	Schedulingalgorithms	1	17-08-2026		TLM1 TLM2	
22.	Multipleprocessor scheduling	1	18-08-2026		TLM1 TLM2	
No.ofclassesrequiredtocompleteUNIT-II:14				**No.ofclasses taken:**		

I MID Examinations (24-08-2026 to 29-08-2026)

UNIT-III:SynchronizationTools

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	Actual Dateof Completion	Teaching Learning Methods	HOD Sign Weekly
24.	SynchronizationTools:The Critical section problem, Peterson'ssolutions	1	20-08-2026		TLM1 TLM2	
25.	MutexLocks	1	21-08-2026		TLM1 TLM2	
26.	Semaphores	2	31-08-2026 01-09-2026		TLM1 TLM2	
27.	Monitors	2	03-09-2026		TLM1 TLM2	
28.	Classicproblemsof Synchronization	1	04-09-2026		TLM1 TLM2	
29.	Synchronizationexamples	1	07-09-2026		TLM1 TLM2	
30.	Deadlocks:Systemmodeland deadlock characterization	1	08-09-2026		TLM1 TLM2	
31.	MethodsforHandlingdeadlocks and deadlock prevention	1	10-09-2026		TLM1 TLM2	

32.	DeadlockAvoidance	1	11-09-2026		TLM1 TLM2	
33.	Deadlockdetection	1	15-09-2026		TLM1 TLM2	
34.	Recoveryfromdeadlock	1	17-09-2026		TLM1 TLM2	
No.ofclasses requiredtocompleteUNIT-III:15				**No.ofclasses taken:**		

UNIT-IV:Memorymanagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Memory-Management Strategies:Introduction	1	18-09-2026		TLM1 TLM2	
36.	ContiguousMemory Allocation	1	21-09-2026		TLM1 TLM2	
37.	Pagingandstructureofa page table	1	22-09-2026		TLM1 TLM2	
38.	Swapping	1	24-09-2026		TLM1 TLM2	
39.	Virtual Memory Management: Introduction,Demand pagingandCopy-on-write	1	25-09-2026		TLM1 TLM2	
40.	Page replacement	2	28-09-2026 29-09-2026		TLM1 TLM2	
41.	Allocationof frames	1	01-10-2026		TLM1 TLM2	
42.	Thrashing	1	05-10-2026		TLM1 TLM2	
No.ofclassesrequiredtocompleteUNIT-IV:9				**No.ofclasses taken:**		

UNIT-V:FileSystemManagement

S. No.	Topicstobecovered	No. of Classes Required	Tentative Date of Completion	ActualDate of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	FileSystem:FileSystem Interface: File concept, Accessmethodsand Directory Structure	1	08-10-2026		TLM1 TLM2	
46.	File system Implementation:File-systemstructure	1	09-10-2026		TLM1 TLM2	
47.	File-systemOperations	1	12-10-2026		TLM1 TLM2	
48.	Allocationmethod,Free space management	1	13-10-2026		TLM1 TLM2	
49.	File-SystemInternals: File-SystemMounting	1	15-10-2026		TLM1 TLM2	
50.	PartitionsandMounting and File Sharing	1	16-10-2026		TLM1 TLM2	
51.	Protection:Goalsof protection	1	26-10-2026		TLM1 TLM2	
52.	Principlesofprotection	1	27-10-2026		TLM1 TLM2	
53.	ProtectionRings	1	29-10-2026		TLM1 TLM2	
54.	Domainofprotectionand Access matrix	1	30-10-2026		TLM1 TLM2	
No.ofclassesrequiredtocompleteUNIT-V:10				**No.ofclasses taken:**		

II MID Examinations (**02-11-2026 to 07-11-2026**)

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

PART-C
EVALUATION PROCESS (R23 Regulation)

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

PART-D

PROGRAMMEOUTCOMES(POs):

