NAGARJUNA

COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF CSE (Artificial Intelligence & Machine Learning)

Scheme and Syllabus

With effect from Academic Year 2024-25

VISION

To be a centre of excellence with quality education and research in Artificial Intelligence through nurturing collaborative culture, disseminating customer oriented innovations and positive contribution to the welfare ofthe society.

MISSION

- To impart quality technical education to the students to enhance their professional skills and make themglobally competitive.
- To carry out research in cutting out technologies in Artificial Intelligence and its allied fields to meet therequirements of industry and society.
- To create an innovation environment with the collaboration of industry in which students can providesolutions to global problems.
- To inculcate strong ethical and leadership qualities to the minds of students and make them as successfulentrepreneurs.
- To produce the Computer Science and Engineering professionals with a specialization in AIML withpersonal and professional responsibilities and commitment to lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

The graduates of Computer Science and Engineering are expected to fulfill the following PEOs after a fewyears of their graduation.

PEO1: Graduates in Computer Science and Engineering will apply the technical knowledge of analysis and design of software used for sustainable societal growth.

PEO2: Graduates of Computer Science and Engineering will demonstrate logical thinking and programming skills**.**

PEO3: Graduates in Computer Science and Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.

PEO4: Computer Science and Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.

PEO5: Computer Science and Engineering graduates will have the ability to be come entrepreneurs there by switching over from responsive engineer to creative engineer.

PROGRAM OUTCOMES (POs):

Graduates of the Computer Science and Engineering Programme will be able to achieve the following POs:

PO1:Engineering Knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and **Computer Science and Engineering** principles to the solution of complex problems in **Computer Science and Engineering.**

PO2: Problem Analysis:

Identify, formulate, research literature, and analyze complex **Computer Science and Engineering** problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO3:Design/Development of Solutions:

Design solutions for complex **Computer Science and 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 related to **Computer Science and Engineering** problems.

PO5: Modern Tool Usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex **Computer Science and Engineering** activities with an understanding ofthe 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 **Computer Science and Engineering**practice.

PO7: Environment and Sustainability:
Understand the impact of the professional **Computer Science and Engineering** solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics:
Apply ethical principles and commit to professional ethics and responsibilities and norms of the **Computer Science and Engineering** practice

PO9: Individual and Teamwork:
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:
Communicate effectively on complex **Computer Science and 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 **Computer Science and Engineering** 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.

PROGRAM SPECIFIC OUTCOMES (PSOs):
Program Specific Outcomes (PSOs) are what the graduates of a specific undergraduate engineering programshould be able to do at the time of graduation.

PSO1: Professional Skills:
The ability to understand, analyze and develop computer programs in the areas related to system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems ofvarying complexity

PSO2: Problem-Solving Skills:
The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3: Foundation of mathematical concepts:
Ability to apply mathematical concepts to solve real world problems using appropriate data structure andsuitable algorithms.

NAGARJUNA COLLEGE OF ENGINEERING AND TECHNOLOGY
B.E.in CSE (AI&ML)
Scheme of Teaching and Examinations 2021
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)
(Effective from the academic year 2024-25)

VII SEMESTER

Sl No	Course and Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
				Theory Lecture	Tutorial	Practcal/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21CIT71	Natural language Processing	Any CS Board Department	3	0	0	0	03	50	50	100	3
2	PCC 21CIT72	Reinforcement Learning		2	0	0	0	03	50	50	100	2
3	PEC 21XX73X	Professional Elective Course - II		3	0	0	0	03	50	50	100	3
4	PEC 21XX74X	Professional Elective Course - III		3	0	0	0	03	50	50	100	3
5	OEC 21XX75X	Open Elective Course-II	Concerned Department	3	0	0	0	03	50	50	100	3
6	Project 21CIP76	Project work		Two contact hours /week for interaction between the faculty and students				03	100	100	200	10
							Total	**350**	**350**	**700**	**24**	

Professional Elective - II			
21CIT731	Chatbot	21CIT733	Big Data Analytics
21CIT732	Blockchain Technology	21CIT734	Full Stack Development
21CIT735	Cognitive System		

Professional Elective - III			
21CIT741	Quantum Computing	21CIT743	Social Media analytics
21CIT742	Precision Agriculture	21CIT744	Robotic Process Automation
21CIT745	Data visualization		

Open Electives - II offered by the Department to other Department students			
21CIT751	R Programming	21CIT753	Deep learning
21CIT752	Social Media Analytics	21CIT754	Data Science & Visualization

NATURAL LANGUAGE PROCESSING					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
21CIT71	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PCC

Pre-Requisites:

- Basic Probability concepts, Linear Algebra, Machine Learning, Automata theory.

