LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
L.B. REDDY NAGAR, MYLAVARAM – 521230. A.P. INDIA
Affiliated to JNTUK Kakinada & Approved by AICTE, New Delhi
Accredited By NAAC, Accredited By NBA Tier-I & Certified by ISO 9001:2015
http://www.lbrce.ac.in, Phone: 08659 – 222933, Fax: 08659 – 222931 Extn:109
DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

Part-A

PROGRAM	:	**B.Tech.(IT), V-Semester**
ACADEMIC YEAR	:	**2023-2024**
COURSE CODE&NAME	:	**20CS12 - COMPUTER NETWORKS**
L-T-P STRUCTURE	:	**3 - -**
COURSE CREDITS	:	**3**
COURSE INSTRUCTOR	:	**M. VIJAYKUMAR**
PRE-REQUISITES	:	Communication systems.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

In this course student will learn:

COURSE OUTCOMES (COs):

The Objective of the course is to provide a foundation to understand computer networks using layered architectures. It also helps the students to understand the various network models, addressing concepts, routing protocols and design aspects of computer networks.

On successful completion of the course, students will be able to:

CO 1	Demonstrate the modern network architectures from a design perspective.
CO 2	Apply various Data Link layer design issues and error detection & correction techniques to solve collisions problems.
CO 3	Demonstrate the network Layer functionalities.
CO 4	Outline the functions of transport layer protocols
CO 5	Examine different application layer protocols.

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	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-
CO4	3	2	2	1	-	-	-	-	-	-	-	2	-	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-

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

1- Slight(Low), **2** –Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1 Behrouz A. Forouzan, "Data Communication and Networking", McGraw-Hill, 4th Edition, 2011.

T2 Andrew S. Tanenbaum, "Computer Networks", Pearson New International Edition, 8th Edition, 2013.

BOS APPROVED REFERENCE BOOKS:

R1 William Stallings, "Data and Computer Communication", Pearson Prentice Hall India, 8 th Edition.

R2 Douglas Comer, Internetworking with TCP/IP, Prentice Hall of India, Volume 1, 6th Edition, 2009.

R3 Richard Stevens, "TCP/IP Illustrated" , Addison-Wesley, Volume 1, 2001.

R4 http://www.cse.iitk.ac.in/users/dheeraj/cs425/.

R5 http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: Data Communication Components

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Discussion of Cos and CEOs of the course	1	05-07-2023		TLM2	
2.	Introduction to Data Communication and Computer Networks	1	06-07-2023		TLM2	
3.	Protocols and Standards	1	07-07-2023		TLM2	
4.	Various Connection Topology s	1	12-07-2023		TLM2	
5.	OSI model	2	13-07-2023 14-07-2023		TLM2	
6.	Transmission Media	2	15-07-2023 19-07-2023		TLM2	
7.	LAN: Wired LAN, Wireless LANs	1	20-07-2023		TLM2	
8.	Connecting LAN and Virtual LAN.	1	21-07-2023		TLM2	
9.	**TUTORIAL-1, Quiz-1 & Assignment-1**	1	22-07-2023		**TLM3**	
No. of classes required to complete UNIT-I		11				

UNIT-II: Data Link Layer and Medium Access Sub Layer

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Introduction to DLL, Data link layer design issues	1	26-07-2023		TLM2	
11.	Error Detection and Error Correction - Fundamentals	1	27-07-2023		TLM2	
12.	Block coding, Hamming Distance	1	28-07-2023		TLM2	
13.	CRC	1	02-08-2023		TLM2	
14.	Flow Control and Error control protocols -Stop and Wait	1	03-08-2023		TLM2	
15.	Go back – N ARQ, Selective Repeat ARQ	1	04-08-2023		TLM2	
16.	Sliding Window, Piggybacking	1	05-08-2023		TLM2	
17.	Random Access s, Multiple access protocols -Pure ALOHA	1	09-08-2023		TLM2	
18.	Slotted ALOHA, CSMA	1	10-08-2023		TLM2	
19.	CSMA/CD,CDMA/CA	1	11-08-2023		TLM2	

20.	**TUTORIAL-2, Quiz-2 ASSIGNMENT-2**	1	16-08-2023		**TLM3**	
No. of classes required to complete UNIT-II		11				

UNIT-III: Network Layer

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Network layer design issues	1	17-08-2023		TLM2	
22.	Switching	1	18-08-2023		TLM2	
23.	Logical addressing – IPV4.	1	19-08-2023		TLM2	
24.	IPV6	1	23-08-2023		TLM2	
25.	Address mapping – ARP, RARP	1	24-08-2023		TLM2	
26.	BOOTP	1	25-08-2023		TLM2	
27.	DHCP–Delivery	1	26-08-2023		TLM2	
28.	Forwarding and Unicast Routing protocols	3	07-08-2023 08-09-2023 09-09-2023		TLM2	
29.	**TUTORIAL-3, Quiz-3 ASSIGNMENT-3**	1	13-09-2023		TLM2	
No. of classes required to complete UNIT-III		11				

UNIT-IV: Transport Layer

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.	Introduction to Transport Layer and Network Layer, Optimality Principle	1	141-09-2023		TLM2	
31.	Process to Process Communication	1	15-09-2023		TLM2	
32.	User Datagram Protocol (UDP)	1	16-09-2023		TLM2	
33.	Transmission Control Protocol (TCP)	1	20-09-2023		TLM2	
34.	SCTP Congestion Contro	1	21-09-2023		TLM2	
35.	Flow and congestion control	1	22-09-2023		TLM2	
36.	Quality of Service	1	23-09-2023		TLM2	
37.	QoS improving techniques: Leaky Bucket	1	27-09-2023		TLM2	
38.	Token Bucket algorithm.	1	29-09-2023		TLM2	
39.	**TUTORIAL4, Quiz-4 ASSIGNMENT-4**	1	30-09-2023		**TLM3**	
No. of classes required to complete UNIT-IV		10				

UNIT-V: APPLICATION LAYER

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Domain Name Space (DNS)	1	04-10-2023		TLM2	
41.	DDNS	1	05-10-2023		TLM2	
42.	TELNET	1	06-10-2023		TLM2	
43.	EMAIL	1	07-10-2023		TLM2	
44.	File Transfer Protocol (FTP), WWW	1	11-10-2023		TLM2	
45.	HTTP, SNMP	1	12-10-2023		TLM2	
46.	Bluetooth, Firewalls0	1	13-10-2023		TLM2	
47.	. **TUTORIAL-5, Quiz-5 ASSIGNMENT-5**	1	18-10-2023		**TLM3**	
No. of classes required to complete UNIT-V		08				

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign
48.	DNS, N/W Layer Design Issues	1	19-10-2023		TLM2	

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

Part – C

EVALUATION PROCESS:

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work	03-07-2022		
I Phase of Instructions	03-07-2023	26-08-2023	8W
I Mid Examinations	28-08-2023	02-09-2023	1W
II Phase of Instructions	04-09-2023	28-10-2023	8W
II Mid Examinations	30-10-2023	04-11-2023	1W
Preparation and Practical's	06-11-2023	11-11-2023	1W
Semester End Examinations	13-11-2023	25-11-2023	2W

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	Pursue a successful career in the area of Information Technology or its allied fields.
PEO 2	Exhibit sound knowledge in the fundamentals of Information Technology and apply practical experience with programming techniques to solve real world problems.
PEO 3	Able to demonstrate self-learning, life-long learning and work in teams on multidisciplinary projects.
PEO 4	Able to understand the professional code of ethics and demonstrate ethical behavior, effective communication and team work and leadership skills in their job.

