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.:** 2025-26

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	05/07/2025		
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.).	03	19/07/2025		

	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	02/08/2025		
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.	03	23/08/2025		
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider	03	06/09/2025		
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.	03	13/09/2025 &20/09/2025		
7.	a) Design a form with various input fields. b) Implement form validation and error handling.	03	27/09/2025		
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	04/10/2025 &11/10/2025		
9.	a) Add animations to UI elements using Flutter's animation framework. b) Experimen	03	18/10/2025		
10.	a) Fetch data from a REST APL b) Display the fetched data in a meaningful way in the UI.	03	25/10/2025		

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.Sk.Jameer	Dr.S.Jayaprada
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT

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

ACADEMIC YEAR : 2025-26

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	30-06-2025		TLM2	CO1	T1	
2.	Network Types, LAN, MAN, WAN	1	01-07-2025		TLM2	CO1	T1	
3	Network Topologies	1	02-07-2025		TLM2	CO1	T1	
4.	Reference models- The OSI Reference Model	2	04-07-2025 & 07-07-2025		TLM2	CO1	T1	
5.	the TCP/IP Reference Model	1	08-07-2025		TLM2	CO1	T1	
6	A Comparison of the OSI and TCP/IP Reference Models	1	09-07-2025		TLM2	CO1	T1	
7	Physical Layer – Introduction to Guided Media	1	11-07-2025		TLM2	CO1	T1	
8	Twisted-pair cable	1	14-07-2025		TLM2	CO1	T1	
9	Coaxial cable and Fiber optic cable	1	15-07-2025		TLM2	CO1	T1	
10	introduction about unguided media.	2	16-07-2025 & 18-07-2025		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	21-07-2025		TLM2	CO2	T1	
12	Framing: fixed size framing	1	22-07-2025		TLM2	CO2	T1	
13	variable size framing	1	23-07-2025		TLM2	CO2	T1	
14	flow control, error control	2	25-07-2025 & 28-07-2025		TLM2	CO2	T1	
15	error detection and correction codes	2	29-07-2025 & 30-07-2025		TLM2	CO2	T1	
16	CRC	2	01-08-2025 & 04-08-2025		TLM2	CO2	T1	
17	Checksum: idea	1	05-08-2025		TLM2	CO2	T1	
18	one's complement internet checksum	1	06-08-2025		TLM2	CO2	T1	
19	services provided to Network Layer	1	08-08-2025		TLM2	CO2	T1	
20	Elementary Data Link Layer protocols: simplex protocol	2	11-08-2025 & 12-08-2025		TLM2	CO2	T1	
21	Simplex stop and wait, Simplex protocol for Noisy Channel	2	13-08-2025 & 18-08-2025		TLM2	CO2	T1	
22	Sliding window protocol: One bit, Go back N	2	19-08-2025 & 20-08-2025		TLM2	CO2	T1	
23	Selective repeat-Stop and wait protocol	1	22-08-2025		TLM2	CO2	T1	
No. of classes requiredto complete UNIT-II		**19**			No.of classes taken:			
MID EXAMINATIONS (25-08-2025 TO 30-08-2025)								

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	01-09-2025 & 02-09-2025		TLM 2	CO3	T1	
25	Carrier sense multiple access (CSMA)	1	03-09-2025		TLM 2	CO3	T1	
26	CSMA with Collision Detection	1	05-09-2025		TLM 2	CO3	T1	
27	CSMA with Collision Avoidance.	1	08-09-2025		TLM 2	CO3	T1	
28	Channelization: frequency division multiple Access(FDMA)	1	09-09-2025		TLM 2	CO3	T1	
29	time division multiple access(TDMA), code division multiple access(CDMA)	2	10-09-2025 & 12-09-2025		TLM 2	CO3	T1	
30	Wired LANs: Ethernet, Ethernet Protocol	1	15-09-2025		TLM 2	CO3	T1	
31	Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.	2	16-09-2025 & 17-09-2025		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 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	19-09-2025		TLM 2	CO4	T1	
33	Implementation of Connectionless Service-Implementation of Connection Oriented Service	2	22-09-2025		TLM 2	CO4	T1	
34	Comparison of Virtual Circuit and Datagram Networks	1	23-09-2025		TLM 2	CO4	T1	
35	**Routing Algorithms** - The Optimality principle-Shortest path, Flooding, Distance vector	2	24-09-2025 & 26-09-2025		TLM 2	CO4	T1	
36	Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control	1	29-09-2025 & 03-10-2025		TLM 2	CO4	T1	
37	Congestion prevention polices, Traffic Control Algorithm-Leaky bucket & Token bucket.	1	06-10-2025 & 07-10-2025		TLM 2	CO4	T1	
38	**Internet Working:** Network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format	2	08-10-2025 & 10-10-2025		TLM 2	CO4	T1	
39	IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4		13-10-2025 & 14-10-2025		TLM2	CO4	T1	

40	to IPV6, Comparison of IPV4 & IPV6.	2	15-10-2025 & 17-10-2025		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 OutcomeCOs	Text Book followed	HOD Sign Weekly
41	The Transport Layer: Transport layer protocols: Introduction-services- port number	2	20-10-2025 & 22-10-2025		TLM2	CO5	T1	
42	User data gram protocol-User datagram-UDP services-UDP applications	1	24-10-2025		TLM2	CO5	T1	
43	Transmission control protocol: TCP services-TCP features- Segment-A TCP connection	1	27-10-2025		TLM2	CO5	T1	
44	Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture	1	28-10-2025		TLM2	CO5	T1	
45	web based mail- email security	1	29-10-2025		TLM2	CO5	T1	
46	TELENET-local versus remote Logging-Domain Name System	1	31-10-2025		TLM2	CO5	T1	
No. of classes requiredto complete UNIT-V		**7**			**No.of classes taken:**			
MID – II EXAMINATIONS(03-11-2025 – 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, 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.
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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	Mrs. Razeena Begum	Dr.B.Srinivasa Rao	Dr.S.Jayaprada
Signature				

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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: 2025-26**

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.	3	02-07-2025		
2.	Write a Program to implement the data link layer framing methods such as i)Character stuffing ii) bit stuffing.	3	09-07-2025		
3.	Write a Program to implement data link layer farming method checksum.	3	16-07-2025		
4.	Write a program for Hamming Code generation for error detection and correction.	3	23-07-2025		
5.	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16.	3	30-07-2025		
6.	Write a Program to implement Sliding window protocol for Goback N.	3	06-08-2025		
7.	Write a Program to implement Sliding window protocol for Selective repeat.	3	13-08-2025		
8.	Write a Program to implement Stop and Wait Protocol.	3	20-08-2025		
9.	Write a program for congestion control using leaky bucket algorithm	3	10-09-2025		
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	17-09-2025		
11.	Wireshark Packet Capture Using Wire shark Starting Wire shark Viewing Captured Traffic Analysis and Statistics & Filters.	6	24-09-2025 & 08-10-2025		
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	6	15-10-2025& 22-10-2025		

	Packets Dropped by TCP/UDP iv)Simulate to Find the Number of Packets Dropped due to Congestion v)Simulate to Compare Data Rate& Throughput.				
13.	Lab Internal	3	29-10-2025		

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
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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	Mrs.Razeena Begum	Dr.B.Srinivasa Rao	Dr. S.Jayaprada

LAKIREDDY BALIREDDYCOLLEGE OFENGINEERING

(AUTONOMOUS)
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L.B.REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521230.
Phone: 08659-222933, Fax: 08659-222931
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Kamala Priya B, 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(AI&ML) V Sem A/S **A.Y.:** 2025-26