PO1	**Engineeringknowledge**:Applytheknowledgeofmathematics,science,engineeringfundamentals,andanengineering specializationtothesolutionofcomplexengineeringproblems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics,naturalsciences, andengineeringsciences.
PO3	**Design/developmentofsolutions**:Designsolutionsforcomplexengineeringproblemsanddesignsystemcomponentsorprocessesthatmeetthespecifiedneedswithappropriateconsiderationfor thepublichealth andsafety,andthecultural,societal,andenvironmentalconsiderations.
PO4	**Conductinvestigationsofcomplexproblems**:Useresearch-basedknowledgeandresearch methodsincludingdesignofexperiments,analysisandinterpretationofdata,andsynthesisoftheinformationtoprovidevalidconclusions.
PO5	**Moderntoolusage**:Create,select,andapplyappropriatetechniques,resources,andmodern engineeringandITtoolsincludingpredictionandmodelingtocomplexengineeringactivitieswithanunderstandingofthelimitations.
PO6	**Theengineerandsociety**:Applyreasoninginformed bythecontextualknowledgetoassesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttothe

	professionalengineeringpractice.
PO7	**Environmentandsustainability**:Understandtheimpactoftheprofessionalengineeringsolutionsinsocietaland environmentalcontexts,and demonstratetheknowledgeof,andneedforsustainable development.
PO8	**Ethics**:Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnorms oftheengineeringpractice.
PO9	**Individualandteamwork**:Functioneffectivelyasanindividual,andasamemberorleaderin diverseteams,andinmultidisciplinarysettings.
PO10	**Communication**:Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunityand withsocietyatlarge,suchas,beingabletocomprehendandwriteeffectivereports anddesigndocumentation,makeeffectivepresentations,andgiveandreceiveclearinstructions.
PO11	**Projectmanagementandfinance**:Demonstrateknowledgeandunderstandingoftheengineering andmanagementprinciplesandapplythesetoone'sownwork,asamemberandleaderinateam,tomanageprojectsand inmultidisciplinaryenvironments.
PO12	**Life-longlearning**:Recognizetheneedfor, andhavethepreparationandabilitytoengageinindependentandlife-longlearninginthebroadestcontextoftechnologicalchange

PROGRAMMESPECIFICOUTCOMES(PSOs):

PSO 1	Design and develop sophisticated software systems, leveraging expertise in data structures, algorithm analysis, web design, and proficiency in machine learning techniques.
PSO 2	Possess the strong data analysis and interpretation skills, enabling them to extract meaningful insights and patterns from large datasets using AI & ML methodologies.

Title	**CourseInstructor**	**Course Coordinator**	**ModuleCoordinator**	**Head of theDepartment**
Name of the Faculty	**Mr.K.Ravi Kumar**	**Mr.K.Ravi Kumar**	**Mr.K.Ravi Kumar**	**Dr.S. Jayaprada**
Signature				

- • •
- • •
- •

- • •
- •

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade
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.
hodcsm@lbrce.ac.in,csmoffice@lbrce.ac.inPhone:08659-222 933,Fax:08659-2931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr M PRUTHVI RAJ

Course Name & Code : INTERNET OF THINGS 23AM04
L-T-P Structure :**3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V SEM /B **A.Y.:** 2026-27
Regulations : R23

PRE REQUISITE: Networking, Internet, Hardware, Programming, Cloud Services.

COURSE EDUCATIONAL OBJECTIVES (CEOs)

. Vision and Introduction to Internet of Things (IoT).

. Understand IoT Market perspective.

. Data and Knowledge Management and use of Devices in IoT Technology.

. Understand State of the Art – IoT Architecture.

. Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

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

CO1	Understand the fundamental concepts of Internet of Things (IoT), including its architecture and communication protocols. **(Understand-L2)**
CO2	Implement the business models, IoT/M2M communication, and standardization layers used in IoT systems. **(Apply-L3)**
CO3	Apply design principles for web connectivity for connected devices. **(Apply-L3)**
CO4	Analyze data acquiring in IoT/M2M, application, storage, business integration and enterprise systems. (**Analyze-L4)**
CO5	Understand the use of cloud platforms and services for data collection, storage, and computing in IoT/M2M applications. **(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	1	1	2							2	2	3	1
CO2	3	2	1	1	2							2	2	3	2
CO3	3	3	3	2	3							2	3	3	2
CO4	3	2	1	2	2							2	2	2	2
CO5	3	3	3	3	2							2	3	3	2
1 - Low								**2 –**Medium					**3 –** High		

