# VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

## JNANASAGARA CAMPUS, BALLARI-583105

## Department of Studies in Computer Science

**Programme:** Master of Science (M.Sc.) in Computer Science

**Duration:** 2 Years (4 semesters)

**Programme Overview:**

Master of Science (M.Sc.) in Computer Science programme is designed to prepare students for a career in Industry, Government, Society and the Scientific community by introducing them to a wide range of new technologies in Computer Science disciplines. The programme aims to address research, solve real-world problems, participate in interdisciplinary research and its applications.

**Programme Educational Objectives (PEOs):**

After 3-4 years of completion of the programme the graduates will be able to:

1. Ability to apply the basic knowledge of database systems, computing, operating system, digital circuits, microcontroller, computer organization and architecture in the design of computer based systems.
2. Ability to specify, design and develop projects, application softwares and system softwares by using the knowledge of data structures, analysis and design of algorithm, programming languages, software engineering practices and open source tools.
3. Ability to debug, verify and validate the systems using various testing methods and tools.

**Program Outcomes:**

1. Computer knowledge: Apply the knowledge of mathematics, science and engineering fundamentals to the solution of complex problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using principles of mathematics, natural sciences.
3. Design/development of solutions: Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Modern tool usage: Create, select, and apply appropriate techniques, resources, and

modern IT tools to complex problems with an understanding of the limitations.

5. Environment and sustainability: Understand the impact of the professional solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

6. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

7. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

# VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
**Distribution of Courses/Papers in Postgraduate Programme as per Choice Based Credit System (CBCS) in**
## Computer Science
### M.Sc. I - SEMESTER

| Semester | Category | Subject code | Title of the Paper | Marks | | | Teaching hours/week | | | Credit | Duration of exams(Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IA | Sem. Exam | Total | L | T | P | | |
| FIRST | DSC1 | 21CSC1C1L | Data Structures and Algorithms | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC2 | 21CSC1C2L | JAVA Programming | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC3 | 21CSC1C3L | Computer Networks | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC4 | 21CSC1C4L | Discrete Mathematical Structures | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | SEC1 | 21CSC1S1TP | Web Technologies | 20 | 30 | 50 | - | 1 | 2 | 2 | 1 |
| | DSC1P1 | 21CSC1C1P | Data Structure and Algorithms Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC2P2 | 21CSC1C2P | JAVA Programming Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC3P3 | 21CSC1C3P | Computer Networks Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| **Total Marks for I Semester** | | | | | | 600 | | | | 24 | |

# M.Sc. II-SEMESTER

| Semester | Category | Subject code | Title of the Paper | Marks | | | Teaching hours/week | | | Credit | Duration of exams (Hrs) |
|----------|----------|--------------|-------------------|-------|-----------|-------|---|---|---|--------|-------------------------|
| | | | | IA | Sem. Exam | Total | L | T | P | | |
| SECOND | DSC5 | 21CSC2C5L | Database Management Systems | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC6 | 21CSC2C6L | Python Programming | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC7 | 21CSC2C7L | Software Engineering | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC8 | 21CSC2C8L | Operating System | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | SEC2 | 21CSC2S2TP | Advanced Web Programming | 20 | 30 | 50 | - | 1 | 2 | 2 | 2 |
| | DSC5P4 | 21CSC2C5P | Database Management Systems Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC6P5 | 21CSC2C6P | Python Programming Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC7P6 | 21CSC2C7P | Mini Project based on DBMS & Software Engineering | 20 | 30 | 50 | - | | 4 | 2 | 4 |
| **Total Marks for II Semester** | | | | | | **600** | | | | **24** | |