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	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	01-07-2025		TLM2	
2.	Role and potential of new and renewable sources	1	02-07-2025		TLM2	
3.	The solar energy option, Environmental impact of solar power	1	05-07-2025		TLM2	
4.	Structure of the Sun, The solar constant	1	08-07-2025		TLM2	
5.	Sun-earth relationships	1	09-07-2025		TLM2	
6.	Coordinate systems and coordinates of the sun	1	15-07-2025		TLM2	
7.	Extraterrestrial and terrestrial solar radiation	1	16-07-2025		TLM2	
8.	Solar radiation on tilted surface	1	19-07-2025		TLM2	
9.	Instruments for measuring solar radiation and sun shine, Solar radiation data	1	22-07-2025		TLM2	
No. of classes required to complete UNIT-I: 09				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, Module Structure, Packing Density	1	23-07-2025		TLM2	
2.	Interconnenctions, Mismatch and temperature effects	1	29-07-2025		TLM2	
3.	Electrical and Mechanical Insulation, Lifetime of PV modules, Degradation and failure	1	30-07-2025		TLM2	
4.	PV module parameters, Efficiency of PV Systems	1	02-08-2025		TLM2	
5.	Solar PV Systems	1	05-08-2025		TLM2	
6.	Battery Operation, Types of Batteries, Battery parameters, Applications, Selection of batteries for Solar PV System	1	06-08-2025		TLM2	
No. of classes required to complete UNIT-II: 06				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	1	09-08-2025		TLM2	

	plate and concentrating collectors					
2.	Classification of concentrating collectors	1	12-08-2025		TLM2	
3.	Solar Energy Storage and Applications: Different methods	1	13-08-2025		TLM2	
4.	Sensible latent heat and stratified storage, Solar ponds	1	19-08-2025		TLM2	
5.	Solar Applications-solar heating cooling technique	1	20-08-2025		TLM2	
6.	Solar distillation and drying	1	23-08-2025		TLM2	
7.	Solar cookers	1	02-09-2025		TLM2	
8.	Central power tower concept	1	03-09-2025		TLM2	
9.	Solar chimney	1	06-09-2025		TLM2	
No. of classes required to complete UNIT-III: 09				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	09-09-2025		TLM2	
2.	Horizontal and Vertical axis wind mill	1	10-09-2025		TLM2	
3.	Performance characteristics	1	13-09-2025		TLM2	
4.	Betz criteria	1	16-09-2025		TLM2	
5.	Types of winds	1	17-09-2025		TLM2	
6.	Wind data measurement	1	20-09-2025		TLM2	
7.	Bio-mass: Principles of bio-conversion	1	23-09-2025		TLM2	
8.	Anaerobic/aerobic digestion	1	24-09-2025		TLM2	
9.	Types of biogas digesters	1	27-09-2025		TLM2	
10.	Gas yield, Gasifiers	1	01-10-2025		TLM2	
11.	Applications	1	04-10-2025		TLM2	
No. of classes required to complete UNIT-IV:11				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	07-10-2025		TLM2	
2.	Types of Geothermal Resources	1	08-10-2025		TLM2	
3.	Geothermal power generation	1	11-10-2025		TLM2	
4.	Relative merits and demerits	1	14-10-2025		TLM2	
5.	Ocean Energy: Ocean Thermal energy	1	15-10-2025		TLM2	

6.	Open cycle and closed cycle OTEC plants, Environmental impacts	1	18-10-2025		TLM2	
7.	Challenges and applications, Fuel Cells: Introduction, Applications	1	22-10-2025		TLM2	
8.	Classification, Different types of Fuel Cells, Phosphoric Acid fuel cell	1	25-10-2025		TLM2	
9.	Alkaline fuel cell	1	28-10-2025		TLM2	
10.	PEM fuel cell	1	29-10-2025		TLM2	
11.	MC fuel cell	1	01-11-2025		TLM2	
No. of classes required to complete UNIT-V: 11				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	30-06-2025	23-08-2025	8
I MID Examinations	25-08-2025	30-08-2025	1
II Phase of Instructions	01-09-2025	01-11-2025	9
II MID Examinations	03-11-2025	08-11-2025	1
Preparation and Practicals	10-11-2025	15-11-2025	1
Semester End Examinations	17-11-2025	25-11-2025	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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 8	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 9	**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 10	**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 11	**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
Kamala Priya B	Dr. P.Vijay Kumar	Dr. P.Vijay Kumar	Dr. M B S Sreekar Reddy

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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)

PART-A

Name of Course Instructor: Mr.L.Narendra
Course Name & Code : Cloud Computing & 23CS11
L-T-P Structure : **3-0-0** **Credits:** 3
Program/ Sem /Sec : B.Tech/V/A **A.Y.:** 2025-26

PREREQUISITES : **Computer networks, and Operating Systems, Parallel and Distributed Computing**

Course Educational Objectives:

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

Text Books:

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

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. https://www.ibm.com/cloud/learn/cloud-computing
4. https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J NPTEL Cloud Computing
5. https://www.youtube.com/watch?v=Rzzi_CGMIHc Cloud Computing Videos
6. https://www.youtube.com/watch?v=10jm7Waan8M&list=PLdpzxOOAlwvIcxgCUyBHVOcWs0Krjx9xR Azure Course Videos
7. https://www.youtube.com/watch?v=GkKNxyLp_V0&list=PLdpzxOOAlwvLNOxX0RfndiYSt1Le9azze Aws Course Videos
8. https://www.youtube.com/watch?v=jVE7qKWg8mc GCP Course Videos

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: introduction to Cloud Computing Fundamnetals

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.	**Cloud computing at a glance**	2	01-07-2025 01-07-2025		TLM1,2	
2.	**Defining a cloud, cloud computing reference models**	2	03-07-2025 04-07-2025		TLM1,2	
3.	**Types of services (IaaS, PaaS, SaaS)**	2	08-07-2025 08-07-2025		TLM1,2	
4.	**Cloud Deployment models (Public, Private, Hybrid)**	2	10-07-2025 11-07-2025		TLM1,2	
5.	**Utility Computing**	2	15-07-2025 15-07-2025		TLM1,2	
6.	**Cloud Computing characteristics and benefits**	1	17-07-2025		TLM1,2	
7	**Cloud Service Providers (AWS, AZURE, GCP)**	2	18-07-2025 22-07-2025		TLM1,2	
No. of classes required to complete UNIT-I: 13				**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
1.	**Ubiquitous Internet, Parallel and distributed computing**	**2**	**22-07-2025 24-07-2025**		**TLM1,2**	