PROGRAMME OUTCOMES (POs):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solution sin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1 Organize, Analyze and Interpret the data to extract meaningful conclusions.

PSO2 Design, Implement and Evaluate a computer-based system to meet desired needs.

PSO3 Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	M VijayKumar	Dr. K. Naga Prasanthi	G.Rajendra	Dr.B.Srinivasa Rao
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
An ISO 21001:2018,14001:2015,50001:2018 Certified Institution
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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: A.Sarvani
Course Name & Code : Machine Learning & 20AD04
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V Sem/Sec-A **A.Y.:** 2023-24

PREREQUISITE : **Probability and Statistics, Data Warehousing and Data Mining**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to provide the basic concepts and techniques of Machine Learning and helps to use machine learning algorithms for solving real world problems. It enables students to gain experience by doing independent study and research.

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

CO	Description	Target
CO1	Identify the characteristics of machine learning. **(Understand- L2)**	70
CO2	Understand the Model building and evaluation approaches **(Understand- L2)**	67
CO3	Apply regression algorithms for real-world Problems. **(Apply- L3)**	63
CO4	Handle classification problems via supervised learning algorithms. **(Apply- L3)**	67
CO5	Learn advanced learning techniques to deal with complex data **(Apply- L3)**	66

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

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

TEXTBOOKS:

T1	Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition,2015.
T2	Tom M. Mitchell, "Machine Learning', MGH, 1997.

REFERENCE BOOKS:

R1	Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory toAlgorithms", Cambridge.
R2	Peter Harington, "Machine Learning in Action", Cengage, 1st edition, 2012
R3	Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge university press,2012.
R4	Jason Brownlee, "Machine Learning Mastery with Python Understand Your Data, Create Accurate Models and Work Projects End-To-End", Edition: v1.4, 2011.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-1: Introduction to Machine Learning and Preparing to Model

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	**Introduction to Machine Learning** - Introduction	1	10-07-2023		TLM1,2	CO1	
2.	Types of Human Learning	1	11-07-2023		TLM1,2	CO1	
3.	How Machine Learning works?	2	13-07-2023 14-07-2023		TLM1,2	CO1	
4.	Types of Machine Learning	2	17-07-2023 18-07-2023		TLM1,2	CO1	
5.	Applications and issues in Machine Learning	1	20-07-2023		TLM1,2	CO1	
6.	**Preparing to Model:** Introduction, Machine Learning Activities	1	21-07-2023		TLM1,2	CO1	
7.	Basic Types of Data in Machine Learning	1	24-07-2023		TLM1,2	CO1	
8.	Exploring Structure Of Data	1	25-07-2023		TLM1,2	CO1	
9.	Data Quality and Remediation, Data Pre-Processing	1	27-07-2023		TLM1,2	CO1	
10.	**Assignment on Unit-1**	1	28-07-2023				
No. of classes required to complete UNIT-I: 12					**No. of classes taken:**		

UNIT-2: Modelling & Evaluation, Basics of Feature Engineering

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Introduction, selecting a Model	1	01-08-2023		TLM1,2	CO2	
2.	Training a Model (for supervised Learning),	1	03-08-2023		TLM1,2	CO2	
3.	Model Representation and Interpretability,	1	04-08-2023		TLM1,2	CO2	
4.	Evaluating Performance of a Model	2	07-08-2023 08-08-2023		TLM1,2	CO2	
5.	**Basics of Feature Engineering**- Introduction,	1	10-08-2023		TLM1,2	CO2	
6.	Feature Transformation – Feature Construction, Feature Extraction,	2	11-08-2023 14-08-2023		TLM1,2	CO2	
7.	Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Linear Discriminant Analysis (LDA),	1	17-08-2023		TLM1,2	CO2	

8.	Feature Subset Selection	2	18-08-2023		TLM1,2	CO2	
9.	**Assignment on Unit-2**	1	21-08-2023				
No. of classes required to complete UNIT-II: 12					**No. of classes taken:**		

UNIT-3: Regression

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Introduction to regression analysis, Simple linear regression	2	22-08-2023		TLM1,2	CO3	
2.	Multiple linear regression, Assumptions in Regression Analysis, Improving Accuracy of the linear regression model	1	24-08-2023		TLM1,2	CO3	
3.	**Revision for Mid-1**	1	25-08-2023		TLM1,2	CO3	
Mid - I Examinations from 28.08.2023 to 02.09.2023							
4.	Polynomial Regression Model Logistic Regression	2	04-09-2023 05-09-2023		TLM1,2	CO3	
5.	Regularization Regularized Linear Regression	2	07-09-2023 08-09-2023		TLM1,2	CO3	
6.	Regularized Logistic Regression	1	11-09-2023		TLM1,2	CO3	
7.	**Assignment on Unit-3**	1	12-09-2023				
No. of classes required to complete UNIT-III: 10					**No. of classes taken:**		

UNIT-IV: Supervised Learning: Classification

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	**Classification-** Introduction, Example of Supervised Learning,	1	14-09-2023		TLM1,2	CO4	
2.	Classification Model	1	15-09-2023		TLM1,2	CO4	
3.	Classification Learning Steps	1	19-09-2023		TLM1,2	CO4	
4.	**Common Classification Algorithms** - k-Nearest Neighbour (kNN),	2	21-09-2023 22-09-2023		TLM1,2	CO4	
5.	Random Forest model	2	25-09-2023 26-09-2023		TLM1,2	CO4	
6.	Support vector Machines (SVM),	2	29-09-2023 03-10-2023		TLM1,2	CO4	
7.	**Assignment on Unit-4**	1	05-10-2023				
No. of classes required to complete UNIT-IV: 10					**No. of classes taken:**		

UNIT-V: Other Types of Learning

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	**Ensemble Learning**	1	06-10-2023		TLM1,2	CO5	
2.	Bagging, Boosting	1	09-10-2023		TLM1,2	CO5	
3.	Stacking and its impact on bias and variance,	1	10-10-2023		TLM1,2	CO5	
4.	AdaBoost	1	12-10-2023		TLM1,2	CO5	
5.	Gradient Boosting Machines	1	13-10-2023		TLM1,2	CO5	
6.	XGBoost.	1	16-10-2023		TLM1,2	CO5	
7.	**Reinforcement Learning** - Introduction	1	17-10-2023		TLM1,2	CO5	
8.	Q Learning	2	19-10-2023 20-10-2023		TLM1,2	CO5	
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
1.	Basics of Neural Network	1	25-10-2023		TLM1,2	
2.	Types of Activation Functions	1	27-10-2023		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

ACADEMIC CALENDAR

Description	From	To	Weeks
B.Tech (V Semester)			
Commencement of Class Work	**03-07-2023**		
I Phase of Instructions	03-07-2023	26-08-2023	8 W
I MID Examinations	**28-08-2023**	**02-09-2023**	**1 W**
II Phase of Instructions	04-09-2023	28-10-2023	8 W
II MID Examinations	**30-10-2023**	**04-11-2023**	**1 W**
Preparation and Practical	06-11-2023	11-11-2023	1 W
Semester End Examinations	**13-11-2023**	**25-11-2023**	**2 W**

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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.

PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs
PSO 3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**A.Sarvani**	**Dr. K. Devi Priya**	**Mrs. M. Hema Latha**	**Dr.B.Srinivasa Rao**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
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Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: REHANA BEGUM
Course Name & Code : Theory of Computation, 20CS13
L-T-P Structure : **3-0-0** **Credits:** 03
Program/Sem/Sec : B.Tech-IT / V SEM/A-Sec
A.Y. : 2023-24

PRE-REQUISITE: Discrete Mathematical Structures

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to provide a formal connection between algorithmic problem solving and the theory of Automata and languages, and develop them into a mathematical view towards algorithmic design and in general computation itself.

