Faculty of Science

Department of Computer Science

Palamuru University
Mahabubnagar — 509001
Telanagana State

M.Sc. Computer Science Programme

Syllabus for M.Sc. Computer Science
II Year (III and IV Semesters)

With effect from 2024-25

With effect from academic year 2024-2025

Department of Computer Science
Palamuru University, Mahabubnagar

M.Sc. Computer Science

(Course under Choice Based Credit System)

SEMESTER - III

Paper	Paper Code	Paper Title	Hours Per Week	Marks			Credits
				CCE	SEE	TOTAL	
I	CS301T	Artificial Intelligence	4	40	60	100	4
II	CS302T	Compiler Design	4	40	60	100	4
III	Elective CS303T(A) CS303T(B) CS303T(C)	 Network Security Block chain and Crypto Currency Technologies Big Data Analytics	4	40	60	100	4
IV	Elective CS304T(A) CS304T(B) CS304T(C)	 Natural Language Processing Web Mining DEVOPS	4	40	60	100	4
V	CS305P	Artificial Intelligence Lab	4	0	50	50	2
VI	CS306P	Compiler Design Lab	4	0	50	50	2
TOTAL			**24**	**160**	**340**	**500**	**20**

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(Dr Venkat Dass)

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SEMESTER -IV

Paper	Paper Code	Paper Title	Hours Per Week	Marks			Credits
				CCE	SEE	TOTAL	
I	CS401T	Cloud Computing	4	40	60	100	4
II	CS402T	Data Science with R	4	40	60	100	4
III	**Elective** CS403T(A) CS403T(B) CS403T(C)	Computer Organization Distributed Systems Machine Learning	4	40	60	100	4
IV	CS404 P	Data Science with R Lab	4	0	50	100	4
V	*CS405P	Project Work	12	50	100	150	4
TOTAL			**28**	**170**	**330**	**500**	**20**

CS205P : 50 Marks for Seminar + 100 Marks for Project Viva Voce

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M.Sc. Computer Science

Semester - III

Paper-I: Artificial Intelligence (CS 301T)

Theory: 4 Hours/ Week **Credits: 4**

Unit — I

Introduction to Artificial Intelligence: Introduction, Al techniques, problem) solving with Al, Al models, data acquisition and learning aspects in Al.

Problem Solving: problem-solving process, formulating problem, problem types and characteristics, problem analysis and representation, problem space and search, toy problems, real-world problems, problem reduction methods.

Uniformed Search: general search algorithm, uniformed search methods — BFS, uniform cost search, DFS, DES, IS, bi-directional search, comparison of the uniformed techniques.

Unit — II

Informed Search: generate and test, best first search, greedy search, A* search, memory bounded heuristic search, heuristic function, A () * search, local search algorithms and optimization problems, adversarial search methods (game theory), online search algorithms.

What is an intelligent agent? Types of agent. what is constraint satisfaction problem (CSP), CSP as search problem. local search for CSP, formulating problem structure.

Knowledge and Reasoning: knowledge representation, knowledge-based agents, the Wumpus world, logic, propositional logic, predicate logic, unification and lifting: in FOL, representing knowledge using rules. semantic networks, frame systems, inference, types of reasoning.

Unit - III

Uncertain Knowledge and Reasoning: uncertainty and methods, Bayesian probability and belief network, probabilistic reasoning, probabilistic reasoning over time, forward and backward reasoning, perception, making simple decisions, making complex decisions, other techniques in uncertainty and reasoning process.

Planning problem, simple planning agent, planning languages, blocks world, goal stack planning, Means-Ends analysis, planning as a state-space search.

Learning: what is Machine learning? Learning paradigms, learning concepts, methods and models, statistical learning methods, Artificial Neural Networks—based learning, support vector machines, reinforcement learning.

Unit - IV

Expert Systems: Architecture of expert system, confidence factors, existing expert systems, knowledge acquisition, shell and explanations, self-explaining system. rule-based expert systems, forward and backward chaining, frame-based expert systems, uncertainty management in expert systems, expert system and DSS, pros and cons of expert systems, case study.

Pattern Recognition: Machine perception and pattern recognition, feature extraction, classification, object recognition, speech recognition, pattern mining. Game Playing: important concepts of game theory, game playing and knowledge structure, game as search problem. alpha-beta pruning, game theory problems, robotics.

