ANX - 'B'

Chaudhary Ranbir Singh University

(Established by the Haryana State Legislature Act 28 of 2014)
(Recognised u/s 2(f) and 12(B) of UGC Act, 1956)

Syllabus
for

Post Graduate Programme

Master of Computer Applications

as per NEP-2020
Curriculum and Credit Framework for Postgraduate Programme

With Multiple Entry-Exit, Internship and CBCS-LOCF
With effect from the session 2024-25 (in phased manner)

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
FACULTY OF SCIENCES

CHAUDHARY RANBIR SINGH UNIVERSITY, JIND - 126102

With effect from the Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Blockchain Technology
Course Code	M24-CAP-301
Course Type	CC-9
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	1. To learn elements of Blockchain technology 2. To understand Cryptocurrency 3. To know the characteristics of a Smart Contract 4. To understand the Security concept of Blockchain 5. To learn Blockchain Platform using Go Language
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Gain an understanding of Blockchain Technology. CLO-2 Clear understanding of concept of Cryptocurrency using Blockchain. CLO-3 Proficiency to understand the smart contracts. CLO-4 To manage the security issues in Blockchain CLO-5 To develop the Blockchain using Go Language.

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

	Topics	Contact Hours
I	Fundamentals of Blockchain: introduction, Origin of Blockchain, Blockchain Solution, components of Blockchain, block in Blockchain, the Technology and the future, Blockchain Types and Consensus Mechanism: Decentralization and Distribution, types of Blockchain, consensus Protocol, Cryptocurrency-Bitcoin, Altcoin and Token: Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrency, Usage, Public Blockchain System: Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.	15

II	Smart Contracts: Introduction, Characteristics of a Smart Contract, Types of Oracles, Smart contracts in Ethereum, Smart Contracts in Industry, Private Blockchain System: Key Characteristics of private Blockchain, Private blockchain Examples, private Blockchain and Open sources, E-commerce Site Example, Various Commands in E-commerce Blockchain, Smart Contracts in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain, Consortium Blockchain: introduction, Key characteristics of Consortium Blockchain, need of Consortium Blockchain, Hyperledger platform, Overview of Ripple Overview of Corda, Initial Coin Offering (ICO):Blockchain Fundraising Methods, Launching an ICO, Investing an ICO, Pros and cons of initial Coin Offerings, Evolution of ICO,ICO Platform.	15
III	Security in Blockchain: Introduction , Securities Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance ,Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric, Applications of Blockchain: Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain IN Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, Blockchain and IoT, Limitations and challenges of Blockchain, Blockchain Case Studies.	15
IV	Blockchain Platform using Go Language: Introduction, learn to execute GoLang Program in Atom, Basic Programming, Packages, Creating Simple Blockchain using GoLang ,Creating Simple Blockchain with Proof of Work using GoLang, Connecting to Ethereum using GoLang, BlockchainEthereum Platform using Solidity: introduction, Remix IDE, Structure of Smart Contract Program, modifiers, events, Array in Solidity, Function Visibility, Variable Visibilty, Function Modifier Keyword , Fallback Function, Contract Inheritance, contract Communicating with Another Contract, External Libraries, ER C20 Token transfer, Error Handling in Solidity, Application Binary Interface, Swarm, Wishper, Blockchain platform using Python, Blockchain platform using Hyperledger Fabric	15
Total Contact Hours		60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
Theory	**30**	**Theory**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

Reference Books:

1. Alan Wright, *Blockchain*, House of Books, 2021.
2. Daniel Dresher, Blockchain Basics, Apress, 2017
3. Roger Wattenhofer, *The Science of Blockchain*, Inverted Forest Publishing; 1st edition, 2016
4. Malanie Swan, *Blockchain: Blueprint for a New Economy*, O' Reilly, 2015
5. Jon Bodner, *Learning Go: An Idiomatic Approach to Real-World Go Programming*, O'Reilly, 2021
6. Alan A. A. Donovan and Brian W. Kernighan, *The Go Programming Language*, Addison-Wesley Professional; 1st edition,2015

CC-10 Machine Learning in Python

With effect from the Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Machine Learning in Python
Course Code	M24-CAP-302
Course Type	CC-10
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	1. *To understand the basics of Python programming.* 2. *To provide the detail of various components of Python.* 3. *To understand the strings and lists in Python.* 4. *To understand working of dictionaries and tuples.* 5. *To understand files in Python.*
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Depth Knowledge of basics of Python Programming CLO-2 Complete understanding of various components of Python CLO-3 Make the program with Strings and Lists in Python CLO-4 Complete understanding of Dictionaries and Tuples in Python. CLO-5 To make program with defined problems using Python.