CO1	Construct finite automata for regular languages and prove it's equivalence. (**Apply-L3**)
CO2	Construct regular expression for regular languages and prove the equivalence of regular expression and Finite Automata. (**Apply-L3**)
CO3	Design Pushdown automata for the context-free languages. (**Understand-L2**)
CO4	Design Turing machine to model computational problems. (**Apply-L3**)
CO5	Distinguish decidable and undecidable problems with the help of Turing machine. (**Understand – L2**)

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

CO	Program Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-

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

TEXTBOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Pearson Education Asia, 1997.

REFERENCE BOOKS:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Pearson Education Asia,2000.
2. Dexter C. Kozen, "Automata and Computability", Springer,2011.
3. Michael Sipser, "Introduction to the Theory of Computation", PWS Publishing,2005.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill,2nd Edition,2003.

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Finite Automata

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
1	Introduction to Finite Automata,	1	03-07-2023		**TLM1**	CO1	
2	Alphabets,	1	05-07-2023		**TLM1**	CO1	
3	Strings, Languages and Grammars,	1	07-07-2023		**TLM1**	CO1	
4	Classification of Automata,	1	08-07-2023		**TLM1**	CO1	
5	Definitions and its applications.	1	10-07-2023		**TLM1**	CO1	
6	Finite Automata: Deterministic Finite Automata (DFA),	2	12-07-2023 14-07-2023		**TLM1**	CO1	
7	Non-Deterministic Finite Automata(NFA)	1	15-07-2023		**TLM1**	CO1	
8	Equivalence of NFA and DFA,	1	17-07-2023		**TLM1**	CO1	
9	Equivalence of NFA with epsilon and NFA without epsilon,	2	19-07-2023 21-07-2023		**TLM1**	CO1	
10	Minimization of finite automata,	1	22-07-2023		**TLM1**	CO1	
11	Finite automata with output: mealy machine,	1	24-07-2023		**TLM1**	CO1	
12	Moore machines,	1	26-07-2023		**TLM1**	CO1	
13	Equivalence of mealy and moore machines	2	28-07-2023 31-07-2023		**TLM1**	CO1	
No. of classes required to complete UNIT-I		16	No. of classes taken:				

UNIT-II: Regular Expression and Regular Languages

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
19	Regular Expressions: Equivalence of Regular expression and finite automata	2	02-08-2023 04-08-2023		**TLM1**	CO2	
20	Regular Grammar: Definition of grammar,	1	05-08-2023		**TLM1**	CO2	
21	Derivation and parse tree,	2	05-08-2023		**TLM1**	CO2	
22	Equivalence of regular grammar and finite automata,	2	07-08-2023		**TLM1**	CO2	
23	Closure properties of regular languages,	1	09-08-2023		**TLM1**	CO2	
24	Pumping lemma for regular languages.	2	11-08-2023		**TLM1**	CO2	
No. of classes required to complete UNIT-2		11	No. of classes taken:				

UNIT – III: CFL and Pushdown Automata

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
31	Context free languages: context free grammars(CFG),	1	14-08-2022 16-08-2023		**TLM1**	CO3	
32	Ambiguity in CFG,	2	18-08-2023 19-08-2023		**TLM1**	CO3	
33	Chomsky and Greibach normal forms.	2	21-08-2023 23-08-2023		**TLM1**	CO3	
34	Pushdown automata (PDA): Definition of PDA,	1	25-08-2023		**TLM1**	CO3	
35	Deterministic and Non deterministic PDA,	2	04-09-2023 08-09-2023		**TLM1**	CO3	
36	Equivalence of PDA and CFG,	2	09-09-2023 11-09-2023		**TLM1**	CO3	
37	Pumping lemma for context free languages,	1	13-09-2023		**TLM1**	CO3	
38	Closure properties of CFLs.	1	15-09-2022		**TLM1**	CO3	
No. of classes required to complete UNIT-3		12	No. of classes taken:				

UNIT-IV: Turing Machine

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
43	Turing machine: The basic model for Turing Machine (TM),	2	16-09-2023 20-09-2023		**TLM1**	CO4	
44	Turing recognizable (recursively enumerable),	2	22-09-2023 23-09-2023		**TLM1**	CO4	
45	Turing-decidable(recursive) languages,	1	25-09-2023		**TLM1**	CO4	
46	Closure properties,	1	27-09-2023		**TLM1**	CO4	
47	Variants of Turing machines,	1	29-09-2023		**TLM1**	CO4	
48	Non deterministic TMs and Equivalence with deterministic TMs,	2	30-09-2023 04-10-2023		**TLM1**	CO4	
49	Unrestricted grammars and equivalence with TMs,	2	06-10-2023 07-10-2023		**TLM1**	CO4	
50	TMs as enumerators.	1	09-10-2023		**TLM1**	CO4	
No. of classes required to complete UNIT-4		12	No. of classes taken:				

UNIT-V: Undecidability

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
55	Undecidability: Church-Turing thesis,	1	11-10-2023		**TLM1**	CO5	
56	Universal turing machine,	2	13-10-2023 14-10-2023		**TLM1**	CO5	
57	the universal and diagnolization languages,	2	16-10-2023 18-10-2023		**TLM1**	CO5	
58	Reduction between languages,	1	20-10-2023		**TLM1**	CO5	
59	Rice's theorem,	1	21-10-2023		**TLM1**	CO5	
60	Post's correspondence problem,	1	25-10-2023		**TLM1**	CO5	
61	Undecidable problems about languages.	1	26-10-2023		**TLM1**	CO5	
No. of classes required to complete UNIT-5		9	No. of classes taken:				

CONTENT BEYOND SYLLABUS

S No	Topics To Be Covered	No Of Classes Required	Tentaive Date Of Completion	Actual Date	Teaching Learning Method	Learning Outcome	HOD Sign Weakly
1	Concept of Halt	1	27-10-2023		**TLM1**	CO5	
2	Halting Problems	1	28-10-2023		**TLM 1**	CO5	

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

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and Interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs.
PSO 3	Develop IT application services with the help ofdifferent currentengineering tools.

	Course Instructor	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	MRS REHANA BEGUM	DR D VEERIAH	DR G RAJENDRA	DR B SRINIVASRAO
Signature				

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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: REHANA BEGUM
Course Name & Code : Theory of Computation, 20CS13
L-T-P Structure : **3-0-0** **Credits:** 03
Program/Sem/Sec : B.Tech-IT / V SEM/B-Sec
A.Y. : 2023-24

PRE-REQUISITE: Discrete Mathematical Structures

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to provide a formal connection between algorithmic problem solving and the theory of Automata and languages, and develop them into a mathematical view towards algorithmic design and in general computation itself.

CO1	Construct finite automata for regular languages and prove it's equivalence. (**Apply-L3**)
CO2	Construct regular expression for regular languages and prove the equivalence of regular expression and Finite Automata. (**Apply-L3**)
CO3	Design Pushdown automata for the context-free languages. (**Understand-L2**)
CO4	Design Turing machine to model computational problems. (**Apply-L3**)
CO5	Distinguish decidable and undecidable problems with the help of Turing machine. (**Understand – L2**)

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

CO	Program Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-

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

TEXTBOOKS:

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REFERENCE BOOKS:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Pearson Education Asia,2000.