# M.Sc. III-SEMESTER

| Semester | Category | Subject code | Title of the Paper | Marks | | | Teaching hours/week | | | Credit | Duration of exams (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IA | Sem. Exam | Total | L | T | P | | |
| THIRD | DSC9 | 21CSC3C9L | Multimedia & Animation | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC10 | 21CSC3C10L | Data Analytics | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSE1 | 21CSC3E1AL | A. Data Mining | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | | 21CSC3E1BL | B. Network Security | | | | | | | | |
| | | 21CSC3E1CL | C. Artificial Intelligence | | | | | | | | |
| | DSE2 | 21CSC3E2AL | A. Digital image processing | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | | 21CSC3E2BL | B. Social networking and analysis | | | | | | | | |
| | | 21CSC3E2CL | C. Software Testing | | | | | | | | |
| | GEC1 | 21CSC3G1AL | A. Web Designing | 20 | 30 | 50 | 1 | 1 | - | 2 | 2 |
| | | 21CSC3G1BL | B. Computer Networks and Internet Technologies | | | | | | | | |
| | | 21CSC3G1CL | C. Introduction to CProgramming. | | | | | | | | |
| | SEC3 | 21CSC3S3LP | Research Methodology | 20 | 30 | 50 | 1 | - | 2 | 2 | 2 |
| | DSC9P7 | 21CSC3C9P | Multimedia & Animation Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC10P8 | 21CSC3C10P | Data Analytics Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| **Total Marks for III Semester** | | | | | | **600** | | | | **24** | |

## M.Sc. IV-SEMESTER

| Semester | Category | Subject code | Title of the Paper | Marks | | | Teaching hours/week | | | Credit | Duration of exams (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IA | Sem. Exam | Total | L | T | P | | |
| FOURTH | DSC11 | 21CSC4C11L | Internet of Things | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC12 | 21CSC4C12L | Machine Learning | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSE3 | 21CSC4E3AL | A. Business Intelligence | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | | 21CSC4E3BL | B. Information Security and Cryptography | | | | | | | | |
| | | 21CSC4E3CL | C. Mobile Computing | | | | | | | | |
| | DSE4 | 21CSC4E4AL | A. Pattern Recognition | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | | 21CSC4E4BL | B. Soft computing | | | | | | | | |
| | | 21CSC4E4CL | C. Digital Forensic and cyberLaws | | | | | | | | |
| | GEC2 | 21CSC4G2AL | A. Multimedia & Animation | 20 | 30 | 50 | 2 | - | - | 2 | 2 |
| | | 21CSC4G2BL | B. Artificial Intelligence | | | | | | | | |
| | | 21CSC4G2CL | C. R Programming. | | | | | | | | |
| | DSC12P9 | 21CSC4C12P | Machine Learning Lab | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | Project | 21CSC4C1R | Major Project | 30 | 70 | 100 | | - | 8 | 4 | 4 |
| **Total Marks for IV Semester** | | | | | | **600** | | | | **24** | |

**(I-IV semester)-Total Marks: 2400 and Total credits: 96**

# M.Sc. Computer Science First Semester

| Course: Data Structure and Algorithms | Course Code: 21CSC1C1L |
|---|---|
| Teaching Hours/Week (L-T-P): 4 - 0 - 0 | No. of Credits: 04 |
| Internal Assessment: 30 Marks | Semester End Examination: 70 Marks |

**Course Objectives:**

1. To impart the basic concepts of data structures and algorithms

2. To understand concepts about searching and sorting techniques

3. To understand basic concepts about stacks, queues, lists, trees and graphs

**UNIT I**                                                                                                          **08Hrs**

Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms- Average, best and worst case analysis).

Introduction To Data Structure: Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non Linear Data Structures

**UNIT II**                                                                                                          **12Hrs**

Linear Data Structure Array: Representation of arrays, Applications of arrays, sparse matrix and its representation., Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi, Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.

**UNIT III**                                                                                                          **12Hrs**

Nonlinear Data Structure : Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, Postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees- Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree ).

**UNIT IV**                                                                        **10Hrs**

SORTING and SEARCHING Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting On SeveralKeys, List and Table Sort,Linear Search, Binary Search.

**UNIT V**                                                                         **10Hrs**

Hashing And File Structures : Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Keyfile organization and access methods.

**Reference Books:**

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. SorensonPublisher-Tata McGraw Hill 2nd Edition 2017.

2. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International 2nd Edition2018.

3. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 2ndedition.

4. Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher-Thomson Learning2014 2nd edition.

