Rayat Shikshan Sanstha's

# Yashavantrao Chavan Institute of Science, Satara
# (Autonomous Institute)

## Department of Computer Science

**Scheme of Credit for**
**M.Sc. Computer Science**
W e f (June 2022-23)

1. **SUBJECT: Computer Science**

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the M.Sc. I Computer Science will be implemented from June 2022 onwards.

3. **PREAMBLE:**

Master of Science is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Computer Science. The revision of existing syllabus of 6 Computer Science subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology. In this year, a student will able to understand Computer languages and technologies to build software with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Artificial Intelligence and IOT.

4. **GENERALOBJECTIVES OF THE COURSE:**

1. To create post-graduates with sound knowledge of fundamentals of Computer Science, who can contribute towards advancing science and technology.
2. To create post-graduates with sufficient capabilities in Computer Science who can become researchers and developers to satisfy the needs of the core Computer Science Industry.
3. To develop ability among students to formulate, analyze and solve real life problems.
4. To provide opportunity to students to learn the latest trends in Computer Science and make them ready for life-long learning process.
5. To make the students aware of professional ethics of the industry, and prepare them with basic soft skills essential for working in community and professional teams.
6. To prepare the students for postgraduate studies through competitive examinations, enabling them to reach higher echelons of excellence.
7. To produce Computer Science professionals who can be directly employed or start his/her own work as Software Developer, Data Scientist, testing professional, Network engineer and even an entrepreneur in IT industry.

5. **DURATION: 02Years (Full Time)**

6. **PATTERN: SEMESTER EXAM**

7. **MEDIUM OF INSTRUCTIONS: ENGLISH**

8. **STRUCTURE OF COURSE:**

**1.** FIRST SEMESTER

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 8 | MCST 101 | Design and Analysis of Algorithms | Theory | 4 | 4 |
| | MCST 102 | Principals of Programming Language | Theory | 4 | 4 |
| | MCST 103 | Advanced Database Management Systems | Theory | 4 | 4 |
| | **CCS (Elective: Any one among two)** | | | | |
| | MCST 104: E1 | Advanced Networking | Theory | 4 | 4 |
| | MCST 104: E2 | Blockchain Technology | | | |
| | MCSP105 | Lab I | Practical | 4 | 4 |
| | MCSP 106 | Lab II | Practical | 4 | 4 |
| | AECC- I | English | | 2 | 2 |
| | SEC – I | Information Technology | | 2 | 2 |
| | | | | **Total** | **28** |

**2.** SECOND SEMESTER

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 8 | MCST 201 | Python Programming | Theory | 4 | 4 |
| | MCST 202 | Cloud Computing | Theory | 4 | 4 |
| | MCST 203 | Cyber Security and Laws | Theory | 4 | 4 |
| | MCST 204 | Digital Image Processing | Theory | 4 | 4 |
| | MCST205:E1 | Mathematical and Statistical Foundations | Theory | 4 | 4 |
| | MCST205:E2 | Control Systems | | | |
| | MCSP 206 | Lab III | Practical | 4 | 4 |
| | MCSP 207 | Lab IV | Practical | 4 | 4 |
| | AECC- II | English | | 2 | 2 |
| | SEC – II | Information Technology | | 2 | 2 |
| | | | | **Total** | **32** |

**3.** THIRD SEMESTER

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 9 | MCST 301 | Emerging Technologies | Theory | 4 | 4 |
| | MCST 302 | Data Mining | Theory | 4 | 4 |
| | MCST 303 | Data Visualization using Tableau | Theory | 4 | 4 |
| | MCST 304 | Artificial Intelligence | Theory | 4 | 4 |
| | MCST 305:E1 | Machine Learning | Theory | 4 | 4 |
| | MCST 305:E2 | Fundamentals of IOT | | | |
| | MCSP 306 | Lab V | Practical | 4 | 4 |
| | MCSP 307 | Lab VI | Practical | 4 | 4 |
| | SEC – III | Start-Ups and Entrepreneurship: An approach for Sustainable Economy | | 2 | 2 |
| | SEC – IV | | | 2 | 1 |
| | | Research Training (20 to 40 Working Days) | - | - | 1 |
| | | | | **Total** | **32** |

**4.** FOURTH SEMESTER

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 9 | MCST 401 | Big data Analytics | Theory | 4 | 4 |
| | **CCS (Elective: Any one among two)** | | | | |
| | MCST 402 | Deep Learning | Theory | 4 | 4 |
| | | Microcontrollers of IoT | | | |
| | MCSP 403 | Lab V | Practical | 4 | 4 |
| | MCSP 404 | Major Project | Project | - | 1 |
| | SEC – V | CIII (Center of Innovation, Invention and Incubation) | | 2 | 2 |
| | SEC – IV | Internship / Industrial Training (30 to 60 Working Days) | | | 2 |
| | | MOOCs / SWYAM / NPTEL | | | 1 |
| | | | | **Total** | **18** |

## 5. Evaluation Structure

M.Sc. I Semester I

| Level | Course Title | Course Category | Internal Evaluation | | | | ESE | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | ISE-I | Mid Semester | ISE-II | Activity / (Activity +Project) | | | |
| 8 | MCST 101 | Design and Analysis of Algorithms | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 102 | Principals of Programming Language | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 103 | Advanced Database Management Systems | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 104 | CCS I | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCSP 105 | Lab I | - | - | - | 40 | 60 | 100 | 04 |
| | MCSP 106 | Lab II | - | - | - | 40 | 60 | 100 | 04 |
| | AECC- I | English | 05 | 05 | 05 | 05 | 30 | 50 | 02 |
| | SEC – I | Information Technology | 05 | 05 | 05 | 05 | 30 | 50 | 02 |
| | | | | | | | **Total** | **700** | **28** |

M.Sc. I Semester II

| Level | Course Title | Course Category | Internal Evaluation | | | | ESE | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | ISE-I | Mid Semester | ISE-II | Activity / (Activity +Project) | | | |
| 8 | MCST 201 | Python Programming | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 202 | Cloud Computing | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 203 | Cyber Security and Laws | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 204 | Digital Image Processing | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCST 205 | CCS II | 10 | 10 | 10 | 10 | 60 | 100 | 04 |
| | MCSP 206 | Lab I | - | - | - | 40 | 60 | 100 | 04 |
| | MCSP 207 | Lab II | - | - | - | 40 | 60 | 100 | 04 |
| | AECC- I | English | 05 | 05 | 05 | 05 | 30 | 50 | 02 |
| | SEC – I | Information Technology | 05 | 05 | 05 | 05 | 30 | 50 | 02 |
| | | | | | | | **Total** | **800** | **32** |

**Rules and Regulations:**

1. Core courses will be offered only to the students of M.Sc. Computer Science.
2. The pre-requisites for electives courses will be decided by the departmental committee and Certificate and diploma program will be mandatory for all students.
3. Electives will be offered for minimum 08 and maximum 12students in view of the infrastructure of the department. Electives to be offered or otherwise will be at the sole discretion of the departmental committee.
4. Minimum attendance required to appear for semester-end examination will be 75 % for each credit course.