Objectives :

1. Understand the basics of languages and grammar.
2. Learn concepts of natural language processing and its application in solving real world problems.
3. Provides a sound understanding of Natural Language Processing and challenges involved.

Teaching-Learning Process

These are sample Strategies, used in DSA to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Problem Based Learning (PBL) is adopted, which fosters student's Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Module I

Overview and language modeling: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications Information Retrieval. Language Modeling: Various Grammar-based Language Models - Statistical Language Model.

08 Hours

Module II

Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata- Morphological Parsing – Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context- free Grammar – Constituency – Parsing –Probabilistic Parsing.

08 Hours

Module III

Semantic Analysis and Discourse Processing: Introduction, Meaning representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: Cohesion, Reference Resolution.

08 Hours

Module IV

Natural Language Generation: Architectures of NLG Systems, Generation tasks and Representations. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches - Direct Machine Translation, Rule based Machine Translation.

08 Hours

Module V

Lexical Resources and Applications of NLP: WordNet, FrameNet, Stemmers, Part-of-Speech Tagger. Other Applications: Information Extraction, Automatic Text Summarization, Question-Answering System.

08 Hours

Assessment Details (both CIE and SEE)

Theory Component	CIE-1 after completion 45 to 50% Syllabus	20 Marks
	CIE-2 after completion 95 to 100% Syllabus	20 Marks
	CIE-3 after completion	20 Marks
	Sum of three CIEs	**60 Marks**
	AAT-1	10 Marks
	AAT-2	10 Marks
	AAT-3	20 Marks
	Sum of three AATs	**40 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes

The Student will be able to:

CO1. Understand the fundamentals of Natural Language Processing.

CO2. Apply the knowledge of various levels of language processing to perform basic NLP tasks.

CO3. Gain knowledge on automated Natural Language Generation and Machine Translation.

CO4. Implement and evaluate different NLP applications

Text Books:

1. Natural language processing and information retrieval by Tanveer Siddiqui & U.S. Tiwary, Publisher: New Delhi Oxford 2021.

Textbook 1: Chapter 1: 1.1 to 1.9; Chapter 2: 2.1 to 2.3; Chapter 3: 3.1 to 3.7; Chapter 4: 4.1 to 4.5; Chapter 5: 5.1 – 5.5; Chapter 6: 6.2 & 6.3; Chapter 7: 7.2 & 7.3; Chapter 8: 8.2 to 8.6; Chapter 11: 11.2 to 11.4; Chapter 12: 12.2 to 12.5.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 3rd Edition, 2019.
2. "Natural Language Processing: An information Access Perspective", Kavi Narayana Murthy, Ess Ess Publications, 2006.
3. Anne Kao and Stephen R. Poteet(Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

E - Resources:

1. https://www.deeplearning.ai/resources/natural-language-processing/
2. https://www.datacamp.com/blog/what-is-natural-language-processing
3. https://www.analyticsvidhya.com/blog/2021/02/basics-of-natural-language-processing-nlp-basics/
4. https://www.freecodecamp.org/news/natural-language-processing-techniques-for-beginners/
5. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp

CO-PO-PSO Mapping

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3				1								2		3
CO 2	3	2	3	3	3								3	3	3
CO 3	2	2	3	3	3								3	3	3
CO 4	2	2	3	3	3								3	3	3
Avg	2.5	2	3	3	2.5								2.75	3	3

REINFORCEMENT LEARNING

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
21CIT72	2:0:0:0	2	CIE:50 SEE:50	3 Hours	PCC

Pre-Requisites:

- Understanding of Machine Learning, Theoretical and practical knowledge of Deep Learning.
- Proficiency in Linear Algebra, Probability and Statistics, Proficiency in Python Programming.