2.	**Elements of parallel computing**	**1**	**25-07-2025**		**TLM1,2**	
3.	**Hardware architectures for parallel computing (SISD,SIMD,MISD,MIMD)**	**2**	**29-07-2025** **29-07-2025**		**TLM1,2**	
4.	**Elements of distributed computing**	**1**	**31-07-2025**		**TLM1,2**	
5.	**Inter-Process Communication**	**2**	**01-08-2025** **05-08-2025**		**TLM1,2**	
6.	**Technologies for distributed computing**	**2**	**05-08-2025** **07-08-2025**		**TLM1,2**	
7.	**Remote procedure call(RPC)**	**2**	**08-08-2025** **12-08-2025**		**TLM1,2**	
8.	**Service-oriented architecture (SOA)**	**2**	**12-08-2025** **14-08-2025**		**TLM1,2**	
9.	**Web Services**	**2**	**19-08-2025** **19-08-2025**		**TLM1,2**	
10.	**Virtualization**	**2**	**21-08-2025** **22-08-2025**		**TLM1,2**	
No. of classes required to complete UNIT-II: 18				**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
1.	**Characteristics of virtualized environments, Taxonomy of virtualization techniques**	2	02-09-2025 02-09-2025		TLM1,2	
2.	**Virtualization and cloud computing**	1	04-09-2025		TLM1,2	
3.	**Pros and cons of virtualization**	1	05-09-2025		TLM1,2	
4.	**Technology examples(XEN,VMware)**	2	09-09-2025 09-09-2025		TLM1,2	
5.	**Budling blocks of containers**	1	11-09-2025		TLM1,2	
6.	**Container platforms (LXC, Docker)**	2	12-09-2025 16-09-2025		TLM1,2	
7.	**Container orchestration**	2	18-09-2025 19-09-2025		TLM1,2	
8.	**Docker Swarm and Kubernetes**	2	23-09-2025 23-09-2025		TLM1,2	
9.	**Public Cloud VM(EC2)**	1	25-09-2025		TLM1,2	
10.	**Container Offerings (AECR)**	1	26-09-2025		TLM1,2	
No. of classes required to complete UNIT-III: 15				**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
1.	**Economics of the cloud**	1	03-10-2025		TLM1,2	
2.	**Cloud Interoperability and standards**	1	07-10-2025		TLM1,2	
3.	**Scalability and fault tolerance**	1	07-10-2025		TLM1,2	
4.	**Energy efficiency in clouds**	1	09-10-2025		TLM1,2	
5.	**Federated clouds**	1	09-10-2025		TLM1,2	
6.	**Cloud computing security**	1	10-10-2025		TLM1,2	
7.	**Fundamentals of computer security**	1	14-10-2025		TLM1,2	
8.	**Cloud security architecture**	1	14-10-2025		TLM1,2	
9.	**Cloud shared responsibility model**	1	16-10-2025		TLM1,2	
10.	**Security in cloud deployment models**	1	16-10-2025		TLM1,2	
No. of classes required to complete UNIT-IV: 10				**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
1.	**Server less Computing**	1	17-10-2025		TLM1,2	
2.	**Function-as-a-service**	1	17-10-2025		TLM1,2	
3.	**Server less computing architecture**	1	23-10-2025		TLM1,2	
4.	**Public cloud (AWS Lambda) and open-source (Open FaaS) server less platforms**	1	23-10-2025		TLM1,2	
5.	**Internet of Things (IoT), Applications**	1	24-10-2025		TLM1,2	
6.	**Cloud-Centric IoT Layers**	1	24-10-2025		TLM1,2	
7.	**Edge and Fog Computing**	1	24-10-2025		TLM1,2	
8.	**DevOps**	1	28-10-2025		TLM1,2	
9.	**Infrastructure-as-code**	1	28-10-2025		TLM1,2	
10.	**Quantum cloud computing**	1	30-10-2025		TLM1,2	
No. of classes required to complete UNIT-V: 10				**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	30-10-2025		TLM1,2	
2.	**hosting a simple cloud application using Microsoft Azure Web services**	1	31-10-2025		TLM1,2	
3.	**Build a sample docker container**	1	31-10-2025		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

I MID EXAMINATIONS (25-08-2025 TO 30-08-2025)
II MID EXAMINATIONS (03-11-2025 TO 08-11-2025)

PEVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz Examination (UNIT-III, IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2	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	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	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr.L.Narendra**	**Mr.L.Narendra**	**Dr.B.Srinivasa Rao**	**Dr. S.Jayaprada**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

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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: K. RAJASREE
Course Name & Code : INFORMATION RETRIEVAL SYSTEMS & 23AM02
L-T-P Structure : 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 .

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

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**)

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	-	-	-	-	-	-	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.

REFERENCE BOOKS:

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, Hinrich Schütze, 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

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Information storage and retrieval 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.	CEOs and COs discussion, **Introduction:** Domain Analysis of IR systems	1	30/06/2025		1 & 2	
2.	IR and other types of Information Systems	1	01/07/2025		1 & 2	
3.	IR System Evaluation	1	03/07/2025		1 & 2	
4.	Introduction to Data structures	1	05/07/2025		1 & 2	
5.	algorithms related to Information Retrieval	1	07/07/2025		1 & 2	
6.	Basic Concepts	1	08/07/2025		1 & 2	
7.	TUTORIAL	1	10/07/2025		1 & 2	
8.	Basic Concepts Continuation	1	12/07/2025		1 & 2	
9.	Data structures	1	14/07/2025		1 & 2	
10	Algorithms	1	15/07/2025		1 & 2	
11.	Algorithms continuation	1	17/07/2025		1 & 2	
12.	TUTORIAL	1	19/07/2025		1 & 2	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Inverted Files and Signature Files

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction	1	21/07/2025		1 & 2	
14.	Structures used in Inverted Files	1	22/07/2025		1 & 2	
15.	building an Inverted file using a sorted array.	1	24/07/2025		1 & 2	
16.	TUTORIAL	1	28/07/2025		1 & 2	
17.	Modifications to the Basic Techniques	1	29/07/2025		1 & 2	
18.	Signature Files	1	31/07/2025		1 & 2	
19.	Concepts of Signature files	1	02/08/2025		1 & 2	
20.	Compression	1	04/08/2025		1 & 2	
21.	Vertical Partitioning,	1	05/08/2025		1 & 2	
22.	Horizontal Partitioning	1	07/08/2025		1 & 2	
I MID EXAMINATIONS (25-08-2025 TO 30-08-2025)						
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

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

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Introduction	1	09/08/2025		1 & 2	
24.	PAT Tree structure	2	11/08/2025 - 12/08/2025		1 & 2	
25.	Algorithms on the PAT Trees	1	14/08/2025		1 & 2	
26.	Building PAT Trees as PATRICA Trees	2	18/08/2025 – 19/08/2025		1 & 2	
27.	PAT representation as Arrays	1	21/08/2025		1 & 2	
28.	TUTORIAL	1	23/08/2025		1 & 2	
29.	Stop lists	2	01/09/2025 – 02/09/2025		1 & 2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Stemming Algorithms and Thesaurus Construction

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Types of Stemming algorithms	1	04/09/2025		1 & 2	
31.	Experimental Evaluations of Stemming	2	06/09/2025 - 08/09/2025		1 & 2	
32.	TUTORIAL	1	09/09/2025		1 & 2	
33.	Experimental Evaluations of Stemming continuation	2	11/09/2025 - 13/09/2025		1 & 2	
34.	stemming to Compress Inverted Files	2	15/09/2025 - 16/09/2025		1 & 2	
35.	Thesaurus Construction	1	18/09/2025		1 & 2	
36.	Features of Thesauri	2	20/09/2025 - 22/09/2025		1 & 2	
37.	Thesaurus Construction	1	23/09/2025		1 & 2	
38.	Thesaurus construction from Texts	2	25/09/2025 – 04/10/2025		1 & 2	
39.	Merging existing Thesauri	2	06/10/2025 – 07/10/2025		1 & 2	
40.	Merging existing Thesauri continuation	2	09/10/2025 – 11/10/2025		1 & 2	
41.	TUTORIAL	1	13/10/2025		1 & 2	
No. of classes required to complete UNIT-IV: 20				**No. of classes taken:**		

UNIT-V: String Searching Algorithms

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Introduction.	1	14/10/2025		1 & 2	
43.	Preliminaries.	1	16/10/2025		1 & 2	
44.	The Naive Algorithm.	1	18/10/2025		1 & 2	
45.	The Knutt-Morris-Pratt Algorithm.	1	20/10/2025		1 & 2	
46.	The Boyer-Moore Algorithm	1	23/10/2025		1 & 2	

47.	The Shift-Or Algorithm.	1	25/10/2025		1 & 2	
48.	The Shift-Or Algorithm continuation	1	28/10/2025		1 & 2	
49.	The Karp-Rabin Algorithm	1	30/10/2025		1 & 2	
50.	Revision of Algorithms	1	01/11/2025		1 & 2	
II MID EXAMINATIONS (03-11-2025 TO 08-11-2025)						
No. of classes required to complete UNIT-V: 09				**No. of classes taken:**		

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. RAJASREE**	**K. RAJASREE**	**K. RAJASREE**	**Dr. S. JAYAPRADA**
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT
PART-A

Name of Course Instructor: K. Rajasree
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 Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Information Retrieval	3	03/07/2025		TLM4	
2	Experiment - 01	6	10/07/2025 - 17/07/2025		TLM4	
3	Experiment - 02	6	24/07/2025 - 31/07/2025		TLM4	
4	Experiment - 03	6	07/08/2025 – 14/08/2025		TLM4	
5	Experiment - 04	6	21/08/2025 – 28/08/2025		TLM4	
6	Experiment – 05	6	04/09/2025 – 11/09/2025		TLM4	
7	Experiment – 06	3	18/09/2025		TLM4	
8	Experiment – 07	3	25/09/2025		TLM4	
9	Experiment – 08	3	09/10/2025		TLM4	
10	Experiment – 09	3	16/10/2025		TLM4	
11	Experiment – 10	3	23/10/2025		TLM4	
12	Internal Exam	3	30/10/2025		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 engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. RAJASREE**	**K. RAJASREE**	**K. RAJASREE**	**Dr. S. JAYAPRADA**
Signature				