**Semester I**

**Course I**

**MCST101: Design& Analysis of Algorithms**

**Course Objectives:** Student will be able to:

1. learn the algorithms and to learn basic Algorithm Analysis techniques and understand the use of asymptotic notation.
2. understand different design strategies and Greedy Method.
3. understand classical problem and solutions and learn a variety of useful algorithms
4. understand classification of problems

| **Credits=4** | **SEMESTER-I**<br>**MCST101: Design& Analysis of Algorithms** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I UNIT I** | **Unit I: Basics of Algorithms** | (15) |
| | Basics of Algorithms , Space complexity , Time complexity, worst case-best case-average case , complexity, asymptotic notation ,Recursive and non-recursive algorithms , Sorting algorithms (insertion sort, heap sort, bubble sort) ,Sorting in linear time: counting sort, concept of bucket and radix sort ,Searching algorithms: Linear, Binary, Divide and conquer strategy ,General method, control abstraction , Binary search, Merge sort, Quick sort , Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication | |
| **Credit –I UNIT II** | **Unit II: Greedy Method** | (15) |
| | Knapsack problem, Job sequencing with deadlines, Minimum-cost spanning trees: Kruskal and Prim's algorithm , Optimal storage on tapes , Optimal merge patterns , Huffman coding , Shortest Path :Dijkstra's Algorithm Graphs : Traversals, Topological sort, Minimum spanning trees, single source shortest path, All pair shortest path, Maximum flow problems. | |
| **Credit –I UNIT III** | **Unit III: Dynamic Programming** | (15) |
| | Principle of optimality , Matrix chain multiplication , 0/1 Knapsack Problem i)Merge & Purge ii)Functional Method , Bellman Ford Algorithm ,All pairs Shortest Path Floyd- Warshall Algorithm ,Longest common subsequence, ,String editing, Travelling Salesperson problem | |
| **Credit –I UNIT IV** | **Unit IV: Backtracking and Problem Classification** | (15) |
| | General method , Fixed Tuple vs. Variable Tuple Formulation , n-Queen's problem • Graph coloring problem , Hamiltonian cycle , Sum of subsets Problem Classification - Nondeterministic algorithm • The class of P, NP, NP-hard and NP -Complete problems • Cook's theorem | |

**Course Outcomes: Students should be able to**

1. Understanding Algorithmic complexity and analyzing the same
2. Developing an understanding of various techniques and methods to design algorithms
3. Make the algorithm and solve real-world problems
4. Analyze traditional algorithms and apply to various problems.

**Reference Books:**


1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, “Computer algorithms”, Silicon Pr Publication, 2007 (Unit I (1-68 ,91-99) ,Unit II (127-179), Unit III (197-250),Unit IV(2532998,339-368)).
2. T. Cormen, C. Leiserson, & R. Rivest, “Introduction to Algorithms”, MIT Press, 2009. (Unit I (5-57 ,151-200) ,Unit II (359-397), Unit III (1048-1086),Unit IV(1111))
3. Steven Skiena,“The Algorithm Manual”, Springer, 2010. Unit I (31-57) Unit II(103-139) Unit III(316-350)
4. Jungnickel, “Graphs, Networks and Algorithms”, Springer, 2012.
5. Rajesh K. Shukla, “Analysis and Design of Algorithms: A Beginner's Approach”,Wiley, 2015.

   Sandeep Sen, “Design and Analysis of Algorithms: A Contemporary Perspective”, Cambridge University Press, 2019 (Unit I (54-78) Unit II(92-103) Unit IV(230-254))

**Semester I**

**Course II**

**MCST 102: Principles of Programming Language Learning**

**Course Objectives:** Student will be able to-

1. Compare programming language designs
2. Learn new languages more quickly
3. Understand basic language implementation techniques
4. Learn small programs in different programming Languages

| **Credits=4** | **SEMESTER-I**<br>**MCST 102: Principles of Programming Language Learning** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I: Introduction, Names, Scopes, and Bindings** | (15) |
| | The Art of Language Design, The Programming Language Spectrum, Why Study Programming Languages? , Compilation and Interpretation , Programming Environments, The Notion of Binding Time, Object Lifetime and Storage Management, Static Allocation- (Stack-Based Allocation, Heap-Based Allocation, Garbage Collection Scope Rules),Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope , Aliases, Overloading, Polymorphism and Related Concepts, the Binding of Referencing Environments, Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures Macro Expansion | |
| **Credit –I**<br>**UNIT II** | **Unit II: Functional Programming in Scala** | (15) |
| | Strings, Numbers, Control Structures, Classes and Properties, Methods, Objects, Functional Programming, List, Array, Map, Set | |
| **Credit –I**<br>**UNIT III** | **Unit III: Data Abstraction and Object Orientation** | (15) |
| | Object-Oriented Programming,Encapsulation and Inheritance Modules, Classes, Nesting (Inner Classes), Type Extensions, Extending without Inheritance, Initialization and Finalization Choosing a Constructor, References and Values, Execution Order, Garbage Collection, Dynamic Method Binding, Virtual- and NonVirtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures,Multiple Inheritance, Semantic Ambiguities, Replicated Inheritance | |
| **Credit –I**<br>**UNIT IV** | **Unit IV: Control Flow** | (15) |
| | Expression Evaluation, Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation , Structured and Unstructured Flow, Structured | |

| | | |
|---|---|---|
| | Alternatives to goto, Sequencing, Selection - Short-Circuited Conditions, Case/Switch Statements Iteration , Iteration - Enumeration-Controlled Loops, Combination Loops, Iterators, Logically Controlled Loops Recursion, Recursion - Iteration and Recursion, Applicative- and Normal-Order Evaluation | |

**Course Outcomes:**

After completion of this course student should be able to

1. Get knowledge of, and ability to use, language features used in current programming languages.
2. To prepare student to think about programming languages analytically:
3. Understand key concepts in the implementation of common features of programming languages.
4. To implement object oriented Programming concepts.