Concepts and terminology of ANN, feed-forward NN, feed-back networks, pattern associative networks, Competitive learning, fuzzy sets, fuzzy inference process, neuro-fuzzy systems, range of Al applications, Al applications and examples, case study: agricultural domain — farmer's intelligent assistant.

Text Book: Parag Kulkarni, Prachi Joshi, Artificial Intelligence: Building Intelligent Systems-PHI learning Pvt. Ltd. New Delhi

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References:

1. Nils J Nilsson, Artificial Intelligence: A New Synthesis
2. Kevin Knight, Elaine Rich, B Nair-Artificial Intelligence
3. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach
4. Eugene Charniak, Drew McDermott, Introduction to Artificial Intelligence
5. Vinod Chandra SS, Anand Hareendran S. Artificial Intelligence and Machine Learning

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Paper-II: Compiler Design (CS 302T)

Theory: 4 Hours/ Week **Credits: 4**

Unit — I

Introduction: Language processors, phases of a compiler. a model for a compiler front end. Syntax directed translation, parsing, a translator for simple expressions, Lexical Analysis: role of lexical analyzer, input buffering, specification of tokens, Lex lexical analyzer generator, data structures in compilation.

Top-Down Parsing: Introduction, Context free grammars, writing a grammar, recursive-descent parsing, LL(I) grammars, predictive parsing, pre-processing steps required for predictive parsing.

Unit — II

Bottom-Up Parsing: shift reduce parsing. SLR parsing. CLR parsing and LALR parsing, error recovery in parsing, handling ambiguous grammar. parser generator — YACC.

Semantic Analysis: syntax-directed definitions, evaluation order for SDD's, application of SDT.

Unit — III

Code Generation: syntax trees, three-address code. types and declarations, translation of expressions, type checking. Runtime Environment: storage organization, stack allocation of space, heap management, storage allocation for arrays, strings and records, introduction to garbage collection and trace based collection,

Unit - IV

Code Generation: Issues in the design of code generator, target language. addresses in the target code, blocks and flow graphs, optimization of blocks, peephole optimization, register allocation and assignment.

Code Optimization: principal sources of optimization. data flow analysis, constant propagation. partial redundancy elimination, loops in flow graphs.

Text Book: A. V. Aho, Monica S. Lam, Ravi Sethi, J. D. Ullman, Compilers Principles, Techniques, & Tools, (2e)

References

1.Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Modern Compiler Design
2.Kenneth C. Louden. Compiler Construction Principles and Practice
3.Thomas w. Parsons. Introduction to Compiler Construction
4.Andrew N. Appel, Modern Compiler Implementation in C
5.John R. Levin, Tony Mason. Doug Brown, LEX & Y ACC
6. Cooper, Linda, Engineering a Compiler

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With effect from academic year 2024-2025

Paper-III (A):Network Security (CS 303T(A))

Theory: 4 Hours/ Week **Credits: 4**

Unit - I

Overview of Network Security: Computer Security Concepts, the OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, the Data Encryption Standard (DES), A DES Example, Strength of DES.

Block Cipher Operation: Double DES, Triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode.

Unit - II

Advanced Encryption Standard (AES): The Origins AES, AES Structure, AES Transformation Functions, AES Key Expansion, an AES Example AES Implementation.

Pseudorandom Number Generation and Stream Ciphers: Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, Pseudorandom Number Generation using Block Cipher, Stream Ciphers, RC4.

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems. the RSA Algorithm.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption and Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Diffie-Hellman Key Exchange.

Unit - III

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Secure Hash Algorithm (SMA) & MD5 Algorithm.

Message Authentication Codes: Message Authentication Requirements. Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC, MACs Based on Block Ciphers: DAA and CMAC.

Digital Signatures: Digital Signatures. NIST Digital Signatures Algorithm.

Unit - IV

Transport-Level Security: Web Security Considerations, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH),

Electronic Mail Security: Pretty Good Privacy, S/MIME.

IP Security: IP Security Overview, IP Security Architecture, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

Intruders, Virus and Firewalls: Intruders, Intrusion Detection. Password Management. Virus and Related Threats, Countermeasures, Firewall Design Principles, Types of Firewalls.