**Course Outcomes (CO): After completion of this course student able to**

| CO | Statement |
|----|-----------|
| 1 | Implements basic data structures such as stacks, queues and trees. |
| 2 | Apply algorithms and data structures in various real-life software problems. |
| 3 | Develop skills in implementations and applications of data structures. |
| 4 | Discuss the computational efficiency of the principal algorithms for sorting, searching. |

| Course: Java Programming | Course Code: 21CSC1C2L |
|---|---|
| Teaching Hours/Week (L-T-P): 4 - 0 - 0 | No. of Credits: 04 |
| Internal Assessment: 30 Marks | Semester End Examination: 70 Marks |

**Course Objectives:**

1. To impart the basic concepts of Java

2. To understand concepts about classes, Objects and methods

3. To understand basic concepts about Polymorphism, Abstract classes and interfaces

**UNIT I**                                                                                    **10 Hrs**

Introduction to Java programming, The Java Virtual Machine, Variables and data types, Conditional andlooping constructs, Arrays.

**UNIT II**                                                                                   **10 Hrs**

Object-oriented programming with Java Classes and Objects, Fields and Methods, Constructors,Overloading methods, Garbage collection, Nested classes.

**UNIT III**                                                                                  **10 Hrs**

Inheritance, Overriding methods, Polymorphism, Making methods and classes final, Abstract classes andmethods, Interfaces.

**UNIT IV**                                                                                   **12 Hrs**

Exception handling with try-throw-catch-finally constructs, The Exception class Packages, Package access, Documentation comments. The Object class, Cloning objects, The JDK Linked List class, Strings, String conversions Working with types: Wrapper classes, Enumeration interface.

**UNIT V**                                                                                    **10 Hrs**

Applets, Configuring applets, Applet capabilities and restrictions, Basics of AWT and Swing, Layout Managers, Event Handling, The Action Listener interface, Panels, Classes for various controls, such as label, choice, list, , Checkbox, etc., Dialogs and frames, Using menus, Using the adapter  classes, Graphics.

**References**:

1. Herbet Schildt and Dale Skrien, Java Fundamentals - A comprehensive Introduction, 2017, McGrawHill Education.

2. P.J. Deitel and H.M. Deitel, Java for Programmers, 9th edition, Pearsoneducation

3. P.J. Deitel and H.M. Deitel, Java: How to Program, 2nd edition, PHI.

**Course Outcomes (CO): After completion of this course student able to**

| CO | Statement |
|----|-----------|
| 1 | Understand Java based software code of medium to high complexity |
| 2 | Identify classes, objects, members of a class and the relationships among them needed for a specificproblem. |
| 3 | Explain and write input – output programming in java and applications using Applets. |
| 4 | Apply the Java programming concepts and develop the applications with graphical user interface. |

| Course: Computer Networks | Course Code: 21CSC2C3L |
|---|---|
| Teaching Hours/Week (L-T-P): 4 - 0 - 0 | No. of Credits: 04 |
| Internal Assessment: 30 Marks | Semester End Examination: 70 Marks |

**Course Objectives:**

1. Build an understanding of the fundamental concepts of data communication and computer networking.

2. Understand how errors detected and corrected that occur in transmission

3. Know about routing mechanisms and different routing protocols

4. Understand transport layer functions

**UNIT-I**                                                                                          **12Hrs**

**Network Layer**: Network-Layer Services: Packetizing, Routing and Forwarding Other Services. Network-Layer Performance: Delay, Throughput, Packet loss. Congestion Control.IPV4

**Addresses:** Address Space, Classfull Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT). Forwarding of Ip Packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches.

**UNIT-II**                                                                                          **10 Hrs**

**Network Layer Protocols**: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security ofIPv4 Datagrams.

**Unicast Routing**: Introduction: General Idea, Least-Cost Routing. Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing.

**UNIT-III**                                                                                          **10Hrs**

**Unicast Routing Protocols**: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4).

**Multicast Routing**: Multicasting Basics: Multicast Addresses, Delivery at Data-Link Layer, Collecting Information about Groups, Multicast Forwarding, Two Approaches to Multicasting.

**UNIT IV**                                                                                           **10 Hrs**

**Intra domain Multicast Protocols**: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF), Protocol Independent Multicast (PIM).