TEXTBOOKS:

T1	Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
T2	Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

REFERENCE BOOKS:

R1	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley
R2	Getting Started with the Internet of Things, Cuno Pfister , Oreilly
R3	https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLJ5C_6qdAvBG7SHg5mLOQq

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: The Internet of Things

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 CO's & PO'S	1	29/06/26		TLM1, 2	
2.	An Overview of Internet of things	1	01/07/26		TLM1, 2	
3.	Internet of Things Technology	1	01/07/26		TLM1, 2	
4.	behind IoTs Sources of the IoTs	1	04/07/26		TLM1, 2	
5.	M2M Communication	1	06/07/26		TLM1,2	
6.	Examples of IoTs	1	08/07/26		TLM1, 2	
7.	Design Principles for Connected Devices Internet Connectivity Principles	1	08/07/26		TLM1, 2	
8.	Internet connectivity	1	11/07/26		TLM1,2	
9.	Application Layer Protocols: HTTP	1	13/07/26		TLM1, 2	
10.	HTTPS, FTP, Telnet.	1	15/07/26		TLM 1, 2	
11.	Tutorial / Activity	1	15/07/26		TLM 3/7	
No. of classes required to complete UNIT-I: 11				**No. of classes taken:**		

UNIT-II:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
12.	Business Models for Business Processes in the Internet of Things	1	18/07/26		TLM1,2	
13.	IoT/M2M systems LAYERS AND designs standardizations	1	20/07/26		TLM1,2	
14.	Modified OSI Stack for the IoT/M2M Systems,	1	22/07/26		TLM1,2	
15.	ETSI M2M domains and High-level capabilities, Communication Technologies	3	22/07/26 25/07/26 27/07/26		TLM1,2	

16.	Data Enrichment	1	29/07/26		TLM1,2	
17.	Consolidation	1	29/07/26		TLM1,2	
18.	Device Management Gateway	1	01/08/26		TLM1,2	
19.	Ease of designing	1	03/08/26		TLM1,2	
20.	affordability	1	05/08/26		TLM1,2	
21.	Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.	1	05/08/26		TLM1,2	
22.	Tutorial / Activity/ Assignment	1	08/08/26		TLM 3 /7	
No. of classes required to complete UNIT-II: 13				**No. of classes taken:**		

UNIT-III:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Design Principles for the Web Connectivity for Connected-Devices	1	10/08/26		TLM1,2	
24.	Updated Design Principles for the Web Connectivity for Connected-Devices	1	12/08/26		TLM1,2	
25.	Suitable Design Principles for the Web Connectivity for Connected-Devices	1	12/08/26		TLM1,2	
26.	Web Communication protocols for Connected Devices	1	17/08/26		TLM1,2	
27.	Updated Web Communication protocols for Connected Devices	1	19/08/26		TLM1,2	
28.	Message Communication protocols for Connected	1	19/08/26		TLM1,2	
29.	Updated Message Communication protocols for Connected Devices	1	22/08/26		TLM1,2	
30.	Message Communication protocols for Connected Devices - Challenges	1	31/08/26		TLM1,2	
31.	Web Connectivity for Connected-Devices.	1	02/09/26		TLM1,2	
32.	Web Connectivity for Connected-Devices - Challenges	1	02/09/26		TLM1,2	
33.	Tutorial/ Activity / Assignment	1	05/09/26		TLM 3/7	
No. of classes required to complete UNIT-III: 11				**No. of classes taken:**		

UNIT-IV:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
34.	Data Acquiring	1	07/09/26		TLM1,2	

35.	Organizing and Analytics in IoT/M2M	1	09/09/26		TLM1,2	
36.	Applications /Services /Business Processes	1	09/09/26		TLM1,2	
37.	IOT/M2M Data Acquiring and Storage	1	12/09/26		TLM1,2	
38.	Business Models for Business Processes in the Internet Of Things	1	16/09/26		TLM1,2	
39.	Organizing Data	1	16/09/26		TLM1,2	
40.	Transactions	1	19/09/26		TLM1,2	
41.	Business Processes	1	21/09/26		TLM1,2	
42.	Integration	1	23/09/26		TLM1,2	
43.	Integration and Enterprise Systems.	1	23/09/26		TLM1,2	
44.	Tutorial /Activity / Assignment	1	26/09/26		TLM 3/7	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V:

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.	Data Collection	1	28/09/26		TLM1,2	
46.	Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services	1	30/09/26		TLM1,2	
47.	Data Collection Storage and Computing Using cloud platform Everything as a service and Cloud Service Models	1	30/09/26		TLM1,2	
48.	IOT cloud-based services using the Xively (Pachube/COSM)	2	03/10/26 05/10/26		TLM1,2	
49.	Nimbits and other platforms Sensor	1	07/10/26		TLM1,2	
50.	Participatory Sensing, Actuator, Radio Frequency Identification	1	07/10/26		TLM1,2	
51.	Wireless, Sensor Network Technology	1	10/10/26		TLM1,2	
52.	Sensors Technology	1	12/10/26		TLM1,2	
53.	Sensors Technology	1	14/10/26		TLM1,2	
54.	Tutorial / Activity / Assignment	1	14/10/26		TLM 3/7	
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.	**Hosting a SMART EC2 Instance machine by using AWS Cloud**	1	17/10/2026		TLM1,2	
2.	**Hosting a simple cloud application using Microsoft Azure Web services**	1	26/10/2026		TLM1,2	
3.	**Build a sample SMART docker container**	**1**	28/10/2026		TLM1,2	

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 (R23 Regulation):

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

PART-D PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using 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 M PRUTHVI RAJ**			**Dr. S Jayaprada**
Signature				

LAKIREDDY BALIREDDYCOLLEGE OFENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier-I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. And Affiliated to JNTUK, Kakinada
L.B.REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521230.
Phone: 08659-222933, Fax: 08659-222931
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AIML)

COURSE HANDOUT

PART-A

Name of Course Instructor :Dr.S.Rami Reddy, Sr. Assistant Professor

Course Name & Code : Sustainable Energy Technologies- 23ME81 **Regulation**: R23

L-T-P Structure : **3-0-0** **Credits:** 03

Program/Sem/Sec : B.Tech- CSE(AIML)/V Sem B/S **A.Y.:** 2026-27

PREREQUISITE : **Nil**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

To provide the insights on different sustainable energy sources, potential, salient features and utilization of solar, wind, geothermal, ocean thermal energy, bio energy and fuel cell systems.

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

CO 1	Demonstrate the importance, the impact of solar radiation. **(Understanding-L2)**
CO 2	Understand the principles of solar PV modules and storage in PV systems. **(Understanding-L2)**
CO 3	Discuss solar energy storage systems and their applications. **(Understanding-L2)**
CO 4	Describe power extraction from wind and bio-mass. **(Understanding-L2)**
CO5	Illustrate the working of geothermal, ocean energy and fuel cells. **(Understanding-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	-	-	-	3	3	-	-	-	-	2	3	-	-
CO2	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO3	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO4	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-
CO5	3	2	-	-	-	3	3	-	-	-	-	2	3	-	-

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

TEXT BOOKS:

T1 Renewable Energy Technologies -Ramesh & Kumar /Narosa

T2 Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

REFERENCE BOOKS:

R1. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.