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

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor	: Dr S Jayaprada	
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 : 2025-26

PREREQUISITE: Knowledge of Computer fundamentals, Data structures & Algorithms

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

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

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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		

TEXT BOOKS:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4 th Edition, Pearson , 2016

Reference Books:

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

Online Learning Resources:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Operating Systems

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Operating systems	1	01-07-2025		TLM1 TLM2	
2.	operating system functions, operating systems operations	1	02-07-2025		TLM1 TLM2	
3.	Computing environments	1	04-07-2025		TLM1 TLM2	
4.	Free and Open-Source Operating Systems	1	05-07-2025		TLM1 TLM2	
5.	System Structures: Operating System Services	1	08-07-2025		TLM1 TLM2	
6.	System programs, System calls	1	09-07-2025		TLM1 TLM2	
7.	Tutorial	1	11-07-2025		TLM3	
8.	Types of System Calls, system programs	2	12-07-2025 15-07-2025		TLM1 TLM2	
9.	operating system Design and Implementation	1	12-07-2025		TLM1 TLM2	
10.	Building and Booting an Operating System	2	16-07-2025 18-07-2025		TLM1 TLM2	
11.	Operating system debugging	1	19-07-2025		TLM1 TLM2	
12.	Tutorial	2	22-07-2025 23-07-2025		TLM3	
No. of classes required to complete UNIT-I: 15				**No. of classes taken:**		

UNIT-II: Process Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Processes: Process Concept,	2	25-07-2025 29-07-2025		TLM1 TLM2	
14.	Process scheduling	2	30-07-2025 01-08-2025		TLM1 TLM2	
15.	Operations on processes	1	02-08-2025		TLM1 TLM2	
16.	Inter-process communication systems	1	05-08-2025		TLM1 TLM2	
17.	Threads and Concurrency: Multithreading models	2	06-08-2025 08-08-2025		TLM1 TLM2	
18.	Thread libraries and Thread issues	2	09-08-2025 &12-08-2025		TLM1 TLM2	
19.	CPU Scheduling: Basic concepts	1	13-08-2025		TLM1 TLM2	
20.	Scheduling Criteria	1	19-08-2025		TLM1 TLM2	
21.	Scheduling algorithms	1	20-08-2025		TLM1 TLM2	
22.	Multiple processor scheduling	1	22-08-2025		TLM1 TLM2	
23.	Tutorial	1	23-08-2025		TLM3	
No. of classes required to complete UNIT-II: 15				**No. of classes taken:**		

MID - I (25.08.2025 TO 30.08.2025)

UNIT-III: Synchronization Tools

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Synchronization Tools: The Critical section problem, Peterson's solutions	2	02-09-2025 03-09-2025		TLM1 TLM2	
25.	Mutex Locks	1	05-09-2025		TLM1 TLM2	
26.	Semaphores	2	06-09-2025 09-09-2025		TLM1 TLM2	
27.	Monitors	2	10-09-2025 12-09-2025		TLM1 TLM2	
28.	Classic problems of Synchronization	1	13-09-2025		TLM1 TLM2	
29.	Synchronization examples	1	16-09-2025		TLM1 TLM2	
30.	Deadlocks: System model and deadlock characterization	1	17-09-2025		TLM1 TLM2	

31.	Methods for Handling deadlocks and deadlock prevention	1	19-09-2025		TLM1 TLM2
32.	Deadlock Avoidance	2	20-09-2025 23-09-2025		TLM1 TLM2
33.	Deadlock detection	1	24-09-2025		TLM1 TLM2
34.	Recovery from deadlock	1	26-09-2025		TLM1 TLM2
No. of classes required to complete UNIT-III: 15				**No. of classes taken:**	

UNIT-IV: Memory management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Memory-Management Strategies: Introduction	1	27-09-2025		TLM1 TLM2	
36.	Contiguous Memory Allocation	1	29-09-2025		TLM1 TLM2	
37.	Paging and structure of a page table	1	01-10-2025		TLM1 TLM2	
38.	Swapping	1	01-10-2025		TLM1 TLM2	
39.	Virtual Memory Management: Introduction, Demand paging and Copy-on-write	1	03-10-2025		TLM1 TLM2	
40.	Page replacement	2	04-10-2025 07-10-2025		TLM1 TLM2	
41.	Allocation of frames	1	08-10-2025		TLM1 TLM2	
42.	Thrashing	1	10-10-2025		TLM1 TLM2	
43.	Tutorial	1	11-10-2025		TLM3	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: File System Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	File System: File System Interface: File concept, Access methods and Directory Structure	1	14-10-2025		TLM1 TLM2	
46.	File system Implementation: File-system structure	1	15-10-2025		TLM1 TLM2	
47.	File-system Operations	1	17-10-2025		TLM1 TLM2	
48.	Allocation method, Free space management	1	18-10-2025		TLM1 TLM2	
49.	File-System Internals: File-System Mounting	1	22-10-2025		TLM1 TLM2	
50.	Partitions and Mounting and File Sharing	1	24-10-2025		TLM1 TLM2	
51.	Protection: Goals of protection	1	25-10-2025		TLM1 TLM2	
52.	Principles of protection	1	28-10-2025		TLM1 TLM2	
53.	Protection Rings	1	29-10-2025		TLM1 TLM2	
54.	Domain of protection and Access matrix	1	31-10-2025		TLM1 TLM2	
55	Tutorial	1	01-11-2025		TLM3	
No. of classes required to complete UNIT-V: 11				**No. of classes taken:**		

MID - II (03.11.2025 TO 08.11.2025)

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

PART-C
EVALUATION PROCESS (R23 Regulation)

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, 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 and designsystem 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 withan 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 solutionsin 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 inindependent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (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	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr S Jayaprada**	**Dr S Jayaprada**	**Dr S Jayaprada**	**Dr. S. Jayaprada**
Signature				

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.
hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222 933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr B.SRINIVASARAO
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.:** 2025-26

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	30-07-2025		**DM5**	
2.	JDBC Programs	3	07-07-2025		**DM5**	
3.	Servlet Programs	3	14-07-2025		**DM5**	
4.	JSP Introduction	3	21-07-2025		**DM5**	
5.	JSP MVC programs	6	38-07-2025 04-08-2025		**DM5**	
6.	Node JS Introduction	3	11-08-2025		**DM5**	
7.	Express JS Framework	3	18-08-2025		**DM5**	
8.	Node JS & Express JS Programs	6	25-08-2025 01-09-2025		**DM5**	
9.	MangoDB	3	08-09-2025		**DM5**	
10.	MangoDB with Express JS	3	15-09-2025		**DM5**	
11.	React JS	3	22-09-2025		**DM5**	
12.	React JS and Full stack Integration	3	29-09-2025		**DM5**	
13.	Web Application Development	3	13-10-2025		**DM5**	
14.	Internal Test	3	20-10-2025		**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.B.SRINIVASARAO			Dr. S.Jayapradha
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)

COURSE HANDOUT

PART-A

Name of Course Instructor	: D Mangamma	
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 : 2025-26

PREREQUISITE: Knowledge of Computer fundamentals, Data structures & Algorithms

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

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

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

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

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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		

TEXT BOOKS:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4 th Edition, Pearson , 2016

Reference Books:

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

Online Learning Resources:

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Operating Systems

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Operating systems	1	01-07-2025		TLM1 TLM2	
2.	operating system functions, operating systems operations	1	02-07-2025		TLM1 TLM2	
3.	Computing environments	1	04-07-2025		TLM1 TLM2	
4.	Free and Open-Source Operating Systems	1	05-07-2025		TLM1 TLM2	
5.	System Structures: Operating System Services	1	08-07-2025		TLM1 TLM2	
6.	System programs, System calls	1	09-07-2025		TLM1 TLM2	
7.	Tutorial	1	11-07-2025		TLM3	
8.	Types of System Calls, system programs	2	12-07-2025 15-07-2025		TLM1 TLM2	
9.	operating system Design and Implementation	1	12-07-2025		TLM1 TLM2	
10.	Building and Booting an Operating System	2	16-07-2025 18-07-2025		TLM1 TLM2	
11.	Operating system debugging	1	19-07-2025		TLM1 TLM2	
12.	Tutorial	2	22-07-2025 23-07-2025		TLM3	
No. of classes required to complete UNIT-I: 15				**No. of classes taken:**		

UNIT-II: Process Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Processes: Process Concept,	2	25-07-2025 29-07-2025		TLM1 TLM2	
14.	Process scheduling	2	30-07-2025 01-08-2025		TLM1 TLM2	
15.	Operations on processes	1	02-08-2025		TLM1 TLM2	
16.	Inter-process communication systems	1	05-08-2025		TLM1 TLM2	
17.	Threads and Concurrency: Multithreading models	2	06-08-2025 08-08-2025		TLM1 TLM2	
18.	Thread libraries and Thread issues	2	09-08-2025 &12-08-2025		TLM1 TLM2	
19.	CPU Scheduling: Basic concepts	1	13-08-2025		TLM1 TLM2	
20.	Scheduling Criteria	1	19-08-2025		TLM1 TLM2	
21.	Scheduling algorithms	1	20-08-2025		TLM1 TLM2	
22.	Multiple processor scheduling	1	22-08-2025		TLM1 TLM2	
23.	Tutorial	1	23-08-2025		TLM3	
No. of classes required to complete UNIT-II: 15				**No. of classes taken:**		

MID - I (25.08.2025 TO 30.08.2025)

UNIT-III: Synchronization Tools

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Synchronization Tools: The Critical section problem, Peterson's solutions	2	02-09-2025 03-09-2025		TLM1 TLM2	
25.	Mutex Locks	1	05-09-2025		TLM1 TLM2	
26.	Semaphores	2	06-09-2025 09-09-2025		TLM1 TLM2	
27.	Monitors	2	10-09-2025 12-09-2025		TLM1 TLM2	
28.	Classic problems of Synchronization	1	13-09-2025		TLM1 TLM2	
29.	Synchronization examples	1	16-09-2025		TLM1 TLM2	
30.	Deadlocks: System model and deadlock characterization	1	17-09-2025		TLM1 TLM2	

31.	Methods for Handling deadlocks and deadlock prevention	1	19-09-2025		TLM1 TLM2	
32.	Deadlock Avoidance	2	20-09-2025 23-09-2025		TLM1 TLM2	
33.	Deadlock detection	1	24-09-2025		TLM1 TLM2	
34.	Recovery from deadlock	1	26-09-2025		TLM1 TLM2	
No. of classes required to complete UNIT-III: 15				**No. of classes taken:**		

UNIT-IV: Memory management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	Memory-Management Strategies: Introduction	1	27-09-2025		TLM1 TLM2	
36.	Contiguous Memory Allocation	1	29-09-2025		TLM1 TLM2	
37.	Paging and structure of a page table	1	01-10-2025		TLM1 TLM2	
38.	Swapping	1	01-10-2025		TLM1 TLM2	
39.	Virtual Memory Management: Introduction, Demand paging and Copy-on-write	1	03-10-2025		TLM1 TLM2	
40.	Page replacement	2	04-10-2025 07-10-2025		TLM1 TLM2	
41.	Allocation of frames	1	08-10-2025		TLM1 TLM2	
42.	Thrashing	1	10-10-2025		TLM1 TLM2	
43.	Tutorial	1	11-10-2025		TLM3	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: File System Management

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	File System: File System Interface: File concept, Access methods and Directory Structure	1	14-10-2025		TLM1 TLM2	
46.	File system Implementation: File-system structure	1	15-10-2025		TLM1 TLM2	
47.	File-system Operations	1	17-10-2025		TLM1 TLM2	
48.	Allocation method, Free space management	1	18-10-2025		TLM1 TLM2	
49.	File-System Internals: File-System Mounting	1	22-10-2025		TLM1 TLM2	
50.	Partitions and Mounting and File Sharing	1	24-10-2025		TLM1 TLM2	
51.	Protection: Goals of protection	1	25-10-2025		TLM1 TLM2	
52.	Principles of protection	1	28-10-2025		TLM1 TLM2	
53.	Protection Rings	1	29-10-2025		TLM1 TLM2	
54.	Domain of protection and Access matrix	1	31-10-2025		TLM1 TLM2	
55	Tutorial	1	01-11-2025		TLM3	
No. of classes required to complete UNIT-V: 11				**No. of classes taken:**		

MID - II (03.11.2025 TO 08.11.2025)

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

PART-C
EVALUATION PROCESS (R23 Regulation)

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
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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.
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PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Design and develop 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	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**D.Mangamma**	**Dr S Jayaprada**	**Dr S Jayaprada**	**Dr. S. Jayaprada**
Signature				

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L.B.REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521230.

Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE

HANDOUT PART-A

Name of Course Instructor : Kamala Priya B, 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 (AI&ML) V Sem B/S **A.Y.:** 2025-26

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	30-06-2025		*TLM2*	
2.	Role and potential of new and renewable sources	1	03-07-2025		*TLM2*	
3.	The solar energy option, Environmental impact of solar power	1	05-07-2025		*TLM2*	
4.	Structure of the Sun, The solar constant	1	07-07-2025		*TLM2*	
5.	Sun-earth relationships	1	10-07-2025		*TLM2*	
6.	Coordinate systems and coordinates of the sun	1	14-07-2025		*TLM2*	
7.	Extraterrestrial and terrestrial solar radiation	1	17-07-2025		*TLM2*	
8.	Solar radiation on tilted surface	1	19-07-2025		*TLM2*	
9.	Instruments for measuring solar radiation and sun shine, Solar radiation data	1	21-07-2025		*TLM2*	
No. of classes required to complete UNIT-I: 09				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, Module Structure, Packing Density*	1	24-07-2025		*TLM2*	
2.	*Interconnenctions, Mismatch and temperature effects*	1	28-07-2025		*TLM2*	
3.	*Electrical and Mechanical Insulation, Lifetime of PV modules, Degradation and failure*	1	31-07-2025		*TLM2*	
4.	*PV module parameters, Efficiency of PV Systems*	1	02-08-2025		*TLM2*	
5.	*Solar PV Systems*	1	04-08-2025		*TLM2*	
6.	*Battery Operation, Types of Batteries, Battery parameters, Applications, Selection of batteries for Solar PV System*	1	07-08-2025		*TLM2*	
No. of classes required to complete UNIT-II: 06				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*	1	11-08-2025		*TLM2*	
	collectors					

2.	*Classification of concentrating collectors*	1	14-08-2025		*TLM2*	
3.	*Solar Energy Storage and Applications: Different methods*	1	18-08-2025		*TLM2*	
4.	*Sensible latent heat and stratified storage, Solar ponds*	1	21-08-2025		*TLM2*	
5.	*Solar Applications-solar heating cooling technique*	1	23-08-2025		*TLM2*	
6.	*Solar distillation and drying*	1	01-09-2025		*TLM2*	
7.	Solar cookers	1	04-09-2025		*TLM2*	
8.	*Central power tower concept*	1	06-09-2025		*TLM2*	
9.	*Solar chimney*	1	08-09-2025		*TLM2*	
No. of classes required to complete UNIT-III: 09				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	11-09-2025		*TLM2*	
2.	Horizontal and Vertical axis wind mill	1	13-09-2025		*TLM2*	
3.	Performance characteristics	1	15-09-2025		*TLM2*	
4.	Betz criteria	1	18-09-2025		*TLM2*	
5.	Types of winds	1	20-09-2025		*TLM2*	
6.	Wind data measurement	1	22-09-2025		*TLM2*	
7.	Bio-mass: Principles of bio-conversion	1	25-09-2025		*TLM2*	
8.	*Anaerobic/aerobic digestion*	1	27-09-2025		*TLM2*	
9.	Types of biogas digesters	1	29-09-2025		*TLM2*	
10.	Gas yield, Gasifiers	1	04-10-2025		*TLM2*	
11.	Applications	1	06-10-2025		*TLM2*	
No. of classes required to complete UNIT-IV:11				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	09-10-2025		*TLM2*	
2.	*Types of Geothermal Resources*	1	11-10-2025		*TLM2*	
3.	*Geothermal power generation*	1	13-10-2025		*TLM2*	
4.	Relative merits and demerits	1	16-10-2025		*TLM2*	
5.	Ocean Energy: Ocean Thermal energy	1	18-10-2025		*TLM2*	