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Overview of Python, Comments, Reserve Keywords, Identifiers, Variables, Constants, Standard Data types, Operators, Control Statements, Iterative Statements.. Functions: Built in functions, Composition of functions, User defined Functions, Parameters, Function call, Return statement, Recursive function.	15
II	Strings: Compound Data Type, Len function, Slices, Traversal, Escape Character, Formatting Operator, Formatting Functions. Lists: Values & Accessing Elements, Traversal, Deleting Element, Built-in Operators, Built-in Methods.	15
III	Tuples: Creating, Accessing Values in Tuples, Tuples Assignment, Tuples as Return Values, Variable length Argument Tuple, Basic Operations, Built-in- Tuple Function. Dictionaries: Creating, Accessing Values, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary Keys, Operations in Dictionary, Built-in Dictionary Methods	15

IV	Text Files and Exceptions: Text Files, Dictionaries, Exceptions, Exception with arguments, User defined exceptions. Applications in Python: Managing Database using SQL: Database concept, Creating database & tables, Inserting data into tables, Retrieving data from table, Deleting data from table & deleting table.	15
Total Contact Hours		60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
Theory	**30**	**Theory**	**70**
1) Class Participation:	5	Written Examination	
2) Seminar/presentation/assignment/quiz/class test etc.:	10		
3) Mid-Term Exam:	15		

Part C-Learning Resources

Reference Books:

1. E. Balagurusamy , "*Introduction to Computing and Problem Solving Using Python*", McGrawHill Education, 2017.
2. Sheetal Taneja, Naveen Kumar, "*Python Programming A Modular Approach*", Pearson, 2017.
3. Rao R. Nageswara , "*Core Python Programming*", Dream Tech, New Delhi, 2018.
4. Satyanarayana, Mani M. Radhika, Jagadesh B.N , "*Python Programming*", India University Press, 2018.
5. Cassell Laura, Gauld Alan , "*Python Projects*", , Wiley Publication, New Delhi, 2014.

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Theory of Computation
Course Code	M24-CAP-303
Course Type	DEC-1
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	This course introduces fundamental concepts of algorithms and data structures, including algorithmic notation, programming principles, and program analysis. Students will explore arrays, searching and sorting techniques, stacks, queues, and linked lists, along with their applications. The course also covers tree structures such as binary trees, AVL trees, B-trees, and tries, as well as graph terminology, representation, and traversal methods. Additionally, students will learn about set operations, file queries, sequential organization, index techniques, and external sorting.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Master algorithmic notation, programming principles, and implement arrays, searching and sorting techniques. CLO-2 Apply stack and queue operations, understand linked lists, and their applications including dynamic storage management. CLO-3 Comprehend binary trees, binary search trees, AVL trees, B-trees, B+ tree indexing, Trie tree indexing, and their applications. CLO-4 Utilize graph representations, traversals, applications, sets operations, and file organization techniques.

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Automata, Computability and Complexity: Complexity Theory, Computability Theory, Automata Theory Basic concepts of Automata Theory: Alphabets, Power of Alphabet, Kleen Closure Alphabet, Positive Closure of Alphabet, Strings, Empty String, Substring of a string, Concatenation of strings, Languages, Empty Language Introduction to Finite Automata, Introduction of Finite State Machine Deterministic Finite Automata (DFA), Notations for DFA, Language of DFA, Extended Transition Function of DFA Non-Deterministic Finite Automaton (NFA), Notations for NFA, Language of NFA, Extended Transition Equivalence of DFA and NFA, Subset-Construction.	15