Objectives :

1. Understand the statistical learning techniques and the importance and challenges of learning agents
2. Formalize problems as Markov Decision Processes
3. Understand value functions
4. Understand how to implement dynamic programming as an efficient solution approach to an industrial control problem
5. Start using Reinforcement Learning for real problems

Teaching-Learning Process

These are sample Strategies, used in Reinforcement learning to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Google site and Web links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class questions is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Introduction to Reinforcement Learning: Reinforcement Learning, Terms used, Approaches to implement reinforcement learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe.

Multiarm Bandits: An n-Armed Bandit Problem, Action-Value Methods, Tracking a Non stationary Problem, Upper confidence -Bound
area selection, Gradient Bandits.

05 Hours

Module II

Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks,The Markov Property, Markov Decision Processes, Optimal Value Functions.

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming.

05 Hours

Module III

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Off-policy Prediction via Importance Sampling, Off-Policy Monte Carlo Control.

Temporal-Difference Learning:TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Off-Policy TD Control.

05 Hours

Module IV

Eligibility Traces: n-Step TD Prediction, The Forward View of TD(λ), The Backward View of TD(λ), Sarsa(λ), Watkins's Q(λ), Off- policy Eligibility Traces using Importance Sampling.

Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting, and Learning, Prioritized Sweeping.

05 Hours

Module V

On-policy Approximation of Action Values: Value Prediction with Function Approximation, Gradient-Descent Methods, Linear Methods.

Policy approximation: Actor–Critic Methods, Eligibility Traces for Actor–Critic Methods, R-Learning and the Average-Reward Setting.

05 Hours

Assessment Details (both CIE and SEE)

Theory Component	CIE-1 after completion 30 to 40% Syllabus	20 Marks
	CIE-2 after completion 40 to 70% Syllabus	20 Marks
	CIE-3 after completion 70 to 100% Syllabus	20 Marks
	Average of three CIEs	**20 Marks**
	AAT-1	10 Marks
	AAT-2	10 Marks
	AAT-3/Quiz	10 Marks
	Total of three AATs	**30 Marks**
Grand Total of IAT Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes

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

1. Define and explain the concepts of Reinforcement learning
2. Identification of suitable learning tasks to which these learning techniques can be applied
3. Appreciation of some of the current limitations of reinforcement learning techniques
4. Investigate Reinforcement techniques and derive effectively learning rules.
5. Application of Reinforcement Learning for real problems.

Text Books:

1. Reinforcement Learning An Introduction by Richard S. Sutton and Andrew G. Barto, Second Edition.

Textbook : Chapter 1: 1.1 - 1.5; Chapter 2: 2.1 - 2.7; Chapter 3: 3.1 - 3.6, 3.8; Chapter 4: 4.1 - 4.5; Chapter 5: 5.1 – 5.3, 5.5, 5.7; Chapter 6: 6.1 – 6.5; Chapter 7: 7.1 – 7.3, 7.5 - 7.7, Chapter 8: 8.1 – 8.2, Chapter 9: 9.1 – 9.3, Chapter 11: 11.1 – 11.3

Reference Books:

1. Algorithms for Reinforcement Learning" CsabaSzepesvari, Ronald Brachman, Thomas Dietterich.
2. Markov Decision Processes: Discrete Stochastic Dynamic Programming (9780471727828): Martin L. Puterman

E - Resources:

1. https://www.learn.ed.ac.uk/webapps/blackboard/content/listContent.jsp?course_id=_98846_1&content_id=_7260062_1
2. https://www.coursera.org/specializations/reinforcement-learning
3. https://www.deepmind.com/learning-resources/reinforcement-learning-lecture-series-2021
4. https://www.youtube.com/playlist?list=PLoROMvodv4rOSOPzutgyCTapiGlY2Nd8u

CO-PO-PSO Mapping

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PS O 1	PS O 2	PSO 3
CO 1	3	3	2	2	3	-	-	-	-	-	-	2	3	2	3
CO 2	3	3	2	2	3	-	-	-	-	-	-	1	3	2	3
CO 3	3	3	2	2	3	-	-	-	-	-	-	2	3	2	2
CO 4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	3
CO 5	3	2	2	2	3	-	-	-	-	-	-	1	3	2	2
Avg	3	2.8	2.2	2.2	3	-	-	-	-	-	-	1.6	3	2	2.6

BLOCKCHAIN TECHNOLOGY					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
21CIT732	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PEC

Pre-Requisites:

- Basic knowledge of Cryptography, Object oriented programming concepts
- Basic knowledge of mathematics.