2. Dexter C. Kozen, "Automata and Computability", Springer,2011.

3. Michael Sipser, "Introduction to the Theory of Computation", PWS Publishing,2005.

4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill,2nd Edition,2003.

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Finite Automata

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
1	Introduction to Finite Automata,	1	03-07-2023		**TLM1**	CO1	
2	Alphabets,	1	06-07-2023		**TLM1**	CO1	
3	Strings, Languages and Grammars,	1	07-07-2023		**TLM1**	CO1	
4	Classification of Automata,	1	08-07-2023		**TLM1**	CO1	
5	Definitions and its applications.	1	10-07-2023		**TLM1**	CO1	
6	Finite Automata: Deterministic Finite Automata (DFA),	2	13-07-2023 14-07-2023		**TLM1**	CO1	
7	Non-Deterministic Finite Automata(NFA)	1	15-07-2023		**TLM1**	CO1	
8	Equivalence of NFA and DFA,	1	17-07-2023		**TLM1**	CO1	
9	Equivalence of NFA with epsilon and NFA without epsilon,	2	20-07-2023 21-07-2023		**TLM1**	CO1	
10	Minimization of finite automata,	1	22-07-2023		**TLM1**	CO1	
11	Finite automata with output: mealy machine,	1	24-07-2023		**TLM1**	CO1	
12	Moore machines,	1	27-07-2023		**TLM1**	CO1	
13	Equivalence of mealy and moore machines	2	28-07-2023 31-07-2023		**TLM1**	CO1	
No. of classes required to complete UNIT-I		16	No. of classes taken:				

UNIT-II: Regular Expression and Regular Languages

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
19	Regular Expressions: Equivalence of Regular expression and finite automata	2	03-08-2023 04-08-2023		**TLM1**	CO2	
20	Regular Grammar: Definition of grammar,	1	05-08-2023		**TLM1**	CO2	
21	Derivation and parse tree,	2	07-08-2023		**TLM1**	CO2	
22	Equivalence of regular grammar and finite automata,	2	10-08-2023		**TLM1**	CO2	
23	Closure properties of regular languages,	1	11-08-2023		**TLM1**	CO2	
24	Pumping lemma for regular languages.	2	12-08-2023		**TLM1**	CO2	
No. of classes required to complete UNIT-2		11	No. of classes taken:				

UNIT – III: CFL and Pushdown Automata

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
31	Context free languages: context free grammars(CFG),	1	14-08-2022 17-08-2023		**TLM1**	CO3	
32	Ambiguity in CFG,	2	18-08-2023 19-08-2023		**TLM1**	CO3	
33	Chomsky and Greibach normal forms.	2	21-08-2023 24-08-2023		**TLM1**	CO3	
34	Pushdown automata (PDA): Definition of PDA,	1	25-08-2023		**TLM1**	CO3	
35	Deterministic and Non deterministic PDA,	2	04-09-2023 07-09-2023		**TLM1**	CO3	
36	Equivalence of PDA and CFG,	2	08-09-2023 09-09-2023		**TLM1**	CO3	
37	Pumping lemma for context free languages,	1	11-09-2023		**TLM1**	CO3	
38	Closure properties of CFLs.	1	14-09-2022		**TLM1**	CO3	
No. of classes required to complete UNIT-3		12	No. of classes taken:				

UNIT-IV: Turing Machine

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
43	Turing machine: The basic model for Turing Machine (TM),	2	15-09-2023 16-09-2023		**TLM1**	CO4	
44	Turing recognizable (recursively enumerable),	2	21-09-2023 22-09-2023		**TLM1**	CO4	
45	Turing-decidable(recursive) languages,	1	23-09-2023		**TLM1**	CO4	
46	Closure properties,	1	25-09-2023		**TLM1**	CO4	
47	Variants of Turing machines,	1	29-09-2023		**TLM1**	CO4	
48	Non deterministic TMs and Equivalence with deterministic TMs,	2	30-09-2023 05-10-2023		**TLM1**	CO4	
49	Unrestricted grammars and equivalence with TMs,	2	06-10-2023 07-10-2023		**TLM1**	CO4	
50	TMs as enumerators.	1	09-10-2023		**TLM1**	CO4	
No. of classes required to complete UNIT-4		12	No. of classes taken:				

UNIT-V: Undecidability

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcomes	HOD Sign Weekly
55	Undecidability: Church-Turing thesis,	1	12-10-2023		**TLM1**	CO5	
56	Universal turing machine,	2	13-10-2023 14-10-2023		**TLM1**	CO5	
57	the universal and diagnolization languages,	2	16-10-2023 19-10-2023		**TLM1**	CO5	
58	Reduction between languages,	1	20-10-2023		**TLM1**	CO5	
59	Rice's theorem,	1	21-10-2023		**TLM1**	CO5	
60	Post's correspondence problem,	1	26-10-2023		**TLM1**	CO5	
61	Undecidable problems about languages.	1	27-10-2023		**TLM1**	CO5	
No. of classes required to complete UNIT-5		9	No. of classes taken:				

CONTENT BEYOND SYLLABUS

S No	Topics To Be Covered	No Of Classes Required	Tentaive Date Of Completion	Actual Date	Teaching Learning Method	Learning Outcome	HOD Sign Weakly
1	Concept of Halt	1	27-10-2023		**TLM1**	CO5	
2	Halting Problems	1	28-10-2023		**TLM 1**	CO5	

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

EVALUATION PROCESS:

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and Interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs.
PSO 3	Develop IT application services with the help ofdifferent currentengineering tools.

	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	MRS REHANA BEGUM	DR D VEERIAH	DR G RAJENDRA	DR B SRINIVASRAO
Signature				

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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs. S. JYOTHI
Course Name & Code **:** POAI & 20CS16
L-T-P Structure **:3-0-0** **Credits:** 3
Program/Sem/Sec **:**BTECH/V/A **A.Y.:** 2023-24

PREREQUISITE: Basic Engineering and Mathematics knowledge

COURSE EDUCATIONAL OBJECTIVES (CEOs):

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

CO1	Understand the fundamentals of Artificial Intelligence types of AI agents and their structures to solve engineering problems. (**Understand – L2**)
CO2	Identify different search algorithms to find and optimise the solution for the given problem. (**Understand-L2**)
CO3	Apply different gaming algorithms and identify the importance of knowledge representations in Artificial Intelligence. (**Apply-L3**)
CO4	Make use of predicate logic and rule-based system to represent the knowledge in AI domain. (**Understand-L2**)
CO5	Interpret the forms of learning in the AI domain as well as present efficient technologies to remove uncertainty in knowledge domain. (**Understand –L2**)

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

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

TEXTBOOKS:

T1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, third edition, 2009.can also second edition,2003.
T2	Elaine Rich, Kevin Knight Artificial Intelligence, TMH, second edition, 2007.

REFERENCE BOOKS:

R1	Nils J.Nilsson "Artificial Intelligence - A New Synthesis", ,Morgan Kaufmann, 1988
R2	David poole,Alan Mackworth, "Artificial Intelligence: Foundations for computational agents",Cambridge Univ.press,2010.
R3	Ronald Brachman, "Knowledge representation and Reasoning", Morgan Kaufmann,2004.
R4	Frank van Harmelen,Vladimir Lifschitz,Bruce Porter(Eds),"Handbook of Knowledge representation",Elsevier,2008.
R5	Ivan Bratko," Prolog Programming for Artificial Intelligence",4th Ed., Addition-Wesley,2011.