Text Book: William Stallings, Cryptography and Network Security — Principles and Practice (6e)

References:

1. Zhenfu Cao, New Directions of Modern Cryptography
2. Douglas R. Stinson, Cryptography Theory and Practices
3. Tom St Denis. Simon Johnson. Cryptography' for Developers
4. Joseph Migga Kizza, A Guide to Computer Network Security
5. A. Menezes, P. Van Oorschot, S. Vanstone, Handbook of Applied Cryptography
6. Henk C.A. van Tilborg, Sushil Jajodia, Encyclopaedia of Cryptography and Security
7. Keith M. Martin, Everyday Cryptography—Fundamental Principles and Applications

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Paper – III (B) Block chain and Crypto Currency Technologies (CS 303T(B))

Theory: 4 Hours/ Week **Credits: 4**

Unit- I

Introduction to Cryptography and Crypto currencies: Foundations of Cryptography and security: Ciphers and secret messages. security attacks and services. Mathematical tools for cryptography: substitution techniques, modular arithmetic, Euclid's algorithm, finite fields, polynomial arithmetic. Design Principles of Block Ciphers: Theory of Block Cipher Design. Feistel cipher network structure, DES and Triple DES. modes of operation (ECB, CBC, OFB, CFB), strength of DES.

Unit- II

Block chain Achieves: Decentralization - Centralizations. Decentralization- Distributed consensus, Consensus with - out identity using a block chain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Unit- III

Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations and improvements.

Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.

Bitcoin and Anonymity: Anonymity, how to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zero coin and Zero cash.

Unit- IV

Community, Politics, and Regulation: Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who sin Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti Money Laundering Regulation, New York's Bit License Proposal.

Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multiparty Lotteries in Bitcoin, Bitcoin as Public Randomness, Source- Prediction, Markets. and Real World Data Feeds.

Text Book:

1. Narayanan, A., Bonneau. J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and crypto currency technologies: a comprehensive introduction. Princeton University Press.
2. William Stallings, Cryptography and Network Security, Pearson 2004.

References:

1 . Antonopoulos, A. M. (2014). Mastering Bitcoin: unlocking digital cryptocurrencies. OReilly Media, Inc.
2. Franco, P. (2014). Understanding Bitcoin: Cryptography, engineering and economics. John Wiley and Sons.

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Paper - III (C) Big Data Analytics (CS 303T(C))

Theory: 4 Hours/ Week **Credits: 4**

Unit — I

Overview of Big Data: What is Big Data? Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the Use of Big Data in Business Context: Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities, Use of Big Data in Detecting Fraudulent Activities in Insurance Sector. Use of Big Data in Retail Industry.

Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Introducing Hadoop. Understanding Hadoop Ecosystem: Hadoop Ecosystem, HDFS, Map Reduce, Hadoop YARN, HBase, Hive, Pig and Pig Latin, Sqoop. Zookeeper, Flume, Oozie.

Unit -II

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Role of HBase in Big Data Processing. Exploring the Big Data Stack, Virtualization and Big Data, Virtualization Approaches.

Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Non-Relational Database, Integrating Big Data with Traditional Data Warehouses. Big Data Analysis and Data Warehouse, Changing Deployment Models in Big Data Era.

Processing Your Data with Map Reduce: Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.

Customizing Map Reduce Execution: Controlling Map Reduce Execution with Input Format, Reading Data with Custom Record Reader. Organizing Output Data with Output Formats, Customizing Data with Record Writer. Optimizing Map Reduce Execution with Combiner, implementing a Map Reduce Program for Sorting Text Data.

Unit-III

Understanding Hadoop YARN Architecture: Introduction YARN, Advantages of YARN, YARN Architecture, Working of YARN.

Exploring Hive: Introducing Hive, Getting Started with Hive, Hive Services, Data Types in Hive, Built-In Functions in Hive, Hive DDL, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive.

Analyzing Data with Pig: Introducing Pig, Running Pig, Getting Started with Pig Latin, Working with Operators in Pig. Working with Functions in Pig, Debugging Pig, Error Handling in Pig.

Unit- IV

Using Oozie: Introducing Oozie, Installing and Configuring Oozie, Understanding the Oozie Workflow. Simple Application.

NoSQL Data Management: Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views. Distributed Models, Sharding, Map Reduce Partitioning and Combining. Composing MapReduce Calculations.

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Developing an Analytic Team. Analytical Approaches and Tools to Analyze Data: Analytical Approaches, History of Analytical Tools, Introducing Analytical Tools, Comparing Various Analytical Tools.