**References:**


1. Michel L. Scott, “Programming Language Pragmatics”, Kaufmann Publishers, An Imprint of Elsevier, USA, 2015(Unit 1,(Pg. 5 -26) Unit –II Pg(27 -144).
2. Robert W. Sebesta, “Concepts of Programming Languages”, Eighth Edition, Pearson Education,2016.(Unit-II Pg. 57-124)
3. Alvin Alexander, “Scala Cookbook”, O’REILLY publication, 2013(Unit-IV,Pg. 3-115).
4. Rajiv Chopra, “Principles of Programming Languages”, I K International Publishing House, 2014(Unit III Pg. 224 -230).
5. Dowek, “Principles of Programming Languages”, Springer, 2009(Unit III,Pg-56-80).

**Semester I**

**Course III**

**MCST103: Advanced Database Management System**

**Course Objectives:** student will be able to

1. Learn different types of databases.
2. Study of query languages and active databases.
3. Be familiar with the indexing techniques.
4. Learn how to solve complex and recursive queries.

| **Credits=4** | **SEMESTER-I**<br>**MCST103: Advanced Database Management System** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I: Query Processing and Evaluation** | (15) |
| | Measures of Query Cost, Selection Operation, Sort Join Operation, other Operations Evaluation of Expression, Transformation of Relational Expressions, Role of Relational Algebra and Relational Calculus in query optimization, Estimating Statistics of Expression, Choice of Evaluation Plans, Views and query processing, Storage and query optimization | |
| **Credit –I**<br>**UNIT II** | **Unit II: Transaction Management and Recovery** | (15) |
| | Advanced feature of Transactions, Enhanced Lock Based and timestamp-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Weak Levels of Consistency, Concurrency in Index Structures, Recovery and Atomicity, Recovery with Concurrent Transaction, Buffer Management, Advanced Recovery Techniques, Remote Backup Systems, Use of SQL in recovery, Examples of etransactions. | |
| **Credit –I**<br>**UNIT III** | **Unit III: Database Security and Authorization** | (15) |
| | Levels of database security, Access control, Multilevel security, Statistical database security, Audit trails in the databases, Examples of e security | |
| **Credit –I**<br>**UNIT IV** | **Unit IV: Distributed Databases** | (15) |
| | Centralized versus non centralized Databases, Homogeneous and Heterogeneous DDBMS and their comparison, Functions and Architecture ,Distributed database design, query processing in DDBMS, Distributed concurrency management, deadlock management, Distributed Commit Protocols: 2 PC and 3 PC, Concepts of replication servers | |

**Course Outcomes:** student should be able to

1. Demonstrate the basics of query evaluation and heuristic query optimization techniques.
2. Apply Concurrency control and recovery mechanisms for the desirable database problem.
3. Apply security to database.
4. Design and implement the database system with the fundamental concepts of DBMS.

**TEXT BOOK:**

1. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015 (Unit I – (Pg. 207-249), Unit II – (Pg. 551-576), (Unit III –(Pg.731-750)
2. Raghu Ramakrishnan, Database Management Systems,Mcgraw-Hill,4th edition,2015.(Unit I – (Pg. 177-189), (Unit I – (Pg. 521-564), (Unit III –(Pg.597-632)

**REFERENCES:**


1. A. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 6th Edition 2010. (Unit I – (Pg. 679-733), Unit II – (Pg. 737-780), Unit III –(Pg.559-590), Unit IV – (Pg. 783-792))
2. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012 (Unit I – (Pg. 679-733), Unit II – (Pg. 737-780), Unit III –(Pg.559-590),Unit IV – (Pg. 783-792))
3. Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012. (Unit I – (Pg. 3-12), Unit II – (Pg. 47-59), Unit IV – (Pg. 81-84))
4. Shashank Tiwari ,ProfessionalNoSql,Wiley ,2011 (Unit I – (Pg. 73-169))

**Semester I**
**Course IV**
**MCST104:E1: Advanced Computer Networks**

**Course Objectives: Student will be able to-**

1. understand the concept of security and its applications
2. study of various detection and prevention techniques in diversified environments
3. learn various vulnerabilities, threats and attacks
4. prepare globally competent post graduates with enhanced domain knowledge and skills attaining professional excellence

| **Credits=4** | **SEMESTER-I**<br>**MCST104:E1: Advanced Computer Networks** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I: Introduction to Network layers and Protocols** | (15) |
| | Introduction to networking, TCP/IP Protocol Model, IP Addressing- Address Space, Network Address Translation, Notations, Internet Protocol- Datagram format, fragmentation, IPV4, IPV6, Virtual Private network technology, Mobile IP – Addressing, Agents, Efficiency in Mobile IP. | |
| **Credit –I**<br>**UNIT II** | **Unit II: Transport Layer Protocols** | (15) |
| | User Datagram Protocol-User datagram, UDP Services, UDP Applications, Transmission Control Protocol- TCP services, TCP Features, State Transition Diagram, Flow Control, Error Control, TCP congestion, SCTP- Services, features, flow control, error control. | |
| **Credit –I**<br>**UNIT III** | **Unit III: Classification of Network Attacks & Cryptographic Techniques** | (15) |
| | Basic Security Concepts, History Of Network Security, Data Security Vs. Network Security, Computer And Network Attacks, Introduction To Vulnerabilities, Threats And Attacks, Layers Of Attacks, Spoofing, Sniffing, Malware: Viruses, Worms, Trojan horses ,Ciphers, Cryptography- Cryptographic systems, Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, Encryption and Decryption Techniques. | |
| **Credit –I**<br>**UNIT IV** | **Unit IV: Application Layer & Protocols** | (15) |
| | WWW, HTTP, File Transfer- FTP, TFTP, Electronic mail – architecture, web based mails ,email security, SMTP,POP,IMAP, MIME ,SNMP, DNS – Concept of domain name space, DNS Operations ,DHCP- Static and Dynamic allocation, DHCP operations, Remote Login – TELNET and SSH. | |

**Course Outcomes:** student should be able to

1. Design and choose appropriate security model
2. Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
3. use specific frameworks as per applications need.
4. Study of a working knowledge of datagram and internet.