Objectives :

1. Understand the basics of Blockchain technology
2. Learn concepts of Cryptocurrency.
3. Gain knowledge to choose the blockchain technology for implementing real world problems.
4. To Learn smart contracts to develop Dapps for suitable real world cases.

Teaching-Learning Process

These are sample Strategies, used in Blockchain subject to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Introduction: Basics for Blockchain: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Distributed Systems,. The Public Key Cryptography, Hash function, Digital Signature. **08 Hours**

Module II

Bitcoin: The history of blockchain and Bitcoin, Electronic cash, Blockchain, Blockchain defined Peer-to-peer, Distributed ledger, Cryptographically-secure, ,Append-only, Updateable via consensus, Generic elements of a blockchain, How blockchain works, How blockchain accumulates blocks, Benefits and limitations of blockchain, Tiers of blockchain technology

Features of a blockchain, Types of blockchain, The structure of a block, Bitcoin Transaction Life cycle.Adding node to a bitcoin network.

08 Hours

Module III

Ethereum Blockchain,The structure of a block header, The genesis block, Mining, Tasks of the miners, Mining rewards, Proof of Work (PoW), The mining algorithm, The hash rate, Mining systems, CPU, GPU, FPGA, ASICs, Mining pools, Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, examples on Smart contract, deploying Smart contracts, Metamask, Ganache **08 Hours**

Module IV

Solidity: Constructors in Solidity, Solidity modifiers, Fallback function, Soft & hard Fork. Applications of Blockchain in various fields, Use cases, vulnerabilities in Smart Contracts, attacks on Smart Contracts. **08 Hours**

Module V

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Proof of Burn, Difficulty Level,SybilAttack.

08 Hours

Assessment Details (both CIE and SEE)

Theory Component	CIE-1 after completion 30 to 40% Syllabus	20 Marks
	CIE-2 after completion 40 to 70% Syllabus	20 Marks
	CIE-3 after completion 70 to 100% Syllabus	20 Marks
	Average of three CIEs	**20 Marks**
	AAT-1	10 Marks
	AAT-2	10 Marks
	AAT-3/Quiz	10 Marks
	Total of three AATs	**30 Marks**
Grand Total of IAT Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Prescribed Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder		Princeton University Press	2016
2	Mastering Blockchain	Imran Bashir	Second	Packt	2018

Reference Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Bitcoin Blockchain: Protocol for Micropayments	Kapil Jain	Kindle	BPB Publications	2020
2	Build Your Own Blockchain: A Practical Guide to Distributed Ledger Technology (Management for Professionals)	Daniel Hellwig, Goran Karlic, Arnd Huchzermeier	First	Springer	2020

E-Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Blockchain by Example	Bellaj Badr, Richard Horrocks and Xun (Brian) Wu		Packt	2018	https://www.packtpub.com/free-ebook/blockchain-by-example/9781788475686

MOOC Course

Sl. No.	Course name	Course Offered By	Year	URL
1.	Blockchain Specialization Course 1: Blockchain Basics Course 2: Smart contracts Course 3: Decentralized Applications Course 4: Blockchain Platforms	Coursera	2021	https://www.coursera.org/specializations/blockchain
2.	Blockchain architecture, Design and Use cases	NPTEL	2018	https://nptel.ac.in/courses/106/105/106105184/

Course Outcomes

At the end of the course the student will be able to

CO1	Apply the principles of Blockchain and Cryptocurrency for a given application.
CO2	Analyze the various protocols and mining techniques in Blockchain.
CO3	Design Blockchain based solution for a given scenario.
CO4	Design Dapps for the given problem

CO-PO-PSO mapping

	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	**2**														
CO2		**3**													
CO3			**1**											**3**	
CO4			**3**		**3**			**2**		**2**					

ROBOTIC PROCESS AUTOMATION					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
21CIT744	3:0:0:0	3	IAT:50 SEE:50	3 Hours	PEC

This course will enable students to:

1. This course will enable the students to: Understand the basic concepts of RPA platform.
2. Describe the different types of variables, control flow and data manipulation techniques.
3. Understand various control techniques, plugins and extensions in RPA.
4. Describe various types and strategies to handle events and exceptions.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teachingmethods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with theirown creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module I

RPA Foundations- What is RPA - flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA- Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- 0CR-Databases-APls- Al-Cognitive Automation-Agile, Scrum, Kanban and Waterfall Devops- Flowcharts.