6.	Open cycle and closed cycle OTEC plants, Environmental impacts	1	20-10-2025		*TLM2*	
7.	Challenges and applications, Fuel Cells: Introduction, Applications	1	23-10-2025		*TLM2*	
8.	Classification, Different types of Fuel Cells, Phosphoric Acid fuel cell	1	25-10-2025		*TLM2*	
9.	Alkaline fuel cell	1	27-10-2025		*TLM2*	
10.	PEM fuel cell	1	30-10-2025		*TLM2*	
11.	MC fuel cell	1	01-11-2025		*TLM2*	
No. of classes required to complete UNIT-V: 11				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	30-06-2025	23-08-2025	8
I MID Examinations	25-08-2025	30-08-2025	1
II Phase of Instructions	01-09-2025	01-11-2025	9
II MID Examinations	03-11-2025	08-11-2025	1
Preparation and Practicals	10-11-2025	15-11-2025	1
Semester End Examinations	17-11-2025	25-11-2025	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
Kamala Priya B	Dr. P.Vijay Kumar	Dr. P.Vijay Kumar	Dr. M B S Sreekar Reddy

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

hodcse@lbrce.ac.in, cseoffice@lbrce.ac.in, Phone: 08659-222 933, 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.:** *2025-26*

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	05/07/2025		
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.).	03	19/07/2025		

	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	02/08/2025		
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.	03	23/08/2025		
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider	03	06/09/2025		
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.	03	13/09/2025 &20/09/2025		
7.	a) Design a form with various input fields. b) Implement form validation and error handling.	03	27/09/2025		
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	04/10/2025 &11/10/2025		
9.	a) Add animations to UI elements using Flutter's animation framework. b) Experimen	03	18/10/2025		
10.	a) Fetch data from a REST APL b) Display the fetched data in a meaningful way in the UI.	03	25/10/2025		

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.Siva RamaKrishna	Dr.Y.VijayaBhaskarReddy	Dr.S.Jayaprada
Signature				

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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)

PART-A

Name of Course Instructor: *Mr.L.Narendra*
Course Name & Code : *Cloud Computing & 23CS11*
L-T-P Structure : **3-0-0** **Credits:** *3*
Program/ Sem /Sec *: B.Tech/V/A* **A.Y.:** *2025-26*

PREREQUISITES : **Computer networks, and Operating Systems, Parallel and Distributed Computing**

Course Educational Objectives:

- 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 to 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)**

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

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

Text Books:

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

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. https://www.ibm.com/cloud/learn/cloud-computing
4. https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J NPTEL Cloud Computing
5. https://www.youtube.com/watch?v=Rzzi_CGMIHc Cloud Computing Videos
6. https://www.youtube.com/watch?v=10jm7Waan8M&list=PLdpzxOOAlwvIcxgCUyBHVOcWs0Krjx9xR Azure Course Videos
7. https://www.youtube.com/watch?v=GkKNxyLp_V0&list=PLdpzxOOAlwvLNOxX0RfndiYSt1Le9azze Aws Course Videos
8. https://www.youtube.com/watch?v=jVE7qKWg8mc GCP Course Videos

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: introduction to Cloud Computing Fundamnetals

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.	**Cloud computing at a glance**	2	01-07-2025 01-07-2025		TLM1,2	
2.	**Defining a cloud, cloud computing reference models**	2	03-07-2025 04-07-2025		TLM1,2	
3.	**Types of services (IaaS, PaaS, SaaS)**	2	08-07-2025 08-07-2025		TLM1,2	
4.	**Cloud Deployment models (Public, Private, Hybrid)**	2	10-07-2025 11-07-2025		TLM1,2	
5.	**Utility Computing**	2	15-07-2025 15-07-2025		TLM1,2	
6.	**Cloud Computing characteristics and benefits**	1	17-07-2025		TLM1,2	
7	**Cloud Service Providers (AWS, AZURE, GCP)**	2	18-07-2025 22-07-2025		TLM1,2	
No. of classes required to complete UNIT-I: 13				**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
1.	**Ubiquitous Internet, Parallel and distributed computing**	**2**	**22-07-2025 24-07-2025**		**TLM1,2**	

2.	**Elements of parallel computing**	**1**	**25-07-2025**		**TLM1,2**	
3.	**Hardware architectures for parallel computing (SISD,SIMD,MISD,MIMD)**	**2**	**29-07-2025** **29-07-2025**		**TLM1,2**	
4.	**Elements of distributed computing**	**1**	**31-07-2025**		**TLM1,2**	
5.	**Inter-Process Communication**	**2**	**01-08-2025** **05-08-2025**		**TLM1,2**	
6.	**Technologies for distributed computing**	**2**	**05-08-2025** **07-08-2025**		**TLM1,2**	
7.	**Remote procedure call(RPC)**	**2**	**08-08-2025** **12-08-2025**		**TLM1,2**	
8.	**Service-oriented architecture (SOA)**	**2**	**12-08-2025** **14-08-2025**		**TLM1,2**	
9.	**Web Services**	**2**	**19-08-2025** **19-08-2025**		**TLM1,2**	
10.	**Virtualization**	**2**	**21-08-2025** **22-08-2025**		**TLM1,2**	
No. of classes required to complete UNIT-II: 18				**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
1.	**Characteristics of virtualized environments, Taxonomy of virtualization techniques**	2	02-09-2025 02-09-2025		TLM1,2	
2.	**Virtualization and cloud computing**	1	04-09-2025		TLM1,2	
3.	**Pros and cons of virtualization**	1	05-09-2025		TLM1,2	
4.	**Technology examples(XEN,VMware)**	2	09-09-2025 09-09-2025		TLM1,2	
5.	**Budling blocks of containers**	1	11-09-2025		TLM1,2	
6.	**Container platforms (LXC, Docker)**	2	12-09-2025 16-09-2025		TLM1,2	
7.	**Container orchestration**	2	18-09-2025 19-09-2025		TLM1,2	
8.	**Docker Swarm and Kubernetes**	2	23-09-2025 23-09-2025		TLM1,2	
9.	**Public Cloud VM(EC2)**	1	25-09-2025		TLM1,2	

10.	**Container Offerings (AECR)**	1	26-09-2025		TLM1,2	
No. of classes required to complete UNIT-III: 15				**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
1.	**Economics of the cloud**	1	03-10-2025		TLM1,2	
2.	**Cloud Interoperability and standards**	1	07-10-2025		TLM1,2	
3.	**Scalability and fault tolerance**	1	07-10-2025		TLM1,2	
4.	**Energy efficiency in clouds**	1	09-10-2025		TLM1,2	
5.	**Federated clouds**	1	09-10-2025		TLM1,2	
6.	**Cloud computing security**	1	10-10-2025		TLM1,2	
7.	**Fundamentals of computer security**	1	14-10-2025		TLM1,2	
8.	**Cloud security architecture**	1	14-10-2025		TLM1,2	
9.	**Cloud shared responsibility model**	1	16-10-2025		TLM1,2	
10.	**Security in cloud deployment models**	1	16-10-2025		TLM1,2	
No. of classes required to complete UNIT-IV: 10				**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
1.	**Server less Computing**	1	17-10-2025		TLM1,2	
2.	**Function-as-a-service**	1	17-10-2025		TLM1,2	
3.	**Server less computing architecture**	1	23-10-2025		TLM1,2	
4.	**Public cloud (AWS Lambda) and open-source (Open FaaS) server less platforms**	1	23-10-2025		TLM1,2	
5.	**Internet of Things (IoT), Applications**	1	24-10-2025		TLM1,2	
6.	**Cloud-Centric IoT Layers**	*1*	24-10-2025		TLM1,2	
7.	**Edge and Fog Computing**	*1*	24-10-2025		TLM1,2	
8.	**DevOps**	*1*	28-10-2025		TLM1,2	
9.	**Infrastructure-as-code**	*1*	28-10-2025		TLM1,2	
10.	**Quantum cloud computing**	*1*	30-10-2025		TLM1,2	
No. of classes required to complete UNIT-V: 10				**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*	30-10-2025		TLM1,2	
2.	**hosting a simple cloud application using Microsoft Azure Web services**	*1*	31-10-2025		TLM1,2	
3.	**Build a sample docker container**	*1*	31-10-2025		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