Text Book: DT Editorial Services. Big Data — Black Book (dreamtech)

References

1. Radha S, M. Vijayalakshmi, Big Data Analytics
2. Arshdeep B and Vijay M. Big Data Science & Analytics — A Hands-On Approach.
3. Frank Ohlhorst, Big Data Fundamentals — Concepts, Drivers, Techniques

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Paper - IV (A):Natural Language Processing (CS 304T(A))

Theory: 4 Hours/ Week **Credits: 4**

Unit- I

Language Processing and Python: Computing with Language: Texts and Words. A Closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding Accessing Text Corpora and Lexical Resources: Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources. WordNet.

Unit- II

Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns. Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings.

Categorizing and Tagging Words: Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word.

Unit- III

Learning to Classify Text: Supervised Classification, Evaluation, Naive Bayes Classifiers Deep Learning for NLP: Introduction to Deep Learning, Convolutional Neural Networks, Recurrent Neural Networks, Classifying Text with Deep Learning

Unit- IV

Extracting Information from Text: Information Extraction. Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction. Analyzing Sentence Structure: Some Grammatical Dilemmas. What's the Use of Syntax. Context-Free Grammar, Parsing with Context-Free Grammar.

NLP applications: Topic modelling, Text classification, Sentiment analysis, Word sense disambiguation, Speech recognition and speech to text, Text to speech, Language detection and translation.

Text Book:

1. Steven Bird, Ewan Klein, and Edward Lope, Natural Language Processing with Python.OReily.2009.
2. Akshay Kulkarni, Adarsha Shivananda, Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Apress, 2019
3. Allen James, Natural Language Understanding, Benjamin/Cumming, 1995. Charniack. Eugene, Statistical Language Learning. MIT Press, 1993.
4. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

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Paper-IV (B): Web Mining (CS 304T(B))

Theory: 4 Hours/ Week **Credits: 4**

UNIT — I:

Introduction to Web Data Mining and Data Mining Foundations, Introduction — World Wide Web (www), A Brief History of the Web and the Internet, Web Data Mining-Data Mining, Web Mining. Data Mining Foundations — Association Rules and Sequential Patterns— Concepts of Association Rules, Apriori Algorithm- Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports — Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Concepts of Sequential Patterns. Mining Sequential Patterns on GSP, Mining Sequential Patterns on Prefix-Span. Generating Rules from Sequential Patterns.

UNIT — II:

Supervised and Unsupervised Learning Supervised Learning — Concepts, Decision Tree Induction — Learning Algorithm, Impurity Function, Handling of Continuous Attributes, Classifier Evaluation, Rule Induction — Sequential Covering, Rule Learning, Classification Based on Associations, Naive Bayesian Classification, Naive Bayesian Text Classification — Probabilistic Framework, Naive Bayesian Model. Unsupervised Learning— Concepts, K-Means Clustering — K-Means Algorithm, Representation of Clusters, Hierarchical Clustering — Single link method, Complete link Method, Average link method, Strength and Weakness.

UNIT - III:

Information Retrieval and Web Search: Concepts of Information Retrieval, Information Retrieval Methods — Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-processing — Stopword Removal. Stemming, Web Page Pre-processing. Duplicate Detection, Inverted Index and its Compression — Inverted Index, Search using Inverted Index, Index Construction, Index C01npression, Latent Semantic Indexing — Singular Value Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.

UNIT — IV :

Link Analysis and Web Crawling: Link Analysis — Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, Community Discovery-Problem Definition, Bipartite Core Communities, Maximum Flow Communities, Email Communities. Web Crawling—A Crawler Algorithm- Breadth First Crawlers, Preferential

Crawlers, Implementation Issues — Fetching, Parsing, Stopword Removal, Link Extraction, Spider Traps, Page Repository, Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.

Sentiment Classification — Classification based on Sentiment Phrases, Classification Using Text Classification Methods.

TEXT BOOK:

1.Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by Bing Liu (Springer Publications)

REFERENCES BOOKS:

1.Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)

2.Web Mining: Applications and Techniques by Anthony Scime

3.Mining the Web: Discovering Knowledge rom Hypertext Data by Soumen Chakrabarti

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Paper-IV (C): DEVOPS (CS 304T(C))

Theory: 4 Hours/ Week **Credits: 4**

UNIT -I

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management. Scrum, Kanban, delivery pipeline, bottlenecks, examples. Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

UNIT - II

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb. The separation of concerns. Handling database migrations,
Micro services, and the data tier, DevOps, architecture, and resilience.
Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT - III

Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT - IV

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons. Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points. Test-driven development, REPL-driven development

Deployment of the system: Deployment systems, Virtualization stacks. code execution at the client. Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

Text Books:

1 . Joakim Verona. Practical Devops, Second Edition. Ingram short title: 2nd edition (2018). ISBN10: 1788392574

2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

Reference Book:

l. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-I O.