08 Hours

Module II

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation -Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.

08 Hours

Module III

Sequence, Flowchart, and Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart.

Data Manipulation: Data Manipulation, Variables and scope, Collections, Arguments Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example.

08 Hours

Module IV

Taking Control of the Controls: Taking Control of the Controls, Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls mouse and keyboard activities, Working with Ui Explorer, Handling events, Revisit recorder, Screen Scraping, when to use OCR, Types of OCR available, Avoiding typical failure points.

08 Hours

Module V

Exception Handling, Debugging, and Logging: Exception Handling, Debugging, and Logging, Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, Collecting crash dumps.

08 Hours

Assessment Details (both CIE and SEE)

Theory Component	CIE-1 after completion of 40% Syllabus	20 Marks
	CIE-2 after completion of 80% Syllabus	20 Marks
	CIE-3 after completion of 100% Syllabus	20 Marks
	Sum of three CIEs	**60 Marks**
	AAT-1	10 Marks
	AAT-2	10 Marks
	AAT-3	20 Marks
	Sum of three AATs	**40 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Text Book(s):

Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool UiPath by Alok_Mani Tripathi, Packtpub, March 2018

Reference Book(s):

1. Learning ServiceNow by Tim Woodruff, Packtpub, March 2017.
2. ServiceNow Automation by Ashish Rudra Srivastava, Packtpub.

E - Resources:

Web and Video link(s):

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with Action verbs for the Course topics
CO1	Apply the concept of Robotic Process Automation to automate real worldapplication.
CO2	Analyze the usage of appropriate Robotic Process Automation technique for a given application.
CO3	Design and implement techniques of Robotic Process Automation for the given application.

CO-PO- PSO Mapping.

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

R-PROGRAMMING					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
21CIO751	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PCC

Pre-Requisites:

Basic knowledge of statistics, probability, calculus, linear algebra, and programming knowledge.

Objectives :

1. Replicating human learning processes to improve accuracy for specific tasks.
2. Classifying data based on developed models (e.g., detecting spam emails).
3. Making predictions for future outcomes (e.g., predicting house prices).
4. Building algorithms that learn from data to find patterns and make accurate predictions.

Teaching-Learning Process

These are sample Strategies, used in ML to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Numeric, Arithmetic, Assignment, and Vectors Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions. . **08 Hours**

Module II

Matrices and Arrays:

Defining a Matrix, Sub-setting, Matrix Operations, Conditions and Looping: if statements, looping with for, looping with while, vector based programming.

08 Hours

Module III

Lists and Data Frames:

Data Frames, Lists, Special values, The apply family. **08 Hours**

Module IV

Functions: Calling functions, scoping, Arguments matching, writing functions: The function command, Arguments, specialized function. **08 Hours**

Module V

Pointers:

packages, frames, de bugging, manipulation of code, compilation of the code. **08 Hours**

Assessment Details (both IAT and SEE)

Theory Component	IAT-1 after completion 40 to 80% Syllabus	20 Marks
	IAT-2 after completion 85 to 100% Syllabus	20 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of IAT Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
IAT + SEE (min marks 40)		**100 Marks**

Course Outcomes

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

CO1. To understand the fundamental syntax of R through readings, practice exercises,

CO2. To demonstrations, and writing R code.

CO3. To apply critical programming language concepts such as data types, iteration,

CO4. To understand control structures, functions, and Boolean operators by writing R programs and through examples

CO5. To import a variety of data formats into R using R-Studio

CO6. To prepare or tidy data for in preparation for analyze.