I MID EXAMINATIONS (25-08-2025 TO 30-08-2025)
II MID EXAMINATIONS (03-11-2025 TO 08-11-2025)

PEVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

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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 : 2025-26

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	30-06-2025		TLM2	CO1	T1	
2.	Network Types, LAN, MAN, WAN	1	01-07-2025		TLM2	CO1	T1	
3	Network Topologies	1	03-07-2025		TLM2	CO1	T1	
4.	Reference models- The OSI Reference Model	2	05-07-2025 & 07-07-2025		TLM2	CO1	T1	
5.	the TCP/IP Reference Model	1	08-07-2025		TLM2	CO1	T1	
6	A Comparison of the OSI and TCP/IP Reference Models	1	10-07-2025		TLM2	CO1	T1	
7	Physical Layer – Introduction to Guided Media	1	12-07-2025		TLM2	CO1	T1	
8	Twisted-pair cable	1	14-07-2025		TLM2	CO1	T1	
9	Coaxial cable and Fiber optic cable	1	15-07-2025		TLM2	CO1	T1	
10	introduction about unguided media.	2	17-07-2025 & 19-07-2025		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	21-07-2025		TLM2	CO2	T1	
12	Framing: fixed size framing	1	22-07-2025		TLM2	CO2	T1	
13	variable size framing	1	24-07-2025		TLM2	CO2	T1	
14	flow control, error control	2	24-07-2025 & 28-07-2025		TLM2	CO2	T1	
15	error detection and correction codes	2	29-07-2025 & 31-07-2025		TLM2	CO2	T1	
16	CRC	2	02-08-2025 & 04-08-2025		TLM2	CO2	T1	
17	Checksum: idea	1	05-08-2025		TLM2	CO2	T1	
18	one's complement internet checksum	1	07-08-2025		TLM2	CO2	T1	
19	services provided to Network Layer	1	09-08-2025		TLM2	CO2	T1	
20	Elementary Data Link Layer protocols: simplex protocol	2	11-08-2025 & 12-08-2025		TLM2	CO2	T1	
21	Simplex stop and wait, Simplex protocol for Noisy Channel	2	14-08-2025 & 18-08-2025		TLM2	CO2	T1	
22	Sliding window protocol: One bit, Go back N	2	19-08-2025 & 21-08-2025		TLM2	CO2	T1	
23	Selective repeat-Stop and wait protocol	1	23-08-2025		TLM2	CO2	T1	
No. of classes required to complete UNIT-II		**19**			No.of classes taken:			
MID EXAMINATIONS (25-08-2025 TO 30-08-2025)								

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	01-09-2025 & 02-09-2025		TLM 2	CO3	T1	
25	Carrier sense multiple access (CSMA)	1	04-09-2025		TLM 2	CO3	T1	
26	CSMA with Collision Detection	1	06-09-2025		TLM 2	CO3	T1	
27	CSMA with Collision Avoidance.	1	08-09-2025		TLM 2	CO3	T1	
28	Channelization: frequency division multiple Access(FDMA)	1	09-09-2025		TLM 2	CO3	T1	
29	time division multiple access(TDMA), code division multiple access(CDMA)	2	11-09-2025 & 13-09-2025		TLM 2	CO3	T1	
30	Wired LANs: Ethernet, Ethernet Protocol	1	15-09-2025		TLM 2	CO3	T1	
31	Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.	2	16-09-2025 & 18-09-2025		TLM 2	CO3	T1	
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	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	19-09-2025		TLM 2	CO4	T1	
33	Implementation of Connectionless Service- Implementation of Connection Oriented Service	2	22-09-2025		TLM 2	CO4	T1	
34	Comparison of Virtual Circuit and Datagram Networks	1	23-09-2025		TLM 2	CO4	T1	
35	Routing Algorithms - The Optimality principle-Shortest path, Flooding, Distance vector	2	24-09-2025 & 26-09-2025		TLM 2	CO4	T1	
36	Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control	1	29-09-2025 & 03-10-2025		TLM 2	CO4	T1	
37	Congestion prevention polices, Traffic Control Algorithm-Leaky bucket & Token bucket.	1	06-10-2025 & 07-10-2025		TLM 2	CO4	T1	
38	Internet Working: Network layer in the internet – IP protocols- IP Version 4 protocol- IPV4 Header Format	2	08-10-2025 & 10-10-2025		TLM 2	CO4	T1	
39	IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6- The main IPV6 header,	2	13-10-2025 & 14-10-2025		TLM2	CO4	T1	
40	Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.	2	15-10-2025		TLM2	CO4	T1	

			& 17-10-2025					
No. of classes required to 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	20-10-2025 & 22-10-2025		TL M2	CO5	T1	
42	User data gram protocol-User datagram-UDP services-UDP applications	1	24-10-2025		TL M2	CO5	T1	
43	Transmission control protocol: TCP services-TCP features-Segment- A TCP connection	1	27-10-2025		TL M2	CO5	T1	
44	Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture	1	28-10-2025		TLM2	CO5	T1	
45	web based mail- email security	1	29-10-2025		TLM2	CO5	T1	
46	TELENET-local versus remote Logging-Domain Name System	1	31-10-2025		TLM2	CO5	T1	
No. of classes required to complete UNIT-V		**7**			**No.of classes taken:**			
MID – II EXAMINATIONS(03-11-2025 – 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, 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 health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,health,safety,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 community and 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 manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	Mrs. Razeena Begum	Dr.B.Sivaramakrishna	Dr.D.Venkata Subbaiah	Dr.S.Jayaprada

Signature				

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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: 2025-26**

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.	3	03-07-2025		
2.	Write a Program to implement the data link layer framing methods such as i)Character stuffing ii) bit stuffing.	3	10-07-2025		
3.	Write a Program to implement data link layer farming method checksum.	3	17-07-2025		
4.	Write a program for Hamming Code generation for error detection and correction.	3	24-07-2025		
5.	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16.	3	31-07-2025		
6.	Write a Program to implement Sliding window protocol for Goback N.	3	07-08-2025		
7.	Write a Program to implement Sliding window protocol for Selective repeat.	3	14-08-2025		
8.	Write a Program to implement Stop and Wait Protocol.	3	21-08-2025		
9.	Write a program for congestion control using leaky bucket algorithm	3	11-09-2025		
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	18-09-2025		
11.	Wireshark Packet Capture Using Wire shark Starting Wire shark Viewing Captured Traffic Analysis and Statistics & Filters.	6	25-09-2025 & 09-10-2025		

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.	6	16-10-2025& 23-10-2025		
13.	Lab Internal	3	30-10-2025		

PROGRAMME OUTCOMES (POs):

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Programming Paradigms: To inculcate algorithmic thinking, formulation techniques and visualization, leading to problem solving skills using different programming paradigms. 2. Data Engineering: To inculcate an ability to Analyze, Design and implement data driven applications into 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 driven applications 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.Sivaramakrishna	Dr. D.Venakata Subbaiah	Dr. S.Jayaprada

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

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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: *K. RAJASREE*
Course Name & Code : *INFORMATION RETRIEVAL SYSTEMS & 23AM02*
L-T-P Structure : *3-0-0* **Credits:** *3*
Program/Sem/Sec *: III 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.