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Paper — V: Artificial Intelligence Lab (CS305P)

Practical: 4 Hours/ Week **Credits: 2**

Implement the following programs using Python Programming Language

1. Write a Program to print multiplication table for given number.
2. Write a Program to check whether the given no is prime or not.
3. Write a Program to find factorial of the given no and similar programs.
4. Write a program to implement List Operations (Nested list, Length, Concatenation, Membership, iteration, indexing and Slicing), List Methods (Add, Append, Extend & Delete).
5. Write a program to Illustrate Different Set Operations.
6. Write a program to implement Simple Chatbot.
7. Write a program to implement Breadth First Search Traversal.
8. Write a program to implement Depth First Search Traversal.
9. Write a program to implement Water Jug Problem.
10. Write a Program to Implement Tic-Tac-Toe game using Python.
11. Write a program to implement K -Nearest Neighbour algorithm.
12. Write a Program to Implement 8-Puzzle problem using.
13. Write a Program to Implement Travelling Salesman Problem.
14. Write a program to implement Regression algorithm.
15. Write a program to implement Random Forest Algorithm.
16. Write a Program to Implement Tower of Hanoi.
17. Write a Program to Implement Monkey Banana Problem.
18. Write a Program to Implement Alpha-Beta Pruning.
19. Write a Program to Implement 8-Queens Problem.

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Paper -VI: Compiler Design Lab (CS306P)

Practical: 4 Hours/ Week **Credits: 2**

1. Write a program to design token separator for the given expression.
2. Write a program to implement a symbol table.
3. Write a program to develop a lexical analyzer to recognize a few patterns.
4. Write a program to develop a lexical analyzer using Lex tool.
5. Write a program to recognize a valid arithmetic expression using Y ACC.
6. Write a program to recognize a valid variable name using YACC.
7. Write a program to implement calculator using Lex and Y ACC.
8. Write a program for implementing type checking tor given expression.
9. Write a program to convert the BNF rules into YACC.
10. Write a program to implement data flow and control flow analysis.
11. Write a program to implement stack storage allocation strategies.
12. Write a program to implement heap storage allocation strategies.
13. Write a program to construct a directed acyclic graph (DAG).
14. Write a program to implement the back end of the compiler.
15. Write a program to implement simple code optimization technique.
16. Write a program to implement simple code optimization technique using do-while.

Note:

- **Recommended to use the C/LEX/YACC on Linux systems**

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Paper—I: Cloud Computing (CS 401T)

Theory: 4 Hours/ Week **Credits: 4**

Unit — I

Era of Cloud Computing (CC): introduction. cloud and other similar configurations, CC vs. peer-to peer architecture, CC vs. client-server architecture, CC vs. GC, components of CC, impact of CC on businesses.

Introduction Virtualization: Introduction, virtualization benefits, implementation levels of virtualization, virtualization at the OS level, virtualization structure, open source virtualization technology, Xen virtualization architecture, binary translation with full virtualization, para virtualization with compiler support, virtualization of CPU, memory, I/O devices, hardware support for virtualization, virtualization in multicore processors.

Cloud Computing Services: IaaS, PaaS, leveraging PaaS for productivity, guidelines for selecting a PaaS provider, concerns with PaaS, languages and PaaS, SaaS, DBaaS. Cloud Computing and Business Value: key drivers for CC, CC and outsourcing, types of scalability, use of load balancers to enhance scalability, variable operating costs using CC, time-to-market benefits of CC, distribution over the internet, levels of business values from CC. Cloud Types and Models: private cloud, public cloud, hybrid cloud.

Unit — II

Open Source Cloud Implementation and Administration: Eucalyptus& OpenSatck cloud architectures. CSB (158) Recent Trends in Cloud Computing and Standards: conflicts of interest for public cloud and IT product providers, BY OD and encryption exposures, cloud standards, cloud ratings, CC trends that are accelerating adoption.

Host Security in the Cloud: security for virtualization products, host security for SaaS, PaaS, IaaS. Data Security in the Cloud: challenges with cloud data and data security, data confidentiality and encryption, data availability, data integrity, CSGs. Cloud application requirements, SOA for cloud applications.