R2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

R3. Non-conventional Energy Source- G S Sawhney- PHI, New Delhi, 2012

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: SOLAR RADIATION

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	1	30-06-2026		TLM2	
2.	Role and potential of new and renewable sources	1	01-07-2026		TLM2	
3.	The solar energy option	1	03-07-2027		TLM2	
4.	Environmental impact of solar power	1	04-07-2026		TLM2	
5.	Structure of the Sun	1	07-07-2026		TLM2	
6.	The solar constant	1	08-07-2026		TLM2	
7.	Sun-earth relationships	1	10-07-2026		TLM2	
8.	Coordinate systems and coordinates of the sun	1	11-07-2026		TLM2	
9.	Extraterrestrial and terrestrial solar radiation	1	14-07-2026		TLM2	
10.	Solar radiation on tilted surface	1	15-07-2026		TLM2	
11.	Instruments for measuring solar radiation and sun shine	1	17-07-2026		TLM2	
12.	Solar radiation data	1	18-07-2026		TLM2	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: SOLAR PV MODULES AND PV 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.	PV module Circuit Design	1	21-07-2026		TLM2	
2.	Module Structure	1	22-07-2026		TLM2	
3.	Packing Density	1	24-07-2026		TLM2	
4.	Interconnenctions	1	25-07-2026		TLM2	
5.	Mismatch and temperature effects	1	28-07-2026		TLM2	
6.	Electrical and Mechanical Insulation	1	29-07-2026		TLM2	
7.	Lifetime of PV modules	1	31-07-2026		TLM2	
8.	Degradation and failure	1	01-08-2026		TLM2	
9.	PV module parameters, Efficiency of PV Systems	1	04-08-2026		TLM2	
10.	Solar PV Systems	1	05-08-2026		TLM2	
11.	Battery Operation, Types of Batteries	1	07-08-2026		TLM2	
12.	Battery parameters, Applications,	1	08-08-2026		TLM2	
13.	Selection of batteries for Solar PV System	1	11-08-2026		TLM2	
No. of classes required to complete UNIT-II: 13				No. of classes taken:		

UNIT-III: SOLAR ENERGY COLLECTION, SOLAR ENERGY STORAGE AND APPLICATIONS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Solar Energy Collection: Flat plate and concentrating collectors	1	12-08-2026		TLM2	
2.	Classification of concentrating collectors	1	14-08-2026		TLM2	
3.	Solar Energy Storage and Applications: Different methods	1	18-08-2026		TLM2	
4.	Sensible latent heat and stratified storage	1	19-08-2026		TLM2	
5.	Solar ponds	1	21-08-2026		TLM2	
6.	Solar Applications	1	22-08-2026		TLM2	
7.	solar heating cooling technique	1	01-09-2026		TLM2	
8.	Solar distillation	1	02-09-2026		TLM2	
9.	Solar drying	1	04-09-2026		TLM2	
10.	Solar cookers	1	05-09-2026		TLM2	
11.	Central power tower concept	1	08-09-2026		TLM2	
12.	Solar chimney	1	09-09-2026		TLM2	
No. of classes required to complete UNIT-III: 12				No. of classes taken:		

UNIT-IV : WIND ENERGY, BIO-MASS

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.	Wind energy: Sources and potential	1	11-09-2026		TLM2	
2.	Horizontal axis wind mill	1	12-09-2026		TLM2	
3.	Vertical Axis wind mill	1	15-09-2026		TLM2	
4.	Performance characteristics	1	16-09-2026		TLM2	
5.	Betz criteria	1	18-09-2026		TLM2	
6.	Types of winds	1	19-09-2026		TLM2	
7.	Wind data measurement	1	22-09-2026		TLM2	
8.	Bio-mass: Principles of bio-conversion	1	23-09-2026		TLM2	
9.	Anaerobic/aerobic digestion	1	25-09-2026		TLM2	
10.	Types of biogas digesters	1	26-09-2026		TLM2	
11.	Gas yield, Gasifiers	1	29-09-2026		TLM2	
12.	Applications	1	30-09-2026		TLM2	
No. of classes required to complete UNIT-IV:12				No. of classes taken:		

UNIT-V : GEOTHERMAL ENERGY, OCEAN ENERGY, FUEL CELLS

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.	Geothermal Energy: Origin, Applications	1	03-10-2026		TLM2	
2.	Types of Geothermal Resources	1	06-10-2026		TLM2	
3.	Geothermal power generation, Relative merits and demerits	1	07-10-2026		TLM2	
4.	Ocean Energy: Ocean Thermal energy	1	09-10-2026		TLM2	
5.	Open cycle OTEC plants, Environmental impacts	1	10-10-2026		TLM2	
6.	Closed cycle OTEC plants, Environmental impacts	1	13-10-2026		TLM2	
7.	Challenges and applications	1	14-10-2026		TLM2	
8.	Fuel Cells: Introduction	1	16-10-2026		TLM2	
9.	Applications of fuel cells	1	27-10-2026		TL M2	
10.	Classification, Different types of Fuel Cells	1	28-10-2026		TLM2	
11.	Phosphoric Acid fuel cell	1	30-10-2026		TLM2	
12.	Alkaline fuel cell, PEM fuel cell,MC fuel cell	1	31-10-2026		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..Continued	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 OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.S.Rami Reddy	Dr. P. Ravindra Kumar	Dr. P.Vijay Kumar	Dr. M B S Sreekara Reddy