**References:**


1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, McGraw Hill, 4th Ed., 2010. (Unit 1 – Pg 93,Unit 2 – Pg 373,Unit 3 – Pg 873, Unit 4 – Pg 542)
2. Tanenbaum, A. S., “Computer Networks”, Prentice Hall, Upper Saddle River, New Jersey, 5 th Ed., 2013.(Unit 1 – Pg 355, Unit 2 – Pg 495, Unit 3 – Pg 763, Unit 4 – Pg 611)
3. B.M.Harwani , “Advanced Computer Networks”, DT Editorial Services, Dreamtech New Delhi-2014. (Unit 1 – Pg 15) 4. Mark Stamp, “Information Security: Principles and Practice”, John Wiley and Sons, 2011.
(Unit 3 – Pg 17 , Unit 4 – Pg 311)
4. William Stallings, “Cryptography and Network Security: Principle and Practice”, Pearson, 5th Edition, 2017.(Unit 1 – Pg 19)

**Semester I**

**Course IV**

**MCST104:E2: Blockchain Technology**

**Course Objectives:** student will be able to

1. understand the history, types and applications of Blockchain
2. acquire knowledge about cryptography and consensus algorithms.
3. Study of how to deploy projects using Web3j
4. Understand the design blockchain based applications.

| **Credits=4** | **SEMESTER-I**<br>**MCST104:E2: Blockchain Technology** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **UNIT 1: Introduction to Blockchain** | (15) |
| | Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain. | |
| **Credit –I**<br>**UNIT II** | **UNIT 2: Blockchain Architecture** | (15) |
| | Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET) | |
| **Credit –I**<br>**UNIT III** | **UNIT 3: Blockchain-Based Futures System** | (15) |
| | Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract | |
| **Credit –I**<br>**UNIT IV** | **UNIT 4: Blockchains in Business and Creating ICO** | (15) |
| | Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchainas-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and testing the code. | |

**Course Outcomes:** student should be able to -

1. discuss and describe the history, types and applications of Blockchain
2. Gains familiarity with cryptography and Consensus algorithms.
3. Create and deploy projects using Web3j.
4. study to implement an ICO on Ethereum

**Reference Books:**


1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018
3. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

**Semester I**

**LAB–I**

**MCSP105: Design& Analysis of Algorithms and Principles of Programming**

**Course Objectives:** student will be able to

1. To understand how to implement different algorithms.
2. To learn how to use different methods to solve real world Problems.
3. To learn how to program using scala language.
4. To understand implementation of Object Oriented concepts.

| **Credits=2** | **SEMESTER-I**<br>**PRACTICAL COURSE – I: LAB - I** | **No. of hours per unit/ credits (30)** |
|---|---|---|
| **GROUP A:** | **Design& Analysis of Algorithms** | |
| | 1. Write a program to Sorting Algorithms<br>2. Write a program to Searching Algorithms<br>3. Write a program to Warshall's Algorithm<br>4. Write a program to Knapsack Problem<br>5. Write a program to Shortest Paths Algorithm<br>6. Write a program to Bellman Ford Algorithm<br>7. Write a program to Minimum Cost Spanning Tree<br>8. Write a program to All Pairs Shortest Paths | |
| **GROUP B:** | **Design& Analysis of Algorithms** | |
| | 1 . Programs based on Control Structures<br>1. Write a program to calculate average of all numbers between n1 and n2(eg.100 to 300 Read values of n1 and n2 from user)<br>2. Write a program to calculate factorial of a number.<br>3. Write a program to read five random numbers and check that random numbers are perfect number or not.<br>4. Write a program to find second maximum number of four given numbers.<br>5. Write a program to calculate sum of prime numbers between 1 to 100<br>6. Write a program to read an integer from user and convert it to binary and octal using user defined functions.<br><br>2.Classes and Objects<br>1. Define a class CurrentAccount (accNo, name, balance, minBalance). Define appropriate constructors and operations withdraw(), deposit(), viewBalance(). Create an object and perform operations.<br>2. Define a class Employee (id, name, salary). Define methods accept() and display().Display details of employee having maximum salary. | |

| | | |
|---|---|---|
| | 3. Create abstract class Order (id, description). Derive two classes PurchaseOrder&SalesOrder with members Vendor and Customer. Create object of each PurchaseOrder and SalesOrder. Display the details of each account.<br>4. Create abstract class Shape with abstract functions volume() and display(). Extend two classes Cube and Cylinder from it. Calculate volume of each and display it.<br><br>3.List<br>1. Create Lists using five different methods(Lisp style, Java style, fill, range and tabulate methods)<br>2. Create two Lists and Merge it and store the sorted in ascending order.<br>3. Create a list of integers divisible by 3 from List containing numbers from 1 to 50.<br>4. Create a list of even numbers up to 10 and calculate its product.<br><br>4.Set<br>1. Write a program to create two sets and find common elements between them.<br>2. Write a program to display largest and smallest element of the Set<br>3. Write a program to merge two sets and calculate product and average of all elements of the Set | |

**Course Outcomes**: student should be able to -

1. understand and implement different algorithms.
2. learn and use different methods to solve real world Problems.
3. Evaluate various program using scala language.
4. Study of to implement Object Oriented concepts.

**References:**


1. Ellis Horowitz, Sartaj Sahni &Sanguthevar Rajasekaran, “Computer algorithms”,Silicon Pr Publication, a. 2007.
2. T. Cormen, C. Leiserson, & R. Rivest, “Introduction to Algorithms”, MIT Press, 2009.
3. Steven Skiena,“The Algorithm Manual”, Springer, 2010.
4. Jungnickel, “Graphs, Networks and Algorithms”, Springer, 2012.
5. Rajesh K. Shukla, “Analysis and Design of Algorithms: A Beginner's Approach”,Wiley, 2015.
6. Sandeep Sen, “Design and Analysis of Algorithms: A Contemporary Perspective”, Cambridge University Press, 2019.
7. Michel L. Scott, “Programming Language Pragmatics”, Kaufmann Publishers, An Imprint of Elsevier, USA, 2015.
8. Robert W. Sebesta, “Concepts of Programming Languages”, Eighth Edition,Pearson Education,2016.
9. Alvin Alexander, “Scala Cookbook”, O’REILLY publication, 2013.
10. Rajiv Chopra, “Principles of Programming Languages”, I K International Publishing House, 2014.
11. Dowek, “Principles of Programming Languages”, Springer, 2009.