II	Method for reduction of NFA to DFA, Theorems for equivalence of Language accepted by DFA and NFA Finite Automaton with Epsilon Transition (ε - NFA), Notations for ε - NFA, Epsilon Closure of a State, Extended Transition Function of ε – NFA, Removing Epsilon Transition using the concept of Epsilon Closure, Equivalence of NFA and ε – NFA, Equivalence of DFA and ε – NFA. Finite State Machines with output: Moore machine and Mealy Machines Regular Expressions, Regular Operators, Regular Languages and their applications, Algebraic Rules for Regular Expressions Equivalence of Regular Expression and Finite Automata, Reduction of Regular Expression to ε – NFA, Conversion of DFA to Regular Expression Properties of Regular Languages, Pumping Lemma, Application of Pumping Lemma, Closure Properties of Regular Languages over (Union, Intersection, Complement) Minimization of Finite State Machines: Table Filling Algorithm Regular Grammars: Right Linear and Left Linear, Equivalence of regular grammar and finite automata	15
III	Introduction to Context Free Grammar (CFG), Components of CFG, Use of CFG, Context Free Language (CFL) Types of derivations: Bottomup and Topdown approach, Leftmost and Rightmost, Language of a grammarParse tree and its construction, Ambiguous grammar, Use of parse tree to show ambiguity in grammar Simplification of CFG: Removal of Useless symbols, Nullable Symbols, and Unit Productions, Chomsky Normal Form (CNF), Greibach Normal Form (GNF), Backus-Naur Form (BNF) Context Sensitive Grammar, Chomsky Hierarchy Pumping Lemma for CFL, Application of Pumping Lemma, Closure Properties of CFL Introduction to Push Down Automata (PDA), Representation of PDA, Operations of PDA, Move of a PDA, Instantaneous Description for PDA Deterministic PDA, Non Deterministic PDA, Acceptance of strings by PDA, Language of PDA Construction of PDA by Final State , Construction of PDA by Empty Stack, Conversion of PDA by Final State to PDA accepting by Empty Stack and vice-versa, Conversion of CFG to PDA, Conversion of PDA to CFG	15
IV	Introduction to Turing Machines (TM), Notations of Turing Machine, Language of a Turing Machine, Instantaneous Description for Turing Machine, Acceptance of a string by a Turing Machines Turing Machine as a Language Recognizer, Turing Machine as a Computing Function, Turing Machine with Storage in its State, Turing Machine as a enumerator of stings of a language, Turing Machine as Subroutine Turing Machine with Multiple Tracks, Turing Machine with Multiple Tapes, Equivalence of Multitape-TM and Multitrack-TM, Non-Deterministic Turing Machines, Restricted Turing Machines: With Semi-infinite Tape, Multistack Machines, Counter Machines Curch Turing Thesis, Universal Turing Machine, Turing Machine and Computers, Encoding of Turing Machine, Enumerating Binary Strings, Codes of Turing Machine, Universal Turing Machine for encoding of Turing Machine Computational Complexity, Time and Space complexity of A Turing Machine, Intractability, Complexity Classes, Problem and its types: Absract, Decision, Optimization, Reducibility, Turing Reducible, Circuit Satisfiability, Cook's Theorem, Undecidability, Undecidable Problems: Post's Correspondence Problem, Halting Problem and its proof, Undecidable Problem about Turing Machines	15
Total Contact Hours		60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
☐ **Theory**	**30**	☐ **Theory**	**70**
• Class Participation:	5	Written Examination	
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		

Part C-Learning Resources

eference Books:

1. Chowdhary K.R., *"Theory of Computation: Automata, Formal Languages, Computation and Complexity"*, Springer, 2025
2. Michael Sipser , *"Introduction to Theory of Computation"*, Cengage Learning, 2012.
3. Martin J.C. , *"Introduction to Languages and Theory of Computation"*, Cengage Learning, 2011
4. Arora, S., & Barak, B., *"Computational Complexity: A Modern Approach"*, Cambridge University Press, 2009
5. Mishra, K. L. P., & Chandrasekaran, N., *"Theory of Computer Science: Automata, Languages and Computation"*, Prentice Hall India Learning, 2006

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Computer Organisation and Architecture
Course Code	M24-CAP-304
Course Type	DEC-1
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	This course introduces fundamental concepts of Digital Logic and Circuits and their applications, Computer Organisation, Architecture, Memory Technologies, Tiled Chip Multicore Processors, Parallel Multiprocessor, Distributed Computer Technologies, High Performance Computing and CUDA Programming Model
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Master concepts of Digital Logic and Circuits. CLO-2 Master concepts of Memory Organisation. CLO-3 Understand the concepts of Tiled Chip Multicore Processor. CLO-4 Depth Knowledge of Parallel Computing, Distributed Computing and High Performance Computing. CLO-5 Perfection in CUDA Programming