**Next Generation IP**: IPv6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering. The IPv6 Protocol: Packet Format, Extension Header, Transition From IPv4TO IPv6: Strategies, Use of IP Addresses.

**UNIT V**                                                                                             **10 Hrs**

**Transport Layer Protocols**: Introduction: Services, Port Numbers. User Datagram Protocol: User Datagram, UDP Services, UDP Applications. Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control (except Sender and Receiver FSMs), TCP Congestion Control, TCP Timers.

**References:**

1. Behrouz A. Forouzan Data Communications and Networking, , McGrawHill, 5th Edition, 2017

2. James F Kurose and Keith W Ross Computer Networking, A Top-Down Approach, PearsonEducation, 6th Edition, 2017.

3. Larry L Peterson and Brusce S Davie, Computer Networks, ELSEVIER, 6th Edition, 2020.

4. Andrew S Tanenbaum, Computer Networks, Pearson Education, 5th Edition

**Course Outcomes (CO): After completion of this course student able to**

| CO | Statement |
|----|-----------|
| 1 | Apply the knowledge of Packet switching concepts in computer networking |
| 2 | Identify different categories of IP addresses and design subnets. |
| 3 | Analyze different Unicast and multicast routing mechanisms. |
| 4 | Analyze the transport-layer concepts and services -unreliable vs. reliable data transfer |

| Course: Discrete Mathematical Structures | Course Code: 21CSC1C4L |
|---|---|
| Teaching Hours/Week (L-T-P): 4 - 0 - 0 | No. of Credits: 04 |
| Internal Assessment: 30 Marks | Semester End Examination: 70 Marks |

**Course Objectives:**

1. Understand sets, propositions and conditional.
2. Apply Principles of Mathematical induction.
3. Solve Different Graph Problems.

**UNIT I**                     **10 Hrs**

Sets and Logic: Sets, propositions, conditional propositions and logical equivalence, arguments and rulesof inference, quantifiers, nested quantifiers.

**UNIT II**                     **12 Hrs**

Proofs: Principles of Mathematical induction, Functions, Relations: relations, operations on relations, Properties of relations, equivalence relations, matrices of relations, Partially ordered sets, lattices, finite Boolean algebra, functions on Boolean algebra.

**UNIT III**                     **10 Hrs**

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs

**UNIT IV**                     **10 Hrs**

Trees: Terminology and characterizations of trees, spanning trees, minimal spanning trees, shortest-path algorithm, binary trees, tree traversals, decision trees, isomorphism of trees.

**UNIT V**                     **10 Hrs**

Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

**References:**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 8th edition, 2021 Tata McGraw Hill.

2. Deo N., Graph theory with application to Engineering and Computer Science, Prentice Hall of India.

3. Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson Education, 6th edition, 2015.

**Reference Books:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical structures with applications to ComputerScience, Tata McGraw Hill, 1st edition, 2017.

**Course Outcomes (CO): After completion of this course student able to**

| CO | Statement |
|----|-----------|
| 1 | Understand sets, relations, functions and discrete structures. |
| 2 | Apply propositional logic and first order logic to solve problems. |
| 3 | Understand discrete mathematical structures. |
| 4 | Formulate and solve graph problems. |

| Course: Web Technologies | Course Code: 21CSC1S1TP |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 1 - 2 | No. of Credits: 02 |
| Internal Assessment: 20 Marks | Semester End Examination: 30 Marks |

**Course Objectives:**

1. Understand the concepts of web design.

2. Understand the concepts of list and tables.

3. Using HTML, CSS in developing the website applications.

**UNIT I**                                                              **09 Hrs**

**Introduction to WWW**: Protocols and programs, secure connections, application and development tools, the web browser, What is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation.
**Introduction to HTML**: The development process, Html tags and simple HTML forms, web site structure

**UNIT II**                                                              **09 Hrs**

**Introduction to XHTML**: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser.
**Style sheets** : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, list, tables, borders and boxes, margins, padding lists, positioning using CSS, CSS2

**UNIT III**                                                            **08 Hrs**

**Javascript**: Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition

**Reference Books:**

1. Web Technologies, Black Book, Dreamtech Press, 2018.

2. Steven Holzner, "HTML Black Book", Dremtech press, 2000.

3. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson, 4th edition, 2012.