**Semester I**

**LAB–II**

**MCSP106: Advanced DBMS & Advanced Computer Networks and Blockchain Technology**

**Course Objectives:** student will be able to

1.Understand the basic concepts and the applications of database systems.
2.use the basics of SQL and construct queries using SQL.
3.study the basics of Computer Networks
4.study TCP /IP Protocols and implement it.

| **Credits=2** | **SEMESTER-I**<br>**PRACTICAL COURSE – I: LAB - II** | **No. of hours per unit/ credits (30)** |
|---|---|---|
| **GROUP A:** | **Advanced DBMS** | |
| | 1. 1.DDL and DML<br>2. Single row and aggregate functions<br>3. Joins and Sub queries<br>4. Anonymous blocks and control structures<br>5. Iterations 3 hours 6. Cursors<br>6. Functions and Procedures<br>7. Exception Handling and triggers<br>8. DBA Concepts<br>9. XML, DTD, XQuery Representations | |
| **GROUP B:** | **Advanced Computer Networks** | |
| | 1. Exercise on Data Transfer.<br>2. Exercise on Advanced Data Transfer.<br>3. Exercise of Flow and Error Control.<br>4. Exercise on Data Encryption with algorithms.<br>5. Exercise on Data Decryption with algorithms. | |
| **GROUP C:** | **Blockchain Technology** | |
| | 1. Create a Public Ledger vs. Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples.<br>2. How would a blockchain help in processing insurance claims of the insurance industry, which suffers from a number of issues like fraud, contract complexity, human error, information flows in reinsurance and claims processing? Use various aspects to summarize the solution.<br>3. Prepare your build system and Building Bitcoin Core.<br>4. Write Hello World smart contract in a higher programming language (Solidity).<br>5. Solidity example using arrays and functions<br>6. create a Maven project using Web3j.<br>7. Construct and deploy your contract (Use deploy method) | |

**Course Outcomes:** student should be able to -

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Apply cryptographic algorithms of encryption and description
4. Learn TCP /IP Protocol suite.

**References:**


1. Silberschatz, H. F. Korth S. Sudershan, “Database System Concepts”, McGraw Hill, 6th Edition 2010.
2. Thomas Connolly, Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, 6th Edition,2012.
3. Pramod J. Sadalage and Marin Fowler, “NoSQL Distilled: A brief guide to merging world of Polyglot persistence”, Addison Wesley, 2012.
4. Shashank Tiwari ,”ProfessionalNoSql”,Wiley ,2011.
5. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, - Pearson Education, 2008.
6. S Sridhar, “Digital Image Processing”, Oxford University Press, 2016.
7. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, “Digital Image Processing Using MATLAB”, Second Edition, - Tata McGraw Hill Publication, 2020.
8. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, Tata McGraw Hill Publication, 2017.
9. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015
10. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

**SEMESTER II**

**Course V**

**MCST 201: Python Programming**

**Course Objectives:** student will be able to

1. Understand of programming language paradigm.
2. Use of Understanding of Lambda Calculus.
3. Learning functional programming language Python.
4. learn and implement Database concepts in python

| **Credits=4** | **SEMESTER-II**<br>**MCST 201: Python Programming** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I : Introduction To Python** | (15) |
| | Installation,Working with Python ,Understanding Python variables , Python basic Operators ,Understanding python blocks, Declaring and using Numeric data types: int, float, complex , Using string data type and string operations , Defining list and list slicing , Use of Tuple data type. | |
| **Credit –I**<br>**UNIT II** | **Unit II: Python Program Flow Control** | (15) |
| | Conditional blocks using if, else and elif , Simple for loops in python , For loop using ranges, string, list and dictionaries , Use of while loops in python Loop manipulation using pass, continue, break and else , Programming using Python conditional and loops block , Modules And Packages , Organizing python codes using functions ,Understanding Packages | |
| **Credit –I**<br>**UNIT III** | **Unit III: Python String, List And Dictionary Manipulations** | (15) |
| | Building blocks of python programs , Understanding string in build methods , List manipulation using in build methods , Dictionary manipulation Programming using string, list and dictionary in build functions , Reading config files in python , Writing log files in python , Read functions, read(), readline() and readlines() , Write functions, write() and writelines() , Manipulating file pointer using seek Programming using file operations | |
| **Credit –I**<br>**UNIT IV** | **Unit IV: Python Database Interaction and Libraries** | (15) |
| | SQL Database connection using python , Creating and searching tables Reading and storing config information on database , Numpy , Pandas , Matplotlib , Scipy Only Introduction | |

**Course Outcomes:** On completion of the course, student should be able to–

1. understand and use basics of Python
2. Solve problems by using Python language.
3. Evaluate projects by using Python Framework.
4. create application with help of python libraries.

**References:**


1. Greg Michaelson, “An Introduction to Functional Programming Through Lambda Calculus” ,Dover Publications Inc.,2011. (Unit 1 (6.1-6.14))
2. Jan van Eijck , Christina Unger, ”Computational Semantics with Functional Programming”, Cambridge University Press, 2012 . (Unit 3 (15-32))
3. Charles Dierbach ,”Introduction to Computer Science Using Python: A Computational Problem-Solving Focus”,John Wiley & Sons,2013. Unit 1- 3 (1-206) ,Unit 4 (289-460)
4. Kenneth C. Louden, “Programming Languages: Principles and Practice”, Course Technology Inc., 2011. Unit 1(47-90))
5. Richard L. Halterman, “LEARNING TO PROGRAM WITH PYTHON”, Southern Adventist University, 2011 (Unit 1 (1-9,11-32m,35-53) Unit 2 (57-77)Unit 3(81-97),Unit 4 (115-231,267-272))
6. Dusty Phillips, “Python 3 Object-oriented Programming Second Edition”, Packt Publishing, 2015. (All related to object oriented Programming and Design patterns)
7. Adrian Holovaty and Jacob Kaplan-Moss, “The Definitive Guide to Web Development Done Right”, Apress Publishing, 200 (Unit 1 (3-16),Unit 2(17-30,59-64))

**Semester II**

**Course VI**

**MCST 202: Cloud Computing**

**Course Objectives:**

1. understand the principles and paradigm of Cloud Computing
2. study to appreciate the role of Virtualization Technologies
3. study of to design and deploy Cloud Infrastructure
4. Understand cloud security issues and solutions

| **Credits=4** | **SEMESTER-II**<br>**MCST 202: Cloud Computing** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I: Introduction to Cloud Computing** | (15) |
| | Overview, Evolution of Cloud Computing, Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Multitenant Technology. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology. Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Deployment Models | |
| **Credit –I**<br>**UNIT II** | **Unit II: Cloud Models & Services:** | (15) |
| | Cloud Models – Benefits of Cloud Models, Public, Private, Hybrid, and Community Clouds , Types of Clouds Services: SaaS, PaaS, IaaS, DaaS, MaaS, CaaS. Service Providers: Google App Engine, Microsoft Azure, Amazon EC2, IBM, Sales Force; Introduction to MapReduce, GFS, HDFS, Hadoop Framework. | |
| **Credit –I**<br>**UNIT III** | **Unit – III: Essentials & Collaborating with Cloud:** | (15) |
| | Hardware and Infrastructure – Clients, Security, Network, Services; Accessing Cloud – Platforms, Web Applications, Web APIs, Web Browsers; Cloud Storage – Overview, Cloud Storage Providers; Standards – Application, Client, Infrastructure, Service; Centralizing Email Communications, Collaborating on Calendars, Schedules & Task Management, Event Management, Project Management and Contact Management | |
| **Credit –I**<br>**UNIT IV** | **Unit IV: Virtualization and Security for Cloud** | (15) |
| | Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management, Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security | |

**Course Outcomes:** student should be able to

1. Understand the fundamental principles of distributed computing.
2. Understand how the distributed computing environments known as Grids can be built from lower level services.
3. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
4. Analyze the performance of Cloud Computing.