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Designing combinational and sequential logic, computers registers and instructions, timing, and control, instructions cycle, memory reference instruction, I/O interruption, Adder and Subtractor circuits, Booth Multiplication Algorithm, Pipelining Review, control hazards and the motivation for caches, cache characteristics and basic superscalar architecture basics.	15
II	Memory technologies, hierarchical memory systems, the locality principle and caching, direct mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimisations, performance improvement techniques, DRAM – organisation, access techniques, scheduling algorithms and signal systems. Tiled Chip Multicore Processors (TCMP), Network on Chips (NoC), NoC router – architecture, design, routing algorithms and flow control techniques, Advanced topics in NoC and storage – compression, prefetching, QoS.	15

	Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs, Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Coordination and Agreement Algorithms, Global State and Distributed Transactions.	15
IV	High Performance Computing (HPC): HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading. CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange	15
	Contact Hours	60

Suggested Evaluation Methods

Internal Assessment: 30		End Term Examination: 70	
Theory	**30**	**Theory**	**70**
•Class Participation:	5	Written Examination	
•Seminar/presentation/assignment/quiz/class test etc.:	10		
•Mid-Term Exam:	15		

Part C-Learning Resources

Reference Books:

1. Jain, R. P., & Sarawadekar, K., *"Modern Digital Electronics"*, Prentice Hall India Learning, 2022
2. Maini A.K., *"Digital Electronics : Principles and Integrated Circuits"*, Wiley India Pvt Ltd, 2007
3. Mano M.M., *"Computer System Architecture"*, Prentice Hall India Learning, 1993
4. Stallings W., *"Computer Organisation and Architecture"*, Pearson, 2021
5. Hsiao M.S. et.al., *"Multicore Processors and Systems"*, Springer, 2009
6. Sarangi, S.R., *"Advanced Computer Architecture"*, McGraw Hill Education, 2021
7. Shiva, S.G., *"Advanced Computer Architecture"*, CRC Press, 2006
8. Sima D. et.al., *"Advanced Computer Architecture: A Design Approach"*, Addison Wesley, 1997
9. Hwang K., *"Advanced Computer Architecture: Parallelism, Scalability, Programmability"*, McGrawHill, 1993

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Computer Graphics
Course Code	M24-CAP-306
Course Type	DEC-2
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	This course provides a comprehensive introduction to Object Oriented Design with Unified Modelling Language, covering its history, features, and applications. Students will learn Object Oriented basics, including object model, class diagram, State Transition Diagram, Abstraction, Encapsulation, Inheritance, Polymorphism, Scripts etc..
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Understand Object Oriented Modeling and UML background, features. CLO-2 Master object-oriented programming principles including classes, objects, inheritance, polymorphism, encapsulation, abstraction etc. CLO-3 Gain Proficiency in Object Oriented Modeling and UML for Software Design purpose. CLO-4 Explore and utilize advanced features of Object Oriented Modeling and UML for Use Case Diagram.

Credits	Theory	Practical	Total
Teaching Hours per week	4	0	4
Internal Assessment Marks	4	0	4
End Term Exam Marks	30	0	30
Max. Marks	70	0	70
Examination Time	100	0	100
	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, Two dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's; Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, midpoint circle drawing algorithm; Filled area algorithms: Scanline: Polygon filling algorithm, boundary filled algorithm.	15

	Two/Three Dimensional Viewing: The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms):- 4 bit code algorithm, Sutherland-cohen algorithm, parametric line clipping algorithm (Cyrus Beck). Polygon clipping algorithm: Sutherland-Hodgeman polygon clipping algorithm. Two dimensional transformations: transformations, translation, scaling, rotation, reflection, and composite transformation. Three-dimensional transformations: Three-dimensional graphics concept, Matrix representation of 3-D Transformations, Composition of 3-D transformation.	15
III	Viewing in 3D: Projections, types of projections, the mathematics of planner geometric projections, coordinate systems. Hidden surface removal: Introduction to hidden surface removal. The Z- buffer algorithm, scan line algorithm, area sub-division algorithm.	15
	Image Compression & Standards: Making still images; editing and capturing images; scanning images; computer color models; color palettes; vector drawing; 3D drawing and rendering; JPEG-objectives and architecture; JPEG-DCT encoding and quantization, JPEG statistical coding, JPEG predictive loss less coding; JPEG performance; overview of other image file formats as GIF, TIFF, BMP, PNG etc.	15
Total Contact Hours		60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
□ **Theory**	**30**	□ **Theory**	**70**
•Class Participation:	5	Written Examination	
•Seminar/presentation/assignment/quiz/class test etc.:	10		
•Mid-Term Exam:	15		