**Course Outcomes (CO): After completion of this course student able to**

| CO | Statement |
|----|-----------|
| 1 | Understand the concepts of WWW protocols. |
| 2 | Analyze a web page and identify its elements and attributes. |
| 3 | Apply the knowledge of HTML, CSS in developing the website applications. |
| 4 | Build dynamic web pages using JavaScript (Client side programming). |

| Course: Web Technologies Lab | Course Code: 21CSC1S1T |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 1 - 2 | No. of Credits: 02 |
| Internal Assessment: 20 Marks | Semester End Examination: 30 Marks |

**Course Objectives**:
1. Students will be able to Make own Web page and how to host own web site on internet.
2. Students will also learn about the protocols involved in internet technology.

**Practical List**
1. Create an XHTML page that provides information about your department. Your XHTML page must use the following tags: a) Text Formatting tags b) Horizontal rule c) Meta element d) Links e) Images f) Tables (Use of additional tags encouraged).

2. Develop and demonstrate the usage of inline, external and internal style sheet using CSS. Use XHTML page that contains at least three paragraphs of text, listed elements and a table with four rows and four columns.

3. Develop, test and validate an XHTML document that has checkboxes for apple (50 rupees each), orange (40 rupees each), and banana (5 rupees each) along with submit button. Each check boxes should have its own onclick event handler. These handlers must add the cost of their fruit to a total cost. An event handler for the submit button must produce an alert window with the message 'your total cost is Rs. xxx', where xxx is the total cost of the choosen fruit, including 5 percent sales tax. This handler must return 'false' (to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes.

4. a) Develop and demonstrate, a HTML document that collects the USN (the valid format is : A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by three upper-case characters followed by two digits; (no embedded spaces are allowed) from the user. Use JavaScript that validate the content of the document. Suitable messages should be display in the alert if errors are detected in the input data. Use CSS and event handlers to make your document appealing. b) Modify the above program to get the current semester also(restricted to be a number from 1 to 6).

5. Develop and demonstrate a HTML file which includes JavaScript that uses functions for the following problems: a. Parameter: A string Output: The position in the string of the left-most vowel. b. Parameter: A number Output: The number with its digits in the reverse order.

6. Develop and demonstrate a HTML5 page which contains a) Dynamic Progressive bar. 02.03.2021 updated 56/ 104 b) Display Video file using HTML5 video tag.

7. Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to the bottom.

8. Develop a simple calculator to perform arithmetic (addition, subtraction, multiplication and division) operations on given two numbers. Use an HTML tag that allows the user to input two numbers and to display the result of arithmetic operation. Write suitable HTML and JavaScript and CSS to your simple calculator.

9. Develop and demonstrate a JavaScript to display a Scrolling Text in Text Box.

| Course: Data Structure Lab | Course Code: 21CSC1C1P |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 0 - 4 | No. of Credits: 02 |
| Internal Assessment: 20 Marks | Semester End Examination: 30 Marks |

**Course Objectives**: At the end of this lab session,

   **1.** The student will be able to design and analyze the time and space efficiency of the data structure ·

   **2**. Be capable to identity the appropriate data structure for given problem ·

   **3**. Have practical knowledge on the applications of data structures

**Practical List:**

1. Program to find factorial of a given number using recursion function.
2. Design, develop and implement a menu driver program in c for the following array operations.
   a) creating array of N integers elements, b) display of array element with suitable

      headings, c) inserting an element at a given valid position, d) deleting a element at a given valid position, e) exit
3. Program to demonstrate use of sequential search.
4. Program to demonstrate use of binary search.
5. Program to search for a student information using rollno as a key.
6. Program to implement singly linked list perform Search, Insert and Delete operation using dynamic memory allocation.
7. Program to implement doubly linked list perform Search, Insert and Delete operation using dynamic memory allocation.
8. Program to implement stack using array implementation.
9. Program to implement stack using linked list, using dynamic memory allocation.
10. Reverse a string using dynamic memory allocation.
11. Program to convert infix to postfix expression using stack, using dynamic memory allocation.
12. Program to evaluation of postfix expression using stack dynamic memory allocation.
13. Program to implement queue to perform enqueue and dequeue operations using dynamic memory allocation.
14. Program to implement queue to perform enqueue and dequeue expression using array operation.
15. Program to implement Double Ended Queue.
16. Program to implement priority queue.
17. Program to implement Tower of Hanoi using recursion.
18. Program to implement Fibonacci series using recursion.
19. Program to implement binary tree traversal.
20. Program to implement Hash Table with open addressing.