Unit— III

Adoption and Use of Cloud by Small and Medium Businesses: Place of adoption, benefits, adoption phases. vendor roles and responsibilities, selection phases, provider liability, provider capabilities, success factors for CC Adoption process of public clouds by enterprises. Cloud migration techniques, Phases during the migration of an application to the cloud. IT Service Management for Cloud Computing: IT IL based service management. service strategy, service design, service transition, service operations, continual service improvement.

SLA with Cloud Service Providers: concept, aspects and requirements of SLA, credit calculation, samples I and 3.

Risks, Consequences, and Costs Cloud Computing: introduction, risk assessment and management, risk of vendor lock-in, loss of control, not meeting regulat01Y compliances, resource scarcity, multitenant environment, failure, inadequate SLA, malware and internet attacks, management of cloud resources, network outages, in fracture, legal, licensing, TCO, cloud costs. cost allocations, chargeback models and methodology, billable items.

Unit - IV

AAA Administration for Cloud: AAA model, single sign () on for clouds, industry implementation for AAA, authentication management in the cloud, SAML, authentication for resource utilization. Security as a Service: benefits of security as a service, concerns with security

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as a service, security service providers, Id MaaS, attributes of Id MaaS providers. Cloud Certifications and Audits: certifications, cloud audit framework, cloud auditing requirements. Application Security in the Cloud: cloud application SDLC, cloud service reports by providers, application security in IaaS. PaaS and SaaS environments.
Mobile Cloud Computing (MCC): architecture of MCC, benefits of MCC, MCC challenges.

Text Book: Kailash J, Jagannath K, Donald J H, Deven Shah- Cloud Computing — Black Book

References:

1. Raj Kumar Buyya, Cloud Computing: Principles and Paradigms
2. Arshdeep Bahga. Vijay Madisetti, Cloud Computing — A Hands-On Approach
3. David E. Y. Sarna, Implementing and Developing Cloud Computing Applications
4. Kai Hwang, Distributed and Cloud Computing from Parallel Processing to Internet of Things

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Paper - II: Data Science with R (CS 402T)

Theory: 4 Hours/ Week **Credits: 4**

Unit- 1

Data Science: Introduction to Data Science — Digital Universe — Sources of Data — Information Commons — Data Science Project Life Cycle: OSEMN Framework.

Data Pre-processing: Introduction to Data Pre-processing— Reading, Selecting, Filtering Data — Filtering Missing Values — Manipulating, Sorting, Grouping, Rearranging, Ranking Data.

Unit- II

Concept Learning: Formulation of Hypothesis — Probabilistic Approximately Correct Learning — VC Dimension —I-hypotheses elimination — Candidate Elimination Algorithm.

Essentials of R: R s - data types and objects - control structures — data frame -Feature Engineering - scaling, Label Encoding and One Hot Encoding, Reduction.

Unit- III

Model Fit Using R: Regression Models- Linear and Logistic Model, Classification Models — Decision Tree. Naive Bayes, SVM and Random Forest, Clustering Models — K Means and Hierarchical clustering.

Visualization: Data visualization: Box plot, histogram, scatter plot, heat map —Working with Tableau — Outlier detection — Data Balancing.

Unit- IV

Performance Evaluation: Loss Function and Error: Mean Squared Error, Root Mean Squared Error — Model Selection and Evaluation criteria: Accuracy, Precision, Fl Score, Recall Score — Binary Predictive Classification —Sensitivity — Specificity. Recent Trends and Challenges in Data Science.

Text Book:

1. Introduction to Machine Learning by Ethem Alpaydin, Fourth Edition, MIT Press, 2020.
2. Hadley Wickhams Garrett Grolemund, R for data science: Import, Tidy, Transform, Visualize, And Model Data Paperback, 2017.

References:

1. Han, .1., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann. 2011.
2. Carl Shan, Henry Wang, William Chen, Max Song. The Data Science Handbook: Advice and Insight from 25 Amazing Data Scientists. The Data Science Bookshelf. 2016.
3. James. G. Witten, D., T., Tibshirani, R. An Introduction to statistical learning with applications in R. Springer. 2013.

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Paper — III(A): Computer Organization (CS 403T(A))

Theory: 4 Hours/ Week **Credits: 4**

Unit- I

Digital Logic Circuits: Digital Computers, Logic Gates, Boolean algebra, Map Simplification, Combinational Circuits, Flip-Flops, Sequential Circuits.