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

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***)*

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	-	-	-	-	-	-	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.*

REFERENCE BOOKS:

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, Hinrich Schütze, 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

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Information storage and retrieval 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.	*CEOs and COs discussion,* **Introduction:** *Domain Analysis of IR systems*	1	30/06/2025		1 & 2	
2.	*IR and other types of Information Systems*	1	01/07/2025		1 & 2	
3.	*IR System Evaluation*	2	04/07/2025 - 05/07/2025		1 & 2	
4.	*Introduction to Data structures*	1	07/07/2025		1 & 2	
5.	*algorithms related to Information Retrieval*	2	08/07/2025 - 11/07/2025		1 & 2	
6.	*Basic Concepts*	1	12/07/2025		1 & 2	
7.	*TUTORIAL*	1	14/07/2025		1 & 2	
8.	*Basic Concepts Continuation*	1	15/07/2025		1 & 2	
9.	*Data structures*	2	18/07/2025 - 19/07/2025		1 & 2	
10	*Algorithms*	2	21/07/2025 - 22/07/2025		1 & 2	
11.	*Algorithms continuation*	2	25/07/2025 - 28/07/2025		1 & 2	
12.	*TUTORIAL*	1	29/07/2025		1 & 2	
No. of classes required to complete UNIT-I: 17				**No. of classes taken:**		

UNIT-II: Inverted Files and Signature Files

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	*Introduction*	1	01/08/2025		1 & 2	
14.	*Structures used in Inverted Files*	2	02/08/2025 - 04/08/2025		1 & 2	
15.	*building an Inverted file using a sorted array.*	1	05/08/2025		1 & 2	
16.	*TUTORIAL*	1	08/08/2025		1 & 2	
17.	*Modifications to the Basic Techniques*	1	09/08/2025		1 & 2	
18.	*Signature Files*	1	11/08/2025		1 & 2	
19.	*Concepts of Signature files*	1	19/08/2025		1 & 2	
20.	*Compression*	1	22/08/2025		1 & 2	
21.	*Vertical Partitioning,*	1	23/08/2025		1 & 2	
22.	*Horizontal Partitioning*	1	23/08/2025		1 & 2	
I MID EXAMINATIONS (25-08-2025 TO 30-08-2025)						
No. of classes required to complete UNIT-II: 11				**No. of classes taken:**		

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

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	*Introduction*	*1*	*01/09/2025*		*1 & 2*	
24.	*PAT Tree structure*	*2*	*02/09/2025 – 05/09/2025*		*1 & 2*	
25.	*Algorithms on the PAT Trees*	*1*	*06/09/2025*		*1 & 2*	
26.	*Building PAT Trees as PATRICA Trees*	*2*	*08/09/2025 – 09/09/2025*		*1 & 2*	
27.	*PAT representation as Arrays*	*2*	*12/09/2025 – 13/09/2025*		*1 & 2*	
28.	*TUTORIAL*	*1*	*15/09/2025*		*1 & 2*	
29.	*Stop lists*	*2*	*16/09/2025 – 19/09/2025*		*1 & 2*	

No. of classes required to complete UNIT-III: 11	No. of classes taken:

UNIT-IV: Stemming Algorithms and Thesaurus Construction

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	*Types of Stemming algorithms*	*1*	*20/09/2025*		*1 & 2*	
31.	*Experimental Evaluations of Stemming*	*1*	*22/09/2025*		*1 & 2*	
32.	*TUTORIAL*	*1*	*23/09/2025*		*1 & 2*	
33.	*Experimental Evaluations of Stemming continuation*	*1*	*03/10/2025*		*1 & 2*	
34.	*stemming to Compress Inverted Files*	*1*	*04/10/2025*		*1 & 2*	
35.	*Thesaurus Construction*	*1*	*06/10/2025*		*1 & 2*	
36.	*Features of Thesauri*	*1*	*07/10/2025*		*1 & 2*	
37.	*Thesaurus Construction*	*1*	*10/10/2025*		*1 & 2*	

38.	*Thesaurus construction from Texts*	*1*	*11/10/2025*		*1 & 2*	
39.	*Merging existing Thesauri*	*1*	*13/10/2025*		*1 & 2*	
40.	*Merging existing Thesauri continuation*	*1*	*14/10/2025*		*1 & 2*	
41.	*TUTORIAL*	*1*	*17/10/2025*		*1 & 2*	
No. of classes required to complete UNIT-IV: 12				**No. of classes taken:**		

UNIT-V: String Searching Algorithms

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	*Introduction.*	*1*	*18/10/2025*		*1 & 2*	
43.	*Preliminaries.*	*1*	*20/10/2025*		*1 & 2*	
44.	*The Naive Algorithm.*	*1*	*24/10/2025*		*1 & 2*	
45.	*The Knutt-Morris-Pratt Algorithm.*	*1*	*25/10/2025*		*1 & 2*	
46.	*The Boyer-Moore Algorithm*	*1*	*27/10/2025*		*1 & 2*	
47.	*The Shift-Or Algorithm.*	*1*	*28/10/2025*		*1 & 2*	
48.	*The Shift-Or Algorithm continuation*	*1*	*31/10/2025*		*1 & 2*	
49.	*The Karp-Rabin Algorithm*	*1*	*01/11/2025*		*1 & 2*	
50.	*Revision of Algorithms*	*1*	*01/11/2025*		*1 & 2*	
II MID EXAMINATIONS (03-11-2025 TO 08-11-2025)						
No. of classes required to complete UNIT-V: 09				**No. of classes taken:**		

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	*To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.*
PSO 2	*To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.*
PSO 3	*To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.*

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. RAJASREE**	**K. RAJASREE**	**K. RAJASREE**	**Dr. S. JAYAPRADA**
Signature				

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML)

COURSE HANDOUT
PART-A

Name of Course Instructor: *K. Rajasree*
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-B

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	02/07/2025		TLM4	
2	*Experiment - 01*	6	09/07/2025 - 16/07/2025		TLM4	
3	*Experiment - 02*	6	23/07/2025 - 30/07/2025		TLM4	
4	*Experiment - 03*	6	06/08/2025 – 13/08/2025		TLM4	
5	*Experiment - 04*	6	20/08/2025 – 03/09/2025		TLM4	
6	*Experiment – 05*	6	10/09/2025 – 17/09/2025		TLM4	
7	*Experiment – 06*	3	24/09/2025		TLM4	
8	*Experiment – 07*	3	01/10/2025		TLM4	
9	*Experiment – 08*	3	08/10/2025		TLM4	
10	*Experiment – 09*	3	15/10/2025		TLM4	
11	*Experiment – 10*	3	22/10/2025		TLM4	
12	*Internal Exam*	3	29/10/2025		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 engineering problems.*
PO 2	**Problem analysis***: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*
PO 3	**Design/development of solutions***: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*
PO 4	**Conduct investigations of complex problems***: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
PO 5	**Modern tool usage***: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations*
PO 6	**The engineer and society***: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice*
PO 7	**Environment and sustainability***: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.*
PO 8	**Ethic***s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.*
PO 9	**Individual and teamwork***: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.*
PO 10	**Communication***: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.*
PO 11	**Project management and finance***: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.*
PO 12	**Life-long learning***: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.*

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	*To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.*
PSO 2	*To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.*
PSO 3	*To provide a concrete foundation and enrich their abilities for employment and Higher studies in Artificial Intelligence and Data Science with ethical values.*

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. RAJASREE**	**K. RAJASREE**	**K. RAJASREE**	**Dr. S. JAYAPRADA**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr B.SRINIVASARAO
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.:** 2025-26

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	26-08-2025 02-09-2025		**DM5**	
9.	MangoDB	3	09-09-2025		**DM5**	
10.	MangoDB with Express JS	3	16-09-2025		**DM5**	
11.	React JS	3	23-09-2025		**DM5**	
12.	React JS and Full stack Integration	3	30-09-2025		**DM5**	
13.	Web Application Development	3	07-10-2025		**DM5**	
14.	Internal Test	3	14-10-2025		**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.B.SRINIVASARAO			Dr. S.Jayapradha
Signature				