| Course: Java Programming Lab | Course Code: 21CSC1C2P |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 0 - 4 | No. of Credits: 02 |
| Internal Assessment: 20 Marks | Semester End Examination: 30 Marks |

**Course Objectives**:
1. To impart hands on experience with java programming
2. To write programs for solving real world problems using java
3. To write multithreaded programs
4. To write programs on applets and servlets.

**Practical List:**
1. **Classes and Objects:**
   a. Write a program in java with class Rectangle with the data fields width, length, area and color. The length, width, area are of double type and color is string type. The methods are set_length(), set_width(), set_color and find_area(). Create two objects of Rectangle and compare their area and color. If area and color both are same for the objects then display "Matching rectangles" otherwise display "Non matching rectangles".
   b. Write a java program to overload constructor and method.

2. **Inheritance and Polymorphism:**
   a. Write a program in java to create player class. Inherit the classes Cricket_player, Football_Player and Hockey_player from Player class.
   b. Consider the trunk calls of a telephone exchange. A trunk call can be ordinary, urgent or lightning. The charges depend on the duration and type of the call. Write a program using the concept of polymorphism to calculate the charges.

3. **String Operations:**
   a. Write a Java program to perform String operations.
   b. Write a Java program to check whether the given string is Anagram or not.

4. **Package and Interface:**
   a. Write a program to make a package Balance in which has account class with display_balance method in it. Import balance package in another program to access Display_balance method of account class.
   b. Create the dynamic stack by implementing the interfaces that defines Push() and Pop() methods.

5. **Exception Handling:**
   a. On a single track two vehicles are running. As vehicles are going on same direction there is no problem. If the vehicles are running in different direction there is a chance of collision. To avoid collision write a java program using Exception handling.

6. **Multithreading**:
   a. Write a program in java to create five java threads with different priorities. Send two threads of higher priority to sleep state. Check the aliveness of the threads and mark which thread is long lasting.
   b. Write a Multi_threaded java program to implement producer-consumer problem.

7. **Applets and Event handling**:
   a. Write a Java Program to create an applet to handle all mouse events.
   b. Design an applet which uses Card Layout with 3 Buttons. When the user clicks on any button, the background color must be change.

8. **Servlets**:
   a. Write a Servlet program to accept username, address and display them in a web page by passing parameters.
   b. Write a Program to request server information viz Request Method, URL, Protocol and remote address.

| Course: Computer Networking Lab | Course Code: 21CSC1C3P |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 0 - 4 | No. of Credits: 02 |
| Internal Assessment: 20 Marks | Semester End Examination: 30 Marks |

**Course Objectives:**

1. To get practical knowledge of working principles of various communication protocols
2. Analyze structure and formats of TCP/IP layer protocols using network tools

**Practical List:**

## PART A

1. Write a networking program in Java to implement a TCP server that provides services for a TCP Client.

2. Write a networking program to implement socket programming using User datagram Protocol in Java.

3. Implement an FTP server using socket programming..

4. Implement a chat server using socket programming.

5. Implement an ECHO server using socket programming..

6. Implement Address Resolution Protocol using socket programming..

7. Implement Ping server and Ping client using socket programming.

8. Implement Remote Command Execution using network programming.

9. Implement a program to retrieve the data for the specified URL.

10. Write a Java program to check whether the given DNS is found in the internet or not.

11. Write a network program using HTTP to print the document for the given URL.

    **PART B (Using NS2)**

1. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.

2. Simulate the different types of Internet traffic such as FTP and TELNET over a network and analyze the throughput.

3. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare the throughput.

4. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and determine the collision across different nodes.