Digital Components: Integrated Circuits, Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Unit.

Data Representation: Data Types, Complements. Fixed Point Representations, Floating Point Representation, Binary Codes, and Error Detection Codes.

Unit- II

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, and Shift Micro operations.

Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory Reference Instructions, Input Output and Interrupt, Design of Accumulator Logic.

Unit- III

Programming the Computer: Machine Language, Assembly Language, The Assembler Program Loops, Programming Arithmetic and Logic Operations, Subroutines, Input - Output Programming.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control. Reduced Instruction Set Computer.

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, and Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Unit- IV

Input - Output Organization: Peripheral Devices, Input - Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input - Output Processor, Serial Communication. Pipeline and Vector Processing: Parallel Processing. Pipelining, Arithmetic Pipelines, Instruction Pipelines and RISC Pipelines, Vector Processing.

Text Book:

Computer System Architecture (3e) by M. Morris Mano.

References:

1. Andrew S. Tanenbaum, Structured Computer Organization.
2. William Stallings, Computer Organization and Architecture.
3. ZviKohavi, NirajK.Jha, Switching and Finite Automata Theory.

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Paper — III (B): Distributed Systems (CS 403T(B))

Theory: 4 Hours/ Week **Credits: 4**

Unit — I

Introduction: definition of a distributed system, goals, types of distributed systems.
Architectures: architectural styles, system architectures, architectures versus middleware, self-management in distributed systems.
Processes: threads, virtualization, clients, servers, code migration.

Unit — II

Communication: Remote Procedure Call, Message-Oriented Communication, Stream-Oriented Communication, Multicast Communication.
Naming: names, identifiers, and addresses, flat naming, structured naming, attribute-based naming.
Synchronization: clock synchronization. logical clocks, mutual exclusion, global positioning of nodes, election algorithms.

Unit- III

Consistency and Replication: introduction, data-centric consistency models, client-centric consistency models, replica management, consistency protocols.
Fault Tolerance: introduction, process resilience, reliable client server communication, reliable group communication, distributed commit, recovery.
Security: introduction, secure channels, access control, security management.

Unit-IV

Distributed Object—Based Systems: Architecture, processes, communication, naming, synchronization. consistency and replication, fault tolerance, security.
Distributed File Systems: architecture, process, communication, naming, synchronization, consistency and replication, fault tolerance, security. Distributed Web based Systems: architecture, process, communication, naming, synchronization, consistency and replication, fault tolerance, security.

Text Book:

Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems — Principles and Paradigms (2e)

References:

1. Sukumar Ghosh. Distributed Systems an Algorithmic Approach
2. Joel M. Crichlow, Distributed Systems Computing Over Networks
3. Kai Hwang, Distributed and Cloud Computing from Parallel Processing to Internet of Things
4. Ajay D. Kshemkalyani, Mukesh Singhal, Distributed Computing Principles, Algorithms, and Systems
5. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems Concepts and Designs

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Paper -III(C): Machine Learning CS 403T(C)

Theory: 4 Hours/ Week **Credits: 4**

Unit-I

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.
Linear machines: General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and window-Hoff learning algorithm; Multi-Layer Perceptrons: two-layers universal approximators, backpropagation learning, on-line, off-line error surface, important parameters.

Unit-II
Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence. pruning, learning with incomplete data.
Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability.

Unit-III
Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, Occam's razor. empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.
Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

Unit-IV
Support Vector Machines: Margin of a classifier, dual perceptron algorithm, learning nonlinear hypotheses with perceptron kernel functions, implicit non-linear feature space. theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Text Book:
1. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.
2. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.

References:
1. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. R. O. Duda, P. E. Hart, and D.G. Stork, Pattern Classification, John Wiley and Sons, 2001.
3. Vladimir N. Vapnik, Statistical Learning Theory, John Wiley and Sons, 1998.
4. J. Shawe-Taylor and N. Cristianini, Cambridge, Introduction to Support Vector Machines, University Press, 2000.

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Paper -IV: Data Science with R Lab (CS 404P)

Practical: 4 Hours/ Week **Credits: 4**

I. Download and install R-Programming environment and install packages using install.packages() command in R.

II. Learn all the basics of R-Programming (Data types, Variables, Operators, Loops, Conditional Statements etc.), Write a R Scripts to demonstrate the same.