PART-B

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	HOD Sign Weekly
1.	AI Introduction	1	3/7/23		TLM1	
2.	Applications of AI	1	4/7/23		TLM1	
3.	History of AI	1	5/7/23		TLM1	
4.	Types of AI	1	10/7/23		TLM1	
5.	Agents and rationality	1	11/7/23		TLM2	
6.	Structure of the agents	1	12/7/23		TLM2	
7.	Agent environment and nature of the environment	1	15/7/23		TLM2	
8.	Types of agents-Simple reflex agents and model-based agents	1	17/7/23		TLM2	
9.	Types of agents-Goal based agents and Utility-based agents	1	18/7/23		TLM2	
10.	Types of agents-Learning agents	1	19/7/23		TLM2	
11.	Problems, search spaces	1	22/7/23		TLM2	
12.	Defining the problem as state space search	1	24/7/23		TLM2	
13.	Production system	1	25/7/23		TLM2	
14.	Problem characteristics	1	26/7/23		TLM2	
15.	Issues in the design of search programs.	1	1/8/23		TLM2	
No. of classes required to complete UNIT-I: 15				**No. of classes taken:**		

UNIT-II:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16.	Problem solving agents and search algorithm terminologies	1	2/8/23		TLM2	
17.	Properties of search algorithms and types of search algorithms	1	3/8/23		TLM2	
18.	Uninformed search algorithms: Breadth-first Search	1	5/8/23		TLM2	
19.	Depth-first Search and Depth-limited Search	1	7/8/23		TLM2	
20.	Iterative deepening depth-first search.	1	8/8/23		TLM2	
21.	Uniform cost search, Bidirectional search.	1	9/8/23		TLM2	
22.	Informed/Heuristic Search algorithms: Greedy best-first search algorithm	1	14/8/23		TLM2	
23.	A* Search algorithm	1	16/8/23		TLM2	
24.	Hill climbing algorithm	1	19/8/23		TLM2	
25.	Constraint satisfaction problem	1	21/8/23		TLM2	
26.	Means-Ends Analysis	1	22/8/23		TLM2	
No. of classes required to complete UNIT-II: 11				**No. of classes taken:**		

UNIT-III:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Adversarial search/Game playing: Introduction	1	23/8/23		TLM2	
28.	Minmax Algorithm	1	26/8/23		TLM2	
29.	Alpha-Beta Pruning	1	4/9/23		TLM2	
30.	Knowledge representation: Representations and mappings	1	5/9/23		TLM2	
31.	Approaches of Knowledge representation	2	9/9/23 11/9/23		TLM2	
32.	Issues in Knowledge Representation	1	12/9/23		TLM2	
No. of classes required to complete UNIT-III: 07				**No. of classes taken:**		

UNIT-IV:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Knowledge Representation Using predicate logic: Representing simple facts in logic.	1	13/9/23		TLM2	
34.	Representing instance and Isa relationships	2	16/9/23 19/9/23		TLM2	
35.	Computable functions and predicates	1	20/9/23		TLM2	
36.	Resolution	2	23/9/23 25/9/23		TLM2	
37.	Natural deduction	1	26/9/23		TLM2	
38.	Representing knowledge using Rules: Procedural verses declarative knowledge	1	27/9/23		TLM2	
39.	Logic programming	1	30/9/23		TLM2	
40.	Forward verses backward reasoning	1	3/10/23		TLM2	
41.	Matching	1	4/10/23		TLM2	
42.	Control knowledge	1	7/10/23		TLM2	
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	HOD Sign Weekly
43.	Uncertain knowledge and Reasoning: Probability and Bayes theorem	2	9/10/23 10/10/23		TLM2	
44.	Certainty factors and rule-based	2	11/10/23 14/10/23		TLM2	
45.	Bayesian networks	1	16/10/23		TLM2	
46.	Dempster – Shafer Theory	2	17/10/23 18/10/23		TLM2	
47.	Fuzzy logic	1	21/10/23		TLM2	
48.	Learning: Overview of different forms of learning	1	24/10/23		TLM2	
49.	Learning Decision Trees	1	25/10/23		TLM2	
50.	Neural networks	1	28/10/23		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

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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 engineer**ing 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	**Mrs.S.JYOTHI**	**Mr.G.V.Suresh**	**Mr.G.Rajendra**	**Dr. B.Srinivasa Rao**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs. S. JYOTHI
Course Name & Code : POAI & 20CS16
L-T-P Structure :**3-0-0** **Credits:** 3
Program/Sem/Sec :BTECH/V/B **A.Y.:** 2023-24

PREREQUISITE: Basic Engineering and Mathematics knowledge

COURSE EDUCATIONAL OBJECTIVES (CEOs):

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

CO1	Understand the fundamentals of Artificial Intelligence types of AI agents and their structures to solve engineering problems. (**Understand – L2**)
CO2	Identify different search algorithms to find and optimise the solution for the given problem. (**Understand-L2**)
CO3	Apply different gaming algorithms and identify the importance of knowledge representations in Artificial Intelligence. (**Apply-L3**)
CO4	Make use of predicate logic and rule-based system to represent the knowledge in AI domain. (**Understand-L2**)
CO5	Interpret the forms of learning in the AI domain as well as present efficient technologies to remove uncertainty in knowledge domain. (**Understand –L2**)

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

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

TEXTBOOKS:

T1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, third edition, 2009.can also second edition,2003.
T2	Elaine Rich, Kevin Knight Artificial Intelligence, TMH, second edition, 2007.

REFERENCE BOOKS:

R1	Nils J.Nilsson "Artificial Intelligence - A New Synthesis", ,Morgan Kaufmann, 1988
R2	David poole,Alan Mackworth, "Artificial Intelligence: Foundations for computational agents",Cambridge Univ.press,2010.
R3	Ronald Brachman, "Knowledge representation and Reasoning", Morgan Kaufmann,2004.
R4	Frank van Harmelen,Vladimir Lifschitz,Bruce Porter(Eds),"Handbook of Knowledge representation",Elsevier,2008.
R5	Ivan Bratko," Prolog Programming for Artificial Intelligence",4th Ed., Addition-Wesley,2011.

PART-B

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	HOD Sign Weekly
1.	AI Introduction	1	4/7/23		TLM1	
2.	Applications of AI	1	5/7/23		TLM1	
3.	History of AI	1	6/7/23		TLM1	
4.	Types of AI	1	11/7/23		TLM1	
5.	Agents and rationality	1	12/7/23		TLM2	
6.	Structure of the agents	1	13/7/23		TLM2	
7.	Agent environment and nature of the environment	1	15/7/23		TLM2	
8.	Types of agents-Simple reflex agents and model-based agents	1	18/7/23		TLM2	
9.	Types of agents-Goal based agents and Utility-based agents	1	19/7/23		TLM2	
10.	Types of agents-Learning agents	1	20/7/23		TLM2	
11.	Problems, search spaces	1	22/7/23		TLM2	
12.	Defining the problem as state space search	1	25/7/23		TLM2	
13.	Production system	1	26/7/23		TLM2	
14.	Problem characteristics	1	27/7/23		TLM2	
15.	Issues in the design of search programs.	1	1/8/23		TLM2	
No. of classes required to complete UNIT-I: 15				**No. of classes taken:**		

UNIT-II:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16.	Problem solving agents and search algorithm terminologies	1	2/8/23		TLM2	
17.	Properties of search algorithms and types of search algorithms	1	3/8/23		TLM2	
18.	Uninformed search algorithms: Breadth-first Search	1	5/8/23		TLM2	
19.	Depth-first Search and Depth-limited Search	1	7/8/23		TLM2	
20.	Iterative deepening depth-first search.	1	8/8/23		TLM2	
21.	Uniform cost search, Bidirectional search.	1	9/8/23		TLM2	
22.	Informed/Heuristic Search algorithms: Greedy best-first search algorithm	1	10/8/23		TLM2	
23.	A* Search algorithm	1	16/8/23		TLM2	
24.	Hill climbing algorithm	1	19/8/23		TLM2	
25.	Constraint satisfaction problem	1	22/8/23		TLM2	
26.	Means-Ends Analysis	1	23/8/23		TLM2	
No. of classes required to complete UNIT-II: 11				**No. of classes taken:**		