Textbooks

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

References:

1. Michael J. Crawley, “Statistics: An Introduction using R”, Second edition, Wiley,2015

Last Updated: Tuesday, January 24, 2023

Textbook 1: Chapter 2(2.1 to 2.7) ,2- 2.8, 3- 3.2 to 3.5, , 5- 5.1 to 5.6, 6- 6.2 to 6.4, 8- 8.1 to 8.8

E - Resources:

1. http://www.tutorialspoint.com/r/r_useful_resources.htm
2. https://rstudio-education.github.io/hopr/

CO-PO-PSO- Mapping

	PO1	PO2	PO3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PS O2	PS O3
CO1	**3**				**3**	2			2	2		2		3	
CO2	**2**		**2**		**2**					3					
CO3	**2**									3		1		2	
CO4	**2**				**3**					3		2			
CO5	**3**				**2**				3	3		1		2	
CO6	**3**				**2**				2	3		2			

FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
21CIO755	3:0:0:0	3	CIE:50 SEE:50	3 Hours	OE

Pre-Requisites:

- Basic knowledge of Cryptography, Object oriented programming concepts
- Basic knowledge of mathematics.

Objectives :

1. Understand the basics of Blockchain technology
2. Learn concepts of Cryptocurrency.
3. Gain knowledge to choose the blockchain technology for implementing real world problems.
4. To Learn smart contracts to develop Dapps for suitable real world cases.

Teaching-Learning Process

These are sample Strategies, used in Blockchain subject to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Introduction: Basics for Blockchain: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Distributed Systems,. The Public Key Cryptography, Hash function, Digital Signature. **08 Hours**

Module II

Bitcoin: The history of blockchain and Bitcoin, Electronic cash, Blockchain, Blockchain defined Peer-to-peer, Distributed ledger, Cryptographically-secure, Append-only, Updateable via consensus, Generic elements of a blockchain, How blockchain works, How blockchain accumulates blocks, Benefits and limitations of blockchain, Tiers of blockchain technology Features of a blockchain, Types of blockchain, The structure of a block, Bitcoin Transaction Life cycle. Adding node to a bitcoin network. **08 Hours**

Module III

Ethereum Blockchain,The structure of a block header, The genesis block, Mining, Tasks of the miners, Mining rewards, Proof of Work (PoW), The mining algorithm, The hash rate, Mining systems, CPU, GPU, FPGA, ASICs, Mining pools,Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, examples on smart contract, deploying smart contracts, ,Metamask, **08 Hours**

Module IV

Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains. , Soft & hard Fork. Applications of blockchain in various fields, Use cases, Vulnerabilities in

Smart contracts, attacks on Smart contracts . **08 Hours**

Module V

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Proof of Burn, Difficulty Level,SybilAttack. **08 Hours**

Assessment Details (both CIE and SEE)

Theory Component	CIE-1 after completion 30 to 40% Syllabus	20 Marks
	CIE-2 after completion 40 to 70% Syllabus	20 Marks
	CIE-3 after completion 70 to 100% Syllabus	20 Marks
	Average of three CIEs	**20 Marks**
	AAT-1	10 Marks
	AAT-2	10 Marks
	AAT-3/Quiz	10 Marks
	Total of three AATs	**30 Marks**
Grand Total of IAT Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Prescribed Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder		Princeton University Press	2016
2	Mastering Blockchain	Imran Bashir	Second	Packt	2018

Reference Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Bitcoin Blockchain: Protocol for Micropayments	Kapil Jain	Kindle	BPB Publications	2020
2	Build Your Own Blockchain: A Practical Guide to Distributed Ledger Technology (Management for Professionals)	Daniel Hellwig, Goran Karlic, Arnd Huchzermeier	First	Springer	2020

E-Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Blockchain by Example	Bellaj Badr, Richard Horrocks and Xun (Brian) Wu		Packt	2018	https://www.packtpub.com/free-ebook/blockchain-by-example/9781788475686

MOOC Course

Sl. No.	Course name	Course Offered By	Year	URL
1.	Blockchain Specialization Course 1: Blockchain Basics Course 2: Smart contracts Course 3: Decentralized Applications Course 4: Blockchain Platforms	Coursera	2021	https://www.coursera.org/specializations/blockchain
2.	Blockchain architecture, Design and Use cases	NPTEL	2018	https://nptel.ac.in/courses/106/105/106105184/

Course Outcomes

At the end of the course the student will be able to

CO1	Apply the principles of Blockchain and Cryptocurrency for a given application.
CO2	Analyze the various protocols and mining techniques in Blockchain.
CO3	Design Blockchain based solution for a given scenario.
CO4	Design Daaps for the given problem

CO-PO-PSO mapping

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