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with 'A' Grade
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
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT
PART-A

Name of Course Instructor: Dr Shaik Salma Asiya Begum
Course Name & Code : Information Retrieval Systems Lab (23AM52)
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : III B.Tech /V/B **A.Y:** 2025-2026

PRE-REQUISITE : Python / R.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this lab is to introduce practical concepts and methods used in Information Retrieval (IR), such as vector space modelling and similarity computation and provide hands-on experience in preprocessing text data, including techniques like stop-word removal and stemming.

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

CO 1	Compute the similarity bet ween text documents (**Apply-L3**)
CO 2	Apply all pre-processing steps for text-data (**Apply-L3**)
CO 3	Implement classification of text documents. (**Apply-L3**)
CO 4	Improve individual/teamwork skills, communication & report writing skills with ethical values.

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

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

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 Information Retrieval	3	02-07-2026		TLM4	
2	Experiment – 01 Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.	6	09-07-2026 16-07-2026		TLM4	
3	Experiment – 02 Pre-processing of a Text Document: stop word removal and stemming	6	23-07-2026 30-07-2026		TLM4	
4	Experiment – 03 Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.	6	06-08-2026 13-08-2026		TLM4	
5	Experiment – 04 Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.	3	20-08-2026		TLM4	
6	Experiment – 05 Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.	3	03-09-2026		TLM4	
7	Experiment – 06 Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.	3	10-09-2026		TLM4	
8	Experiment – 07 To parse XML text, generate Web graph and compute topic specific page rank	3	17-09-2026		TLM4	
9	Experiment – 08 Implement Matrix Decomposition and LSI for a standard dataset.	3	24-09-2026		TLM4	
10	Experiment – 09 Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.	3	01-10-2026		TLM4	
11	Experiment – 10 Implementation of Page Rank on Scholarly Citation Network.	3	08-10-2026		TLM4	
12	Virtual Lab	3	15-10-2026		TLM4	
13	Internal Exam	3	29-10-2026		TLM4	

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

PART-C

EVALUATION PROCESS (R23 Regulations):

According to Academic Regulations of R23 Distribution and Weightage of Marks For Laboratory Courses is as follows

(a) **Continuous Internal Evaluation (CIE):** The Continuous Internal Evaluation (CIE) is based on the following parameters:

Parameter	Marks
Day to Day work	10
Record	05
Internal Test	15
Total	30

(b) **Semester End Examinations (SEE:** The Semester End examinations (SEE) for laboratory courses shall be jointly conducted by internal and external examiners with 3 hours duration and evaluated for 70 marks.

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 engineeringproblems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using firstprinciples of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineeringproblems 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 andresearch 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 complexengineering 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 consequentresponsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professionalengineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member orleader 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 theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.
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 technologicalchange.

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	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr SK SALMA ASIYA BEGUM**	**Dr. S. JAYAPRADA**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with'A' Grade
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.
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING(AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.Razeena Begum Shaik
Course Name & Code : **COMPUTER NETWORKS LAB & 23CS58**
L-T-P Structure : 0-0-3 Credits: 1.5
Program/Sem/Sec : B.Tech/V-Sem/Section-**B** **A.Y: 2026-27**

PRE-REQUISITES: C-Programming

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of this course are to introduce

- Understand fundamental concepts of computer networking, including network types, topologies, and layered architectures (OSI and TCP/IP models).
- Gain detailed knowledge of core networking protocols, with an emphasis on the TCP/IP protocol suite.
- Learn how data is transmitted over Ethernet and Internet networks through hands-on lab experiments.
- Develop practical skills in assembling and configuring small-scale networks using real or simulated network devices.
- Analyze and troubleshoot network communication using protocol analyzers to observe how key protocols function across layers.