UNIT-III:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Adversarial search/Game playing: Introduction	1	24/8/23		TLM2	
28.	Minmax Algorithm	1	26/8/23		TLM2	
29.	Alpha-Beta Pruning	1	5/9/23		TLM2	
30.	Knowledge representation: Representations and mappings	2	7/9/23 9/9/23		TLM2	
31.	Approaches of Knowledge representation	2	12/9/23 13/9/23		TLM2	
32.	Issues in Knowledge Representation	2	14/9/23 16/9/23		TLM2	
No. of classes required to complete UNIT-III: 07				**No. of classes taken:**		

UNIT-IV:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Knowledge Representation Using predicate logic: Representing simple facts in logic.	1	19/9/23		TLM2	
34.	Representing instance and Isa relationships	2	20/9/23 21/9/23		TLM2	
35.	Computable functions and predicates	1	23/9/23		TLM2	
36.	Resolution	2	26/9/23 27/9/23		TLM2	
37.	Natural deduction	1	30/9/23		TLM2	
38.	Representing knowledge using Rules: Procedural verses declarative knowledge	1	3/10/23		TLM2	
39.	Logic programming	1	4/10/23		TLM2	
40.	Forward verses backward reasoning	1	5/10/23		TLM2	
41.	Matching	1	7/10/23		TLM2	
42.	Control knowledge	1	10/10/23		TLM2	
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	HOD Sign Weekly
43.	Uncertain knowledge and Reasoning: Probability and Bayes theorem	2	11/10/23 12/10/23		TLM2	
44.	Certainty factors and rule-based	2	14/10/23 17/10/23		TLM2	
45.	Bayesian networks	1	18/10/23		TLM2	
46.	Dempster – Shafer Theory	2	19/10/23 21/10/23		TLM2	
47.	Fuzzy logic	1	24/10/23		TLM2	
48.	Learning: Overview of different forms of learning	1	25/10/23		TLM2	
49.	Learning Decision Trees	1	26/10/23		TLM2	
50.	Neural networks	1	28/10/23		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

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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 engineer**ing 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	**Mrs.S.JYOTHI**	**Mr.G.V.Suresh**	**Mr.G.Rajendra**	**Dr. B.Srinivasa Rao**
Signature				

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr.V.V.Rama Krishna
Course Name & Code : SATELLITE TECHNOLOGY - 20EC81
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., IT., V-Sem., A.Y : 2023-24

PRE-REQUISITE: Basics related to Dynamics, Kinematics, Thermodynamics and Properties of an Ellipse.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on different laws associated with the motion of a satellite. The course gives the knowledge on launching a satellite into orbit with launch vehicles. The course also provides the knowledge on various subsystems, structures, thermal control, and applications of a satellite.

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

CO 1	**List** out the operational bands, Space craft control mechanisms**,** sensors andnavigational aids forsatellite applications**(Remember-L1)**
CO 2	**Summarize** the functions of satellite space segment, earth segment, Multiple access techniques and satellite services. **(Understand-L2)**
CO 3	**Illustrate** the operational principles of satellite power system and space craft Control mechanism. **(Understand-L2)**
CO 4	**Outline** the concepts of orbital mechanics & satellite communication and its application**(Understand-L2)**

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	-	-	-	-	3	2	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	2	1	-	-	-	-	1	2	-	-
CO3	1	1	1	-	-	2	1	-	-	-	-	1	2	-	-
CO4	1	1	1	-	-	2	1	-	-	-	-	1	2	-	-

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

TEXT BOOKS:

T1 Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite communications", John Wiley & Sons,2"^{d} edition, 2003.

REFERENCE BOOKS:

R1 M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.

R2 D.C Agarwal , "Satellite communications", Khanna Publications, 5thEdition,2006.

R3 Richard, Filipowsky Eugen 1 Muehllorf, 'Space Communication Systems', Prentice Hall 1995

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Satellite 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.	Course Objectives	1	10-07-2023		TLM2	
2.	Brief introduction about the course and its importance.	1	11-07-2023		TLM2	
3.	Need for Space Communications,.	1	13-07-2023		TLM2	
4.	Definition of a satellite and Orbit	1	15-07-2023		TLM2	
5.	General Structure of satellite Communication	1	17-07-2023		TLM2	
6.	Types of Spacecraft Orbits	1	18-07-2023		TLM2	
7.	Common satellite applications and missions	1	20-07-2023		TLM2	
8.	Launch Vehicles and Launching of a satellite	1	22-07-2023		TLM2	
9.	Satellite system and their functions-(Structural,	1	24-07-2023		TLM2	
10.	Thermal, power mechanisms, propulsion, etc)	1	25-07-2023		TLM2	
11.	Revision	1	27-07-2023		TLM2	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: Orbital Mechanics:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction and overview of Orbital Mechanics	1	29-07-2023		TLM1	
2.	Newton's laws of Force,	1	31-07-2023		TLM2	
3.	Fundamentals of Orbital Dynamics-Kepler's laws	1	01-08-2023		TLM2	
4.	Orbital parameters	1	03-08-2023		TLM2	
5.	Orbital determination	1	05-08-2023		TLM2	
6.	Orbital Perturbations-	1	07-08-2023		TLM1	
7.	Need for station keeping	1	08-08-2023		TLM2	
8.	GPS systems-Architecture of GPS,	1	10-08-2023		TLM2	
9.	Working Principle of GPS	1	12-08-2023		TLM2	
10.	Ground station or Earth station Requirements	1	14-08-2023		TLM1	
11.	Ground station or Earth station Requirements	1	17-08-2023		TLM2	
12.	Problems and Revision	1	19-08-2023		TLM1	
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: Power System and Bus Electronics:

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 Power system	1	21-08-2023		TLM2	
2.	Bus electronics	1	22-08-2023 24-08-2023		TLM2	
3.	Solar Panels: Silicon and Ga-As Cells	1	26-08-2023		TLM2	
4.	Solar Panels: Silicon and Ga-As Cells	1	04-09-2023		TLM2	
5.	Power generation capacity, efficiency	1	05-09-2023		TLM1	
6.	Power generation capacity, efficiency	1	07-09-2023		TLM2	
7.	Space Battery Systems	1	09-09-2023		TLM2	
8.	Battery Types, Characteristics ,	1	11-09-2023		TLM2	
9.	Battery efficiency Parameters	1	12-09-2023		TLM2	
10.	Telemetry of Satellite	1	14-09-2023		TLM2	
11.	Tracking of Satellite	1	16-09-2023		TLM2	
12.	Control (TT&C) functions	1	18-09-2023		TLM2	
13.	Control (TT&C) functions	1	19-09-2023		TLM2	
14.	Generally Employed Communication Bands	1	21-09-2023		TLM2	
15.	Revision	1	23-09-2023			
No. of classes required to complete UNIT-III: 15				No. of classes taken:		