1 a) Perform some arithmetic and logical operations in R.
b) Write a program to find list of even numbers from 1 to n using R-Loops.

2 a) Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
b) Implement different String Manipulation functions in R.

3. a) Implement different data structures in R (Vectors, Lists, Data Frames)
b) Write a program to read a csv file and analyze the data in the file in R

4. a) Create pie chart and bar chart using R.
b) Create a data set and do statistical analysis on the data using R

5. Demonstrate the process of creating a user defined function in R.

6. a) Write an R script to change the structure of a Data frame.
b) Write an R script to expand a data frame.

7. a) Write an R script to convert a vector to factors.
b) Write an R script to demonstrate R objects.

8. Demonstrate the following aggregate functions in R: sum, mean, count, min, max.

9. Write an R script to read and write different files.

10. a) Write an R script to find subset of a dataset.
b) Elucidate the process of data exploration in R using read (), summary (), nrow (), ncol (), str ().

11. a) Write an R script to handle missing values in a dataset.
b) Write an R script to handle outliers.
c) Write an R script to handle invalid values.

12 a) Visualize iris dataset using mosaic plot.
b) Visualize correlation between sepal length and petal length in iris data set using scatter plot.

13. Linear Regression: Consider the following mice data:
Height: 140,142, 50,147,139,152,154,135, 148, 147.
Weight: 59, 61, 66, 62. 57, 68. 69. 58, 63, 62.
Derive relationship coefficients and summary for the above data.

14. Consider the above data and predict the weight of a mouse for a given height and plot the results using a graph.

15. Perform Logistic Regression analysis on the above mice data (Sl.No. 13) and plot the results.

16. Time Series: Write R script to decompose time series data into random, trend and seasonal data.

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Practical: 12 Hours/ Week **Credits: 4**

The project report should be in the following format

I – Algorithm based Projects

Title Page
Certificates by HoD, guide(s) and Declaration
Acknowledgements
Abstract
Contents
List of Figures & Tables
Chapters:
1. Introduction
2. Literature Survey /Related Work
3. Outline the Solution
4. Results and Discussion
5. Conclusion and Future Work
6. References

II – System-Based Projects

Title Page
Certificates by HoD, guide(s) and Declaration
Acknowledgements
Abstract
Contents
List of Figures
Chapters:
1. Introduction
2. Requirements and Specifications
3. Analysis and Design
4. Implementation
5. Results and Discussion
6. Conclusion and Future Work
7. References

III- References and Bibliography should be written in the format given below:
Author(s) Title of the Paper, Publisher, Volume No., Issue No., Year
Example:
Ganesh S., Vijayalakshmi M. and Kannan A., "Intelligent Agent based Approach for transaction Processing in mobile Database Systems", The IAJIT, Vol. 4, No. 2, pp, 97-102, 2007.

IV- Text format: Font Type: Time New Roman; Font Size: 12; Line Space: 1 ½

- ✓ Pages, Figures, Tables and Algorithms should be titled and numbered, Students should be discouraged writing about languages, platforms, operating systems and packages used for the purpose of project in the project report.
- ✓ The report should be organized into chapters, chapter into sections, sections into subsections etc.
- ✓ Hierarchical numbering should be followed in numbering the chapters, sections, subsections etc. (1, 1.1, 1.1.1).

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Code:

FACULTY OF SCIENCE
M.Sc. (CBCS) III/IV Semester Examinations, _____2024
Computer Science
Paper:
Title of the Paper

Time: 3 Hrs. **Max. Marks: 60**

Section – A (Short answer questions)

Marks: 4*5=20

Note: Answer the following Questions shortly. Each question carries equal marks.

1)

2)

3)

4)

Section- B (Essay Answer Questions)

Marks: 4*10=40

Note: Answer the following questions. Each carries equal marks.

6) a)

OR

b)

7) a)

OR

b)

8) a)

OR

b)

9) a)

OR

b)

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Faculty of Science

M.Sc. Comp. Sc. III / IV Semester (2024-2025)

Internal Examination (I/II/III/IV)

Sub: **Date:**

Hall Ticket No:	**Student Name:**

Section A

Fill in the Blanks: **Marks: 5 x 1 = 5**

1)

2)

3)

4)

5)

Section B

Choose the Correct Answer **Marks: 5 x 1 = 5**

1)

2)

3)

4)

5)

Section C

Answer the following Question Shortly. **Marks: 5 x 2 =10**

1)

2)

3)

4)

5)

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