**References:**


**1.** Brian J.S. Chee and Curtis Franklin, "Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center", CRC Press, 2019. (Unit I –(Pg.1-26), Unit II– (Pg. 27-71), Unit III – (Pg. 73-103), Unit IV – (Pg. 139-150))

**2.** Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi , "Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, 2013. (Unit I –(Pg.3-27), Unit II– (Pg. 111-139),Unit IV – (Pg. 71-109))

**3.** Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.(Unit I –(Pg.3-51), Unit II(Pg. 189-203), Unit III – (Pg. 215-225),Unit IV – (Pg. 129-183))

**Semester II**
**Course VII**
**MCST 203: Cyber Security and Law**

**Course Objectives:** student should be able to

1) Study the concepts of Cyber Security
2) Understand and defend computer systems and networks from cyber security attacks
3) Understand the cyber law and Rights in Cyberspace
4) Understand Cyber Torts and Dispute Resolution in Cyberspace

| **Credits=4** | **SEMESTER-II**<br>**MCST 203: Cyber Security and Law** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit-I Introduction to Cyber Security** | (15) |
| | Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.<br>Cyber Security Vulnerabilities and Cyber Security Safeguards:Cyber Security Vulnerabilities Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness.<br>Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management. | |
| **Credit –I**<br>**UNIT II** | **Unit-II Securing Web Applications and Servers** | (15) |
| | Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Intrusion Detection and Prevention: Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems,<br>Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation. | |

| | | |
|---|---|---|
| **Credit –I UNIT III** | **Unit-III Introduction to Cyber Law and Rights in Cyberspace** | (15) |
| | Computer and its impact in society, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013,Need for Cyber Law, Cyber Jurisprudence at Indian Level, Freedom of speech and expression in cyberspace, Right to access cyberspace-access to internet, Right to privacy, Right to data protection | |
| **Credit –I UNIT IV** | **Unit –IV Cyber Torts and Dispute Resolution in Cyberspace** | (15) |
| | Different offences under IT act,2000, Different types of civil wrongs under the IT act ,2000, Interface with copyright law, Interface with patent law, Concept of Jurisdiction, Indian context of Jurisdiction and IT Act,2000, Dispute resolutions, Impact of cyber warfare on privacy, identity theft, International law governing Censorship, online privacy, copyright regulations, Online Intermediaries in the governance of Internet, Social Networking Sites, Human Rights, Trademarks and Domain name related issue | |

**Course Outcomes:** After completion of this course student should be able to

1) Realize the need for Cyber Security
2) Understand the need for Security in day to day communications
3) Understand the cyber law and rights in cyberspace
4) Understand Cyber Torts and Dispute Resolution in Cyberspace

**References:**


1. Preston Gralla, "How Personal and Internet Security Work", QuePublications, 2004 (Unit I ,Pg. 15-199).
2. Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and Implementation,Cengage Learning, 2010(Unit I, Pg. 5-26)(Unit- II Pg. 40-80).
3. Joseph Pelton , Indu B.Singh, "Digital Defense: A Cybersecurity Primer", Copernicus, 2015(Unit III, Pg. 25-48), (Unit III, Pg. 83-101)..
4. John R. Vacca, "Computer and Information Security Handbook", Morgan Kaufmann, 3rd Edition, 2017(Unit I, Pg. 8-56), (Unit III, Pg. 80-112).
5. Brian Craig, "Cyberlaw: The Law of the Internet and Information Technology", Lexis Nexis publishing, 2014(Unit III, Pg. 1-66), (Unit IV, Pg. 70-201).
6. Jason Andress, Steve Winterfeld, "Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners2nd Edition ", Syngress publishing, 2013 (Unit IV, Pg. 56-110).

**Semester II**
**Course VIII**
**MCST 204: Digital Image Processing**

**Course Objectives:** student will be able to

1. learn the fundamental concepts of Digital Image Processing.
2. study basic image processing operations.
3. understand image analysis algorithms.
4. study current applications in the field of digital image processing.

| **Credits=4** | **SEMESTER-II**<br>**MCST 204: Digital Image Processing** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Unit I: Fundamentals of Image Processing** | (15) |
| | Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images- image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram, Color fundamentals & models – RGB, HSI YIQ. | |
| **Credit –I**<br>**UNIT II** | **Unit II: Image Enhancement, Restoration and Compression** | (15) |
| | Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement:2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering. Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG. | |
| **Credit –I**<br>**UNIT III** | **Unit III: Image Segmentation and Morphological Operations** | (15) |
| | Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton. | |

| | | |
|---|---|---|
| **Credit –I UNIT IV** | **Unit IV: Object Recognition and Applications** | (15) |
| | Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing | |

**Course Outcomes:** After successfully completing the course students should be able to-

1. understand fundamentals of Image Processing
2. understand image segmentation and morphological operations.
3. develop and implement algorithms for digital image processing.
4. apply image processing algorithms for practical object recognition applications.

**Reference Books:**


1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, - Pearson Education, 2008. (Unit I, Pg. 58-118,Unit II, Pg. 334-403,Unit- III Pg. 649-698,Unit IV pg.883-926).
2. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, “Digital Image Processing Using MATLAB”, Second Edition, - Tata McGraw Hill Publication, 2020.
3. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, Tata McGraw Hill Publication, 2017. (Unit I, Pg. 1-42,Unit II, Pg. 243-337,Unit- III Pg. 368-397,Unit IV pg.408-434).