UNIT-IV : Spacecraft Control:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Spacecraft Control	1	25-09-2023		TLM2	
2.	Control Requirements: Attitude Control	1	26-09-2023		TLM2	
3.	Station keeping functions, type of control maneuvers	1	28-09-2023		TLM2	
4.	Stabilization Schemes: Spin stabilization	1	30-09-2023		TLM2	
5.	gravity gradient method,	1	02-10-2023		TLM2	
6.	3 axis stabilization	1	03-10-2023		TLM2	
7.	Commonly Used Control Systems: Mass expulsion systems,	1	05-10-2023		TLM2	
8.	Momentum exchange systems.	1	07-10-2023		TLM2	
9.	Gyro and Magnetic Torque -sensors, Star and sun sensor, Earth sensor.	1	09-10-2023		TLM2	
10.	Magnetometers and Inertial Sensors.	1	11-10-2023		TLM2	
11.	Revision	1	12-10-2023		TLM2	
No. of classes required to complete UNIT-IV: 11				No. of classes taken:		

UNIT-V : Satellite Servicesand 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.	Introduction, GPS architecture	1	14-10-2023		TLM2	
2.	Location principle	1	16-10-2023		TLM2	
3.	Location principle	1	17-10-2023		TLM2	
4.	Direct to home, home receiver	1	19-10-2023		TLM2	
5.	Satellite mobile services	1	21-10-2023		TLM2	
6.	VSAT, MSAT, RADARSAT	1	23-10-2023		TLM2	
7.	IRNSS Constellation	1	24-10-2023		TLM2	
8.	IRNSS Constellation	1	02-10-2023		TLM2	
9.	Satellite structures and materials	1	26-10-2023		TLM2	
10.	Latest Satellites	1	28-10-2023			
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.V.V.Rama Krishna	Mr.V.V.Rama Krishna	Dr.M.V.Sudhakar	Dr. Y. Amar Babu

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

COURSE HANDOUT

PART-A

Name of Course Instructor : M. Sivasankara Rao
Course Name & Code : SATELLITE TECHNOLOGY - 20EC81
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., IT., V-Sem. B.Sec. A.Y : 2023-24
PRE-REQUISITE : Dynamics, Kinematics, Thermodynamics.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on different laws associated with the motion of a satellite, launching a satellite into orbit with launch vehicles, subsystems, structures, thermal control and applications.

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

CO 1	List out the operational bands, space craft control mechanisms, sensors and navigational aids for satellite applications (Remember-L1)
CO 2	Summarize the functions of satellite space segment, earth segment, multiple access techniques and satellite services. (Understand-L2)
CO 3	Illustrate the operational principles of satellite power system and space craft control mechanism. (Understand-L2)
CO 4	Outline the concepts of orbital mechanics & satellite communication and its applications (Understand-L2)

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

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

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

TEXT BOOKS:

T1 Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite communications", John Wiley & Sons,2"[d] edition, 2003.

T2 Dennis Roddy, "Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

REFERENCE BOOKS:

R1 M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2' [d] Edition, 2005.

R2 D.C Agarwal, "Satellite communications", Khanna Publications, 5* Edition,2006.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Satellite 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.	Course Objectives	1	11-07-2023		TLM2	
2.	Brief introduction about the course and its importance.	1	13-07-2023		TLM2	
3.	Need of Space Communication, Common satellite applications and missions.	1	14-07-2023		TLM2	
4.	General Structure of satellite Communication system.	1	15-07-2023		TLM2	
5.	Types of Spacecraft Orbits, Launch vehicles.	1	18-07-2023		TLM2	
6.	Satellite subsystems and their functions – structure.	1	20-07-2023		TLM2	
7.	Satellite subsystems and their functions – thermal mechanisms.	1	21-07-2023		TLM2	
8.	Satellite subsystems and their functions – power, propulsion.	1	22-07-2023		TLM2	
9.	Satellite subsystems and their functions – Guidance and control.	1	25-07-2023		TLM2	
10.	Satellite subsystems and their functions – bus electronics.	1	27-07-2023		TLM2	
11.	Revision of Unit -1	1	28-07-2023		TLM2	
No. of classes required to complete UNIT-I:11				No. of classes taken:		

UNIT-II: Orbital Mechanics:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction and overview of Orbital Mechanics	1	29-07-2023		TLM2	
2.	Fundamentals of Orbital Dynamics – Kepler's laws.	1	01-08-2023		TLM2	
3.	Fundamentals of Orbital Dynamics – Kepler's laws	1	03-08-2023		TLM2	
4.	Orbital parameters	1	04-08-2023		TLM2	
5.	Orbital parameters	1	05-08-2023		TLM2	
6.	Orbital Perturbations	1	08-08-2023		TLM2	
7.	Need for station keeping.	1	10-08-2023		TLM2	
8.	Need for Co-ordinate systems.	1	11-08-2023		TLM2	
9.	GPS System – architecture of GPS	1	17-08-2023		TLM2	
10.	working principle of GPS , merits, demerits and applications,	1	18-08-2023		TLM2	
11.	Ground/Earth station network requirements.	1	19-08-2023		TLM2	
12.	Revision of Unit -2	1	22-08-2023		TLM2	
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: Power System and Bus Electronics:

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 Power system	1	24-08-2023		TLM2	
2.	Bus electronics	1	25-08-2023		TLM2	

3.	Solar Panels: Silicon and Ga-As Cells.	1	26-08-2023		TLM2	
4.	Power generation capacity, efficiency.	1	05-09-2023		TLM2	
5.	Space Battery Systems.	1	07-09-2023		TLM2	
6.	Battery Types, Characteristics.	1	08-09-2023		TLM2	
7.	Battery efficiency Parameters, power electronics.	1	12-09-2023		TLM2	
8.	Telemetry of satellite	1	14-09-2023		TLM2	
9.	Command Control and monitoring functions.	1	15-09-2023		TLM2	
10.	Communication bands - and applications.	1	16-09-2023		TLM2	
11.	Revision of Unit -3	1	21-09-2023		TLM2	
No. of classes required to complete UNIT-III: 11				No. of classes taken:		

UNIT-IV : Spacecraft Control:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Spacecraft Control	1	22-09-2023		TLM2	
2.	Control Requirements: Attitude Control	1	23-09-2023		TLM2	
3.	Station keeping functions, type of control maneuvers.	1	26-09-2023		TLM2	
4.	Stabilization Schemes: Spin stabilization.	1	28-09-2023		TLM2	
5.	Stabilization Schemes: gravity gradient method, 3 axis stabilization.	1	29-09-2023		TLM2	
6.	Control Systems: Mass expulsion systems.	1	30-09-2023		TLM2	
7.	Control Systems: Momentum exchange systems.	1	03-10-2023		TLM2	
8.	Gyro and Magnetic Torque -sensors, Star and sun sensor, Earth sensor.	1	05-10-2023		TLM2	
9.	Magnetometers and Inertial Sensors.	1	06-10-2023		TLM2	
10.	Revision of Unit -4	1	07-10-2023			
No. of classes required to complete UNIT-IV: 10				No. of classes taken:		

UNIT-V : Satellite services 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.	Introduction to Satellite services and applications	1	10-10-2023		TLM2	
2.	GPS location and principle.	1	12-10-2023		TLM2	
3.	GPS location and principle.	1	13-10-2023		TLM2	
4.	Direct to Home, Home receiver		17-10-2023		TLM2	
5.	Satellite Mobile Services: VSAT.	1	19-10-2023		TLM2	
6.	Satellite Mobile Services: MSAT, RADARSAT.	1	20-10-2023		TLM2	
7.	IRNSS constellation.	1	21-10-2023		TLM2	
8.	Satellite structures and materials.	1	26-10-2023		TLM2	
9.	Revision of Unit -5	1	27-10-2023		TLM2	
No. of classes required to complete UNIT-V: 9				No. of classes taken:		

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Information about NaviC & some recently launched satellites information.	1	28-10-2023		TLM2	

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
(M.SivasankaraRao)	(V V Ramakrishna)	(Dr.M.V.Sudhakara Reddy)	(Dr.Y.Amara Babu)

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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PART-A

Name of Course Instructor: A.Sarvani
Course Name & Code : Machine Learning & 20AD04
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V Sem/Sec-A **A.Y.:** 2023-24

PREREQUISITE : **Probability and Statistics, Data Warehousing and Data Mining**

Course Educational Objective: The objective of this lab is to make use of Data sets in implementing the machine learning algorithms in any suitable language of choice.