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

- CO1: Apply fundamental networking concepts by configuring network devices, analyzing protocols, and implementing data link layer techniques. (Apply – L3)
- CO2: Implement various network algorithms, including error detection, congestion control, routing, and shortest path computation. (Apply – L3)
- CO3: Analyze network traffic, security vulnerabilities, and performance metrics using tools like Wireshark, Nmap, and NS2 Simulator. (Apply – L3)
- CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Lab Experiments

CO \ PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	0	0	0	1	2	1	1	3	2	2
CO2	3	3	3	3	3	0	0	0	1	2	1	1	3	3	3
CO3	3	3	2	3	3	2	1	1	2	2	2	2	3	3	3
CO4	1	1	1	1	2	3	3	3	3	3	3	2	2	2	1

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - A

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign
1.	Study of Network devices in detail and connect the computers in Local Area Network.	6	30.06.2026 & 07.07.2026		
2.	Write a Program to implement the data link layer framing methods such as i)Character stuffing ii) bit stuffing.	3	14.07.2026		
3.	Write a Program to implement data link layer farming method checksum.	3	21.07.2026		
4.	Write a program for Hamming Code generation for error detection and correction.	3	28.07.2026		
5.	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16.	3	04.08.2026		
6.	Write a Program to implement Sliding window protocol for Goback N.	3	11.08.2026		
7.	Write a Program to implement Sliding window protocol for Selective repeat.	3	18.08.2026		
8.	Write a Program to implement Stop and Wait Protocol.	3	01.09.2026		
9.	Write a program for congestion control using leaky bucket algorithm	3	08.09.2026		
10.	Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).	3	15.09.2026		
11.	Wireshark Packet Capture Using Wire shark Starting Wire shark Viewing Captured Traffic Analysis and Statistics & Filters.	6	22.09.2026 & 29.09.2026		

12.	Do the following using NS3 Simulator i)NS3 Simulator-Introduction ii)Simulate to Find the Number of Packets Dropped iii)Simulate to Find the Number of Packets Dropped by TCP/UDP iv)Simulate to Find the Number of Packets Dropped due to Congestion v)Simulate to Compare Data Rate& Throughput.	3	06.10.2026		
13.	Virtual Lab	3	13.10.2026		
14	Lab Internal	3	27.10.2026		

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Programming Paradigms: To inculcate algorithmic thinking, formulation techniques and visualization, leading to problem solving skills using different programming paradigms. 2. DataEngineering: To inculcate an ability to Analyze, Design and implement data driven applicationsinto the students. 3. Software Engineering: Develop an ability to implement various processes /methodologies /practices employed in design, validation, testing and maintenance of software products.
PSO 2	Data Engineering: To inculcate an ability to Analyze, Design and implement data drivenapplications into the students.
PSO 3	Software Engineering: Develop an ability to implement various processes / methodologies /practices employed in design, validation, testing and maintenance of software products.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mrs.Razeena Begum**	**Dr.B.Siva Rama Krishna**	**Dr.K.V.Pandu Ranga Rao**	**Dr. S.Jayaprada**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

Accredited by NAAC with 'A' Grade
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
hodcsm@lbrce.ac.in, csmoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931
DEPARTMENT OF CSE(Artificial Intelligence & Machine Learning)

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. Johnwesily Chappidi
Course Name & Code : FULL STACK DEVELOPMENT-II (23CSS3)
L-T-P Structure : 0-1-2 **Credits:** 2
Program/Sem/Sec : B.Tech. – CSE/V/B **A.Y.:** 2026-27

PREREQUISITE: Object oriented programming, Full stack development-I

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to equip students with hands-on skills in developing full stack web applications using Java, Node.js, and React. It focuses on building backend services using JDBC, Servlets, and Express.js, along with frontend development using React.js. Students will learn to integrate databases like MySQL and MongoDB for real-time data handling. The course emphasizes applying MVC architecture, REST APIs, and deployment practices for complete web solutions.