**Semester II**
**Course IX**
**MCST205:E1: Mathematical and Statistical Foundation**

**Course Objectives:** student will be able to

1. Understand the notion of vector space.
2. Study of to Work out algebra of linear transformations.
3. Understand the connection between linear transformation and matrices.
4. Study to work out Eigen values, Eigen vectors and its connection with real life situation.

| **Credits=4** | **SEMESTER-II**<br>**MCST205:E1: Mathematical and Statistical Foundation** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **UNIT – I: Vector Spaces** | (15) |
| | Vector space, Subspace, Sum of subspaces, direct sum, Quotient space, Homomorphism or Linear transformation, Kernel and Range of homomorphism, Fundamental Theorem of homomorphism, Isomorphism theorems, Linear Span, Finite dimensional vector Space, Linear dependence and independence, basis, dimension of vector space and Subspaces. | |
| **Credit –I**<br>**UNIT II** | **UNIT – II: Linear Transformations** | (15) |
| | Linear Transformation, Rank and nullity of a linear transformation, Sylvester's Law, Algebra of Linear Transformations, Sum and scalar multiple of Linear Transformations. The Vector space of homomorphism, Product (composition) of Linear Transformations, Linear Operator, Linear functional, Invertible and nonsingular Linear Transformation, Eigen space, Characteristic Polynomial of a matrix and remarks on it, similar matrices, Characteristic Polynomial of a Linear operator, Examples on eigenvalues and eigenvectors. | |
| **Credit –I**<br>**UNIT III** | **UNIT III: Statistical Modeling and Distributions** | (15) |
| | Overview of linear correlation and correlation, application and numerical examples on linear correlation and correlation. Introduction to Residual Error, Mean Square Error, RMSE, Multilinear correlation ,Regression, Logistic Regression, Simulation using Monte Carlo Method,Overview of Discrete and Continuous Probability Distributions, Binomial Distribution,Poisson ,Distribution ,Geometric Distribution, Exponential Distribution, Normal Distributions, Numeric Examples and Random No. Generation Using Python | |
| **Credit –I**<br>**UNIT IV** | **UNIT IV: Hypothesis Tests and Statistical Tests** | (15) |
| | Typical Analysis procedures, Hypothesis Concept, Errors, p-Value, and Sample Size, Confusion Matrix, ANOVA, Test on Sample Mean, Comparison of Two Groups, Comparison of Multiple Groups, Categorical data analysis | |

**Course Outcomes:** student should be able to

1. Explain the concepts of basis and dimension of a vector space.
2. Understands Eigen values, Eigen functions, Characteristic Polynomial of a matrix.
3. Design and analyse real world engineering problems by applying various statistical modeling techniques.
4. Study Model and solve computing problem using correlation, and resampling using appropriate statistics algorithms.

**References:**


1. Khanna V. K. and Bhambri S. K., "A Course in Abstract Algebra", Vikas Publishing House PVT Ltd., New Delhi , 5$^{th}$Edition 2016. (Unit I,(Pg. 275-328) Unit –II Pg(329-393))
2. H. Anton & C. Rorres, "Elementary Linear Algebra (with Supplemental Applications)", Wiley India Pvt.Ltd (Wiley Student Edition), New Delhi, 11$^{th}$Edition 2016.
3. S. Friedberg, A. Insel, L. Spence, "Linear Algebra", Prentice Hall of India, 4$^{th}$ Edition, 2014.(Unit 1,(Pg. 6-24) Unit –II Pg(26-58))
4. David Lay, Steven Lay, Judi McDonald, "Linear Algebra and its Applications", Pearson Education Asia, Indian Reprint, 5$^{th}$ Edition 2016 . (Unit I,(Pg. 191-264))
5. Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life Sciences", Springer International Publishing Switzerland 2016.(Unit III(Pg. 39,51-71,76-78,89-118) Unit –IV Pg(121-156))

**Semester II**

**Course IX**

**MCST205:E2: Control Systems**

**Course Objectives:** Student will be able to:-

1. Study of systems theory to complex real-world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
2. Understand system behaviour based on the mathematical model of that system where the model may be expressed in time or frequency domain.
3. Study of the behaviour of closed loop systems using various methods.
4. Understand controllers using classical PID methods, root locus methods, and frequency domain methods.

| **Credits=4** | **SEMESTER-II**<br>**MCST205:E1: Mathematical and Statistical Foundation** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **UNIT I: Introduction to Control Theory** | (15) |
| | A.Basic Concepts of Control System, B. Open loop and Closed loop systems, C. Classifications, effect of feedbacks on Control System performance. D.Transfer function modeling and representation of Control system, pole & zero concept, E. Mathematical modeling of linear mechanical and Electrical systems, F. Electrical analogy, Block reduction techniques, G.Signal flow graph, Mason's gain formula. | |
| **Credit –I**<br>**UNIT II** | **UNIT II Time Domain Analysis and stability** | (15) |
| | A. Type and Order of Control system, B. Typical tests signal, Time Response of first and second order systems to unit step input, C. Steady state errors, D. Time Domain Specifications of Second Order System, E. Dominant Closed loop Poles of Higher Order Systems. F. Concept of Stability: absolute, relative and marginal, nature of system response, stability analysis using Hurwitz's criterion, Routh's criterion, G. Basic properties of Root Loci, Construction of Root loci, H. Angle and magnitude condition for stable systems, I. Concept of inverse root locus and root contour. | |
| **Credit –I**<br>**UNIT III** | **UNIT III Frequency Domain and State Variable Analysis** | (15) |
| | A. Steady state response of a system to sinusoidal input, B. Relation between time and frequency response for second order systems, C. Frequency response specifications, D. Stability Analysis with Bode Plots, E. Nyquist stability criterion. F. Introduction to state space analysis, G. State space representation for i) Electrical Network ii) nth order differential equation iii) Transfer function. | |
| **Credit –I**<br>**UNIT IV** | **UNIT IV Control system components and controllers** | (15) |
| | A. Modeling and transfer function of control system components- Potentiometer, B. DC and AC Servomotors, gear trains, C. Tacho-generators. D. Design concepts of P, PI, PD, PID controllers, Compensator Networks-lag and lead. | |

**Course Outcomes:** After successful completion students should be able to:

1. Understand the modeling of discrete systems in state space
2. Apply programming strategies in the domain of control systems
3. Understand the systems in Time and frequency domain.
4. Design modern control systems with computer simulation

**Reference Books:**


1. I.J. Nagrath, M.Gopal "Control Systems Engineering", 5th Edition, New Age International Publication Ogata Katsuhiko, "Modern Control Engineering", 4th Edition, PHI.
2. Kuo B.C. Automatic Control System, PHI, New Delhi, Third Edition
3. Schaum's Series book "Feedback Control Systems".Les Fenical "Control Systems", 1st Edition, Cengage Learning India.
4. Samarjeet Ghosh, "Control Systems Theory & Applications", 1 st Pearson education.
5. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education.
6. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
7. U.A.Bakshi, V.U.Bakshi "Control System Engineering",First Edition 2008 , Technical Publications, Pune