Part C-Learning Resources

Reference Books:

1. James D. Foley, Andeies Van Dam, Stevan K. Feiner & Johb F. Hughes, "Computer Graphics Principles and Practices"", 2nd ed, Addision Wesley.
2. Donald Hearn & Pauline M. Baker, "Computer Graphics", 2nd ed, PHI.
3. David F. Rogers, "Procedural Elements for Computer Graphics",2nd ed, T.M.H.
4. Alan Watt, "Fundamentals of 3-Dimensional Computer Graphics", Addision Wesley.

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Big Data & Pattern Recognition
Course Code	M24-CAP-307
Course Type	DEC-2
Level of the course (As per Annexure-I	400-499
Pre-requisite for the course (if any)	-
Course Objectives	The aim of this course is to develop knowledge of big data tools including MapReduce, NoSQL and Hadoop. The course provides an idea about data analysis; pattern recognition approaches and gives the practical exposure of NoSQL.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO-1. Comprehensive Knowledge of Big Data strategies in Big Data Environment. CLO-2 Learning of HDFS and Learn map-reduce analytics using Hadoop. CLO-3 Acquire knowledge of pattern recognition approaches and methods. CLO-4 To develop solutions in NoSQL to meet the current job requirements.

Credits	Theory	Practical	Total
	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Time	3 hours		

Part B- Contents of the Course

Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit	Topics	Contact Hours
I	Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.	15
II	Data Governance for Big Data Analytics: Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.	15

	Data Analysis and Pattern Recognition: Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier and Modeling an AND Gate Neural Nets.	15
IV	An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Introduction of NoSQL Products, NoSQL Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, NoSQL Misconceptions, NoSQL over RDBMS.	15
Total Contact Hours		60

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
☐ **Theory**	**30**	☐ **Theory**	**70**
•Class Participation:	5	Written Examination	
•Seminar/presentation/assignment/quiz/class test etc.:	10		
•Mid Term Exam:	15		

Part C-Learning Resources

Reference Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.
4. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing.
5. Rajjan Shinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education.

PC-5 PRACTICAL-5 (Based on CC-9)

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Practical-5
Course Code	M24-CAP-309
Course Type	PC-5
Level of the course	400-499
Pre-requisite for the course (if any)	
Course objectives	This is a laboratory course and the objective of this course is to acquaint the students with the understanding and implementing of Blockchain technologies. Also, the concepts of GO Programming will be implemented for implementation of Blockchain.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO 1: Solve practical problems related to theory courses undertaken in the CC-9 from application point of view. CLO 2: Know how to use the Blockchain technologies. CLO 3: implement the various functions of GO Language. CLO 4: Designing and implementing the Blockchain with GO Language.

Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

Practicals	Contact Hours
The examiner will set 3 questions at the time of practical examination by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve two problems by writing algorithm and execute programs from the Part-B.	120

1) Write a simple program to display "Hello Blockchain" that covers blockchain fundamentals. 2) Write a program that definesa Block Struct in the Go Language. 3) Write a program to generate a Hash using SHA-256. 4) Write a program in Go to create the first genesisblock manually and print its data. 5) Write a program to append a new block to the chain using Go slices. 6) Write a program to validate the blockchain by checking hashes and previous links. 7) Write a program to add the Nonce Field to the Block. 8) Write a program to implement Proof of Work and adjust the nonce until the hash starts with "0000". 9) Write a program to create a command-line interface (CLI) for adding/viewing blockchain blocks. 10) Write a program to simulate transactions by defining a Transaction structure and including it in block data. 11) Write a program to create a simple wallet by generating public/private key pairs using crypto libraries. 12) Write a program to digitally sign and verify transactions for authenticity using public-key cryptography. 13) Write a program to build a Blockchain API using net/http. 14) Write a program to simulate multiple nodes and compare lengths. 15) Write a program to use encoding/gob to save or load the blockchain from a file. 16) Create a Blockchain for Real Time Application	120 (Lab hours include instructions for writing programs and demonstration by a teacher and for running the programs on computer by students.)