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

CO1: Apply the appropriate pre-processing techniques on data set. (**Apply – L3**)

CO2: Implement supervised Machine Learning algorithms. (**Apply – L3**)

CO3: Implement unsupervised Machine Learning algorithms (**Apply – L3**)

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	2	-	2	3	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

1- Slight(Low), 2 - Moderate(Medium), 3 - Substantial (High).

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.NO	CYCLE	Date	List Of Programmes	Signature
1	-	10-07-2023	Introduction of lab	
2	1	17-07-2023	Basic statistical functions for data exploration	
3	2	24-07-2023	Data Visualization: Box plot, scatter plot, histogram	
4	3	31-07-2023	Data Pre-processing: Handling missing values, outliers, normalization, Scaling	
5	4	07-08-2023	Principal Component Analysis (PCA)	
6	5	07-08-2023	Singular Value Decomposition (SVD)	
7	6	14-08-2023	Linear Discriminant Analysis (LDA)	
8	7	21-08-2023	Regression Analysis: Linear regression, Logistic regression, Polynomial regression	
9	8	04-09-2023	Regularized Regression	
10	9	04-09-2023	K-Nearest Neighbour (kNN) Classifier	
11	10	18-09-2023	Support Vector Machines (SVMs)	
12	11	25-09-2023	Random Forest model	
13	-	09-10-2023	Revision and practice	
14	-	16-10-2023	Internal Exam	

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work	18-07-2022		
I Phase of Instructions	18-07-2022	10-09-2022	8W
Technical Training/Value added courses	12-09-2022	24-09-2022	2W
I Mid Examinations	**26-09-2022**	**01-10-2022**	1W
II Phase of Instructions	03-10-2022	26-11-2022	8W
II Mid Examinations	**28-11-2022**	**03-12-2022**	1W
Preparation and Practicals	05-12-2022	10-12-2022	1W
Semester End Examinations	12-12-2022	24-12-2022	2W

ACADEMIC CALENDAR

Description	From	To	Weeks
B.Tech (V Semester)			
Commencement of Class Work	**03-07-2023**		
I Phase of Instructions	03-07-2023	26-08-2023	8 W
I MID Examinations	**28-08-2023**	**02-09-2023**	**1 W**
II Phase of Instructions	04-09-2023	28-10-2023	8 W
II MID Examinations	**30-10-2023**	**04-11-2023**	**1 W**
Preparation and Practical	06-11-2023	11-11-2023	1 W
Semester End Examinations	**13-11-2023**	**25-11-2023**	**2 W**

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Organize, Analyze and interpret the data to extract meaningful conclusions.
PSO 2	Design, Implement and Evaluate a computer-based system to meet desired needs
PSO 3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**A.Sarvani**	**Dr. K. Devi Priya**	**Mrs. M. Hema Latha**	**Dr.B.Srinivasa Rao**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

PROGRAM : B.Tech.,V-Sem., IT – R20 Regulation (B-sec)

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Computer Networks Lab–20CS12

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

COURSE CREDITS : 1

COURSE INSTRUCTOR : **R Pavitra**

PRE-REQUISITE : **Network Simulation -2,Python,C++**

COURSE OBJECTIVE: In this course student will learn about how to build and understanding the fundamental concepts of computer networking and gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

COURSE OUTCOMES (CO)

CO1: Implement Network layer functionalities using NS3 simulator. (Apply-L3)

CO2: Demonstrate Transport Layer functionalities. (Understand- L2)

CO3: Analyze Application layer protocols using Wireshark. (Analyze – L4)

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2									1	2	2	2
CO2	2	3	2									1	2	3	3
CO3	2	2	2									1	3	2	2
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-
1- Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High).															

BOS APPROVED TEXT BOOKS:

T1 B. A. Frouzan, Data Communication, Tata Mc Graw Hill.

T2 A. S. Tanenbaum –Computer Network: Second Ed. Prentice Hall, India (tan).

BOS APPROVED REFERENCE BOOKS:

R1 William Stallings, "Data and Computer Communication", Pearson Prentice Hall India, 8 th Edition.

R2 Douglas Comer, Internetworking with TCP/IP, Prentice Hall of India, Volume 1, 6th Edition, 2009.

R3 Richard Stevens, "TCP/IP Illustrated" , Addison-Wesley, Volume 1, 2001.

R4 http://www.cse.iitk.ac.in/users/dheeraj/cs425/.

R5 http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Programs to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	To gain familiarity with the basic network commands & utilities available in the Linux OS	3	5-07-2023		**TLM8/TLM5**	
2.	To learn about network layer tools and analyze captures for congestion.	3	12-07-2023		**TLM8/TLM5**	
3.	To learn about queue management techniques, and global routing in ns3.	6	19-07-2023 26-07-2023		**TLM8/TLM5/TLM4**	
4.	To learn about broadcasting, multicasting, and bridging in a Local Area Network using ns3.	6	02-08-2023 9-08-2023		**TLM8/TLM5/TLM4**	
5.	To learn about Wi-Fi and Mobile Adhoc topologies with ns3.	3	16-08-2023		**TLM8/TLM5/TLM4**	
6.	To introduce Socket Programming in TCP and UDP.	3	23-08-2023		**TLM8/TLM5**	
7.	Observations of Transmission Control Protocol (TCP) Connection states, Flags and Flow Control.	3	13-9-2023		**TLM8/TLM5**	
8.	To learn Transmission Control Protocol (TCP) Flow Control, Error	6	20-9-2023 27-9-2023		**TLM8/TLM5**	

	Control, and Congestion.					
9.	To introduce Wireshark & tcpdump, and observation of packets in a LAN network.	6	4-10-2023 11-10-2023		**TLM8/TLM5**	
10.	To analyze HTTP packets using Wireshark tool, and understand the records returned by a DNS server.	3	18-10-2023		**TLM8/TLM5**	
11.	**Lab-Internal-**	3	25-10-2023			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	18-07-2022	10-9-2022	8W
Technical Training/Value Added Courses	12-09-2022	24-09-2022	2W
I Mid Examinations	26-09-2022	01-10-2022	1W
II Phase of Instructions	03-10-2022	26-11-2022	8W
II Mid Examinations	28-11-2022	03-12-2022	1W
Preparation and Practical's	05-12-2022	10-12-2022	1W
Semester End Examinations	12-12-2022	24-12-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Internal Lab Exam-I	1,2,3	A1= 5
Internal Lab Exam-II	1,2,3	A2= 5
Day to Day Evaluation	1,2,3	B= 5
Record	1,2,3	C= 5
Evaluation of Internal Lab Exam Marks: A=(A1+A2)/2	1,2,3	A= 5
Cumulative Internal Examination: A+B+C	**1,2,3**	**A+B+C =15**
Semester End Examinations	**1,2,3**	**E=35**
Total Marks: A+B+C+D	**1,2,3**	**50**

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R Pavitra			**DrB. Srinivasa Rao**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**