**Semester II**

**LAB–III**

**MCSP : 206 Python Programming and Cloud Computing**

**Course Objectives:** student will be able to

1. learn how to read and write files in Python and use libraries of Python.
2. learn how to design object-oriented programs with Python classes.
3. Understand the problems and solutions to cloud application problems.
4. Study of to apply principles of best practice in cloud application design and management

| **Credits=2** | **SEMESTER-II**<br>**PRACTICAL COURSE – III: LAB - III** | **No. of hours per unit/ credits (30)** |
|---|---|---|
| **GROUP A:** | **Python Programming** | |
| | 1. Introduction To Python Installation of Python on different OS Working with Python as a calculator<br>2. Programs on Flow Control Basic programs for understanding of different control flow in Python<br>3. Functions Writing Programs using functions Use of Modules Use of packages<br>4. Python programs for String, List Building blocks of python programs Understanding string in build methods List manipulation using in build methods<br>5. Dictionary Manipulations Dictionary manipulation Programming using string, list and dictionary in build functions<br>6. Python File Operation Reading config files in python Writing log files in python read functions, read(), readline() and readlines() write functions, write() and writelines()<br>7. Python Database Interaction Demo for SQL/ SQlite connectivity<br>8. Python Libraries Numpy Pandas<br>9. Python Libraries Matplotlib Scipy<br>10. Python Framework Tutorial on Django | |
| **GROUP B:** | **Cloud Computing** | |
| | 1. Working and Implementation of Infrastructure as a service.<br>2. Working and Implementation of Software as a service.<br>3. Working and Implementation of Platform as a services.<br>4. Practical Implementation of Storage as a Service.<br>5. Working of Google drive to make spreadsheet and notes.<br>6. Working and Implementation of identity management.<br>7. Write a program for web feed.<br>8. Execute the step to Demonstrate and implementation of cloud on single sign on.<br>9. Practical Implementation of cloud security.<br>10. Installing and Developing Application Using Google App Engine. | |

**Course Outcomes:** student should be able to

1. Understand the fundamental principles of distributed computing.
2. Understand how the distributed computing environments known as Grids can be built from lower level services
3. Explain basic principles of Python programming language
4. Implement object oriented concepts, Implement database and GUI applications.

**Reference Books:**


1. Greg Michaelson, "An Introduction to Functional Programming Through Lambda Calculus" ,Dover Publications Inc.,2011.
2. Jan van Eijck,Christina Unger, "Computational Semantics with Functional Programming",Cambridge University Press, 2012.
3. Charles Dierbach,"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus",John Wiley & Sons,2013.
4. Kenneth C. Louden, "Programming Languages: Principles and Practice", Course Technology Inc.,2011.
5. Richard L. Halterman,"LEARNING TO PROGRAM WITH PYTHON", Southern Adventist University,2011
6. Dusty Phillips, "Python 3 Object-oriented Programming Second Edition", Packt Publishing, 2015.
7. Adrian Holovaty and Jacob Kaplan-Moss, "The Definitive Guide to Web Development Done Right",Apress Publishing, 2009.
8. Brian J.S. Chee and Curtis Franklin, "Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center", CRC Press, 2019.
9. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi , "Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, 2013.
10. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012

**Semester II**
**LAB–IV**
**MCSP 207: Cyber Security & Laws and Digital Image Processing and Control Systems**

**Course Objective:** student will be able to

1. study different types of Vulnerabilities of E-commerce services and learn encryption and decryption techniques.
2. Understand the basics of images, image transforamtions,Image Color Processing.
3. Understand system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
4. Study of controllers using classical PID methods, root locus methods, and frequency domain methods.

| **Credits=2** | **SEMESTER-II**<br>**PRACTICAL COURSE – IV: LAB - IV** | **No. of hours per unit/ credits (30)** |
|---|---|---|
| **GROUP A:** | **Cyber Security & Laws** | |
| | 1. Study of the features of firewall in providing network security and to set Firewall Security in windows.<br>2. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome) 7. Study of different types of vulnerabilities for hacking a websites / Web Applications.<br>3. Analysis the Security Vulnerabilities of E-commerce services.<br>4. Analysis the security vulnerabilities of E-Mail Application<br>5. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.<br>6. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations<br>7. Case Study on – Cyber Harassment.<br>8. Case Study on – Cyber Law<br>9. Case Study on – Patent Law | |
| **GROUP B:** | **Digital Image Processing** | |
| | 1. Image Basics:<br>1. W.A.P to read and Display an Image.<br>2. W.A.P to read an image & Display its Matrix information.<br>2. Image Arithmetic: -<br>1. W.A.P to perform image Addition.<br>2. W.A.P to perform image Subtraction.<br>3. W.A.P to perform image Multiplication.<br>4. W.A.P to perform image Division.<br>3. Image Transforms using Properties of 2D-DFT. :-<br>1. W.A.P to implement 2DFT Convolution Property.<br>2. W.A.P to implement 2DFT Rotational Property.<br>4. Image Enhancement in Spatial Domain:-<br>1. Enhancement Through Point Operation:-<br>2. Linear Gray Level Transformations:-<br>5.Image Enhancement in Frequency Domain:-<br>1. Low-Pass Filtering in Frequency Domain:- | |

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|---|---|---|
| | 2. High-Pass Filtering In Frequency Domain:-<br>6. Color Image Processing:-<br>1. W.A.P to Read an RGB Image and extract the three Colour Components Red, Green and Blue.<br>2. W.A.P to Read a colour image and separate the colour image into Red,Green and Blue Planes.<br>3. W.A.P to implement RGB to YCbCr Model Conversion.<br>4. W.A.P to implement RGB to HSV Model Conversion | |
| **GROUP C:** | **Control Systems** | |
| | A. Study of introduction to MATLAB.<br>B. Study of commands in MATLAB.<br>C. MATLAB base program along with the functions from the Control System Toolbox.<br>D.Design and analysis of first order control system(Simulink)<br>E. Design and analysis of second order control system(Simulink)<br>F. BODE PLOT USING MAT LAB G.NYQUIST PLOT USING MAT LAB<br>H.To obtain step response of the given system and evaluate the effect P,PD controllers<br>I. To obtain step response of the given system and evaluate the effect PI andPID controllers<br>J. Simulation of transfer function using Poles and Zeros | |

**Course Outcomes:** student should be able to

1. Understand to check security of Emails and E commerce Vulnerabilities.
2. learn case studies of Cyber Security.
3. Understand modeling of discrete systems in state space.
4. Evaluate programming strategies in the domain of control systems

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