Suggested Evaluation Methods			
Internal Assessment: 30		**End Term Examination: 70**	
☐ **Practicum**	**30**	☐ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the programs	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		
• Mid-Term Examination:	15		

Part C-Learning Resources

1. Alan Wright, *Blockchain*, House of Books, 2021.
2. Daniel Dresher, Blockchain Basics, Apress, 2017
3. Roger Wattenhofer, *The Science of Blockchain*, Inverted Forest Publishing; 1st edition, 2016
4. Malanie Swan, *Blockchain: Blueprint for a New Economy*, O' Reilly, 2015
5. Jon Bodner, *Learning Go: An Idiomatic Approach to Real-World Go Programming*, O'Reilly, 2021
6. Alan A. A. Donovan and Brian W. Kernighan, *The Go Programming Language*, Addison-Wesley Professional; 1st edition,2015

PC-6 PRACTICAL-6 (Based on CC-10)

With effect from Session: 2024-25

Part A - Introduction

Name of the Programme	MCA
Semester	3rd
Name of the Course	Practical-6
Course Code	M24-CAP-310
Course Type	PC-6
Level of the course	400-499
Pre-requisite for the course (if any)	
Course objectives	This is a laboratory course and the objective of this course is to acquaint the students with the understanding and implementation of Python. Also, the students will implement the concepts of Machine Learning and Python.
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO 1: Solve practical problems related to theory courses undertaken in the CC-10. CLO 2: Know how to use and implement the concepts of Python CLO 3: Implement the various features of Python Programming by writing suitable programs. CLO 4: Designing and implementing applications in Python.

Credits	Theory	Practical	Total
	0	4	4
Teaching Hours per week	0	8	8
Internal Assessment Marks	0	30	30
End Term Exam Marks	0	70	70
Max. Marks	0	100	100
Examination Time	0	4 hours	

Part B- Contents of the Course

Practicals	Contact Hours
The examiner will set 3 questions at the time of practical examination by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve two problems by writing algorithm and execute programs from the Part-B.	120

1) Write a program to design a simple calculator using Python.
2) Write a program to display different patterns using loops in Python.
3) Write a program that implements all the methods and operations of the List.
4) Write a program that implements all the methods and operations of the Tuple.
5) Write a program for Data Analysis on a CSV File using Pandas.
6) Write a program that implements all the methods and operations of the Dictionary.
7) Write a program that implements all the methods and operations of the string.
8) Write a program to create a Dataset and saveit as a CSV file using Pandas.
9) Write a program to perform all the operations on a data frame in Python.
10) Write a program to perform training and testing on the dataset.
11) Write a program to predict the House Price using Linear Regression.
12) Write a program in Python to predict Student Performance using Logistic Regression.
13) Write a program to create a Chatbot using machine learning.
14) Write a program to perform classification approaches in Python.
15) Develop a mini-prediction project using machine learning techniques

120 (Lab hours include instructions for writing programs and demonstration by a teacher and for running the programs on computer by students.)

Suggested Evaluation Methods

Internal Assessment: 30		**End Term Examination: 70**	
☐ **Practicum**	**30**	☐ **Practicum**	**70**
• Class Participation:	5	Lab record, Viva-Voce, write-up and execution of the programs	
• Seminar/Demonstration/Viva-voce/Lab records etc.:	10		
• Mid-Term Examination:	15		

Part C-Learning Resources

Reference Books:

1. E. Balagurusamy , "*Introduction to Computing and Problem Solving Using Python*", McGrawHill Education, 2017.
2. Sheetal Taneja, Naveen Kumar, "*Python Programming A Modular Approach*", Pearson, 2017.
3. Rao R. Nageswara , "*Core Python Programming*", Dream Tech, New Delhi, 2018.
4. Satyanarayana, Mani M. Radhika, Jagadesh B.N , "*Python Programming*", India University Press, 2018.
5. Cassell Laura, Gauld Alan , "*Python Projects*", , Wiley Publication, New Delhi, 2014.