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

CO1	Apply JDBC and Servlet technologies to develop web applications that interact with relational databases. **(Apply-L3)**
CO2	Apply the MVC architecture using JSP, Servlets, and JavaBeans to design structured and maintainable web applications**. (Apply-L3)**
CO3	Apply Node.js and Express.js to create RESTful services and perform backend operations with MongoDB. **(Apply-L3)**
CO4	Apply React.js to develop dynamic user interfaces and integrate them with backend APIs for full stack web solutions. **(Apply-L4)**

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

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

REFERENCE BOOKS:

R1	"Head First Servlets and JSP" By: Bryan Basham, Kathy Sierra, Bert Bates Publisher: O'Reilly Media
R2	"Learning Node.js Development" By: Andrew Mead Publisher: Packt Publishing
R3	"MongoDB: The Definitive Guide" By: Kristina Chodorow Publisher: O'Reilly Media
R4	"Learning React: Modern Patterns for Developing React Apps" By: Alex Banks and Eve Porcello Publisher: O'Reilly Media

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	FSD-II & JDBC Introduction	3	06-07-2025		**DM5**	
2.	JDBC Programs	3	13-07-2025		**DM5**	
3.	Servlet Programs	3	20-07-2025		**DM5**	
4.	JSP Introduction	3	27-07-2025		**DM5**	
5.	JSP MVC programs	6	03-08-2025 10-08-2025		**DM5**	
6.	Node JS Introduction	3	17-08-2025		**DM5**	
7.	Express JS Framework	3	31-09-2025		**DM5**	
8.	Node JS & Express JS Programs	6	07-09-2025 21-09-2025		**DM5**	
9.	MangoDB	3	28-09-2025		**DM5**	
10.	MangoDB with Express JS	3	28-09-2025		**DM5**	
11.	React JS & Full Stack Integration	3	05-10-2025		**DM5**	
12.	Web Application Development	3	12-10-2025		**DM5**	
13.	Virtual Lab	3	26-10-2025		**DM6**	
14.	Internal Test	3	16-11-2025		**DM4**	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	**Marks**
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using 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	Dr. Johnwesily Chappidi	Dr. K. Devi Priya		Dr. S. Jayaprada
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.
hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.B.Rajendra Prasad
Course Name & Code : User Interface Design using Flutter LAB & 23IT53
L-T-P Structure : **0-0-3** **Credits:** 1.5
Program/Sem/Sec : B.Tech/CSE/III/B **A.Y.:** 2026-27

COURSE EDUCATIONAL OBJECTIVE:
The objectives of the course are to introduce

- Learns to implements Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on widgets and customize widgets for specific UI elements, themes
- Understand to include animation apart from fetching data

COURSE OUTCOMES (CO):
At the end of the course student will be able to
• CO1: Apply Flutter and Dart fundamentals to design and develop interactive user interfaces. (ApplyL3)
• CO2: Implement UI layouts, navigation, state management, and responsive design principles for mobile applications. (Apply-L3)
• CO3: Integrate animations, API data fetching, form validation, and debugging techniques to enhance application performance and usability. (Apply-L3)
• CO4: Improve individual / teamwork skills, communication & report writing skills with ethical value

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

Note: 1- Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

PART-B:

COURSE DELIVERY PLAN (LESSON PLAN):

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign
1.	a) Install Flutter and Dart SDK. b) Write a simple Dart program to understand the language basics.	03	03-07-2026 10-07-2026		
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.).	03	17-07-2026 24-07-2026		

	b) Implement different layout structures using Row, Column, and Stack widgets.				
3.	a) Design a responsive UI that adapts to different screen sizes. b) Implement media queries and breakpoints for responsiveness.	03	31-07-2026		
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.	03	07-08-2026 14-08-2026		
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider	03	21-08-2026 04-09-2026		
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.	03	11-09-2026		
7.	a) Design a form with various input fields. b) Implement form validation and error handling.	03	18-09-2026		
8.	a) Create a scrollable List Widget in Form & Add items to it. b) Implement the List View & Display the selected item in the prompt window	03	25-09-2026		
9.	a) Add animations to UI elements using Flutter's animation framework. b) Experimen	03	09-10-2026		
10.	a) Fetch data from a REST APL b) Display the fetched data in a meaningful way in the UI.	03	16-10-2026		

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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