Bharatiya Vidya Bhavan

# BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE
(Reaccredited with 'A' Grade by NAAC)
Autonomous College – Affiliated to Osmania University
Sainikpuri, Secunderabad-500094

# 12th BOS Meeting for M.Sc. (CS) Course (2024-2026)

## 22-03-2024

## 11:00 AM

# Department of Computer Science

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BOS in Computer Science
Bhavan's Vivekananda College
Sainikpuri

Bharatiya Vidya Bhavan

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**OF SCIENCE, HUMANITIES AND COMMERCE**
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**Autonomous College - Affiliated to Osmania University**
**Scheme of Instruction and Examination [CBCS Syllabus]**
Department of Computer Science

## M.Sc. [Computer Science] SEMESTER-I
effective for 2024-2026

| Paper | Code | Paper Title | PPW | | Max Marks | | Max Marks | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | TH | PR | TH | TH-CIA | PR | PR-CIA | |
| I | CS101 | Advanced Java Programming | 4 | | 70 | 30 | | | 4 |
| II | CS102 | Operating Systems | 4 | | 70 | 30 | | | 4 |
| III | CS103 | Software Engineering | 4 | | 70 | 30 | | | 4 |
| IV | CS104 | Discrete Mathematics | 4 | | 70 | 30 | | | 4 |
| V | CS101P | Advanced Java Lab | | 4 | | | 50 | | 2 |
| VI | CS102P | Operating Systems Lab | | 4 | | | 50 | | 2 |
| | | Total | 16 | 8 | 280 | 120 | 100 | | 20 |

## M.Sc. [Computer Science] SEMESTER-II

| Paper | Code | Paper Title | PPW | | Max Marks | | Max Marks | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | TH | PR | TH | TH-CIA | PR | PR-CIA | |
| I | CS201 | Programming in Python | 4 | | 70 | 30 | | | 4 |
| II | CS202 | Computer Networks | 4 | | 70 | 30 | | | 4 |
| III | CS203 | Design and Analysis of Algorithms | 4 | | 70 | 30 | | | 4 |
| IV | CS204 | Automata Theory | 4 | | 70 | 30 | | | 4 |
| V | CS201P | Python Lab | | 4 | | | 50 | | 2 |
| VI | CS202P | Computer Networks Lab | | 4 | | | 50 | | 2 |
| | | Total | 16 | 8 | 280 | 120 | 100 | | 20 |

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Prof. N. KISHAN
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**Department of Computer Science**

**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: ADVANCED JAVA PROGRAMMING**

**PAPER CODE: CS101** **PPW: 4**
**YEAR/SEMESTER: I/I** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** To enable students with the concepts of programming to develop Client/Server based applications.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To inculcate knowledge on AWT and Swing API.
**COb2:** To demonstrate the concepts of Java Servlets and Java Server Pages.
**COb3:** To inculcate knowledge on JDBC and Hibernate
**COb4:** To illustrate the concepts of JNDI, Java Beans and JSF.

**UNIT-I** **15Hrs.**

**AWT:** Introduction, AWT Class Hierarchy, Creating Container, Adding Components, Layout, Using Panel, TextField, TextArea, List, Checkbox, Check Box Group, Choice, Event Handling, Dialog Boxes, Scroll Bar, Menu.
**Swing**: Containment Hierarchy, Adding Components, JTextField, JPasswordField, JTable, JComboBox, JProgressBar, JList, JTree, JColorChooser, Dialogs.
**(Ch: 9)**

**UNIT-II** **15Hrs.**

**Servlet:** Server-Side Java, Servlet Alternatives, Servlet Strengths, Servlet Architecture, Servlet Life Cycle, GenericServlet, HttpServlet, Servlet Example, Passing Parameters to Servlets, Retrieving Parameters, Cookies, Filters.
**Java Server Pages (JSP):** Introduction, JSP Engines, How JSP Works, JSP and Servlet, Anatomy of a JSP Page, JSP Syntax, JSP Components, Beans, Session Tracking, Users Passing Control and Data between Pages, Sharing Session and Application Data.
**(Ch: 20, 21)**

**UNIT-III** **15Hrs.**

**Java Database Connectivity (JDBC):** Introduction, JDBC Drivers, JDBC Architecture, JDBC Classes and Interfaces, Loading a Driver, Making a Connection, Execute SQL Statement, SQL Statements, Retrieving Result, Getting Database Information, Scrollable and Updatable ResultSet, ResultSet Metadata.

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**Hibernate:** Introduction, Architecture, Writing POJO Class, Creating a Table, Writing a Hibernate Application, Compiling and Running Application, Book Application Using Annotation, Object Life Cycle, HQL, Using Native SQL Query, Named Queries, Generating DDL, Generator Class.
**(Ch:22, 23)**

**UNIT-IV** **15Hrs.**

**Java Naming and Directory Interface (JNDI):** Naming Concepts, Directory Concepts, Java Naming and Directory Interface, Specifying JNDI Properties, Name Servers, Naming Operations, Working with Directory.
**Overview of J2EE:** Introduction to JavaBeans, Advantages of JavaBeans, Properties of Java Beans with examples, Java Beans API, Introduction to spring and sprint boot.
**Java Server Faces (JSF):** Introduction, Simple Application, Request Processing Life-Cycle, Tracing Phases, Managed Bean, Basic JSF Tags, Expression Language, Event Handling with Example, Page Navigation.
**(Ch: 24, 26, 28)**

**Prescribed Book:**
Uttam K.Roy, Advanced Java programming, Oxford University Press, 2015.

**Reference Books:**
1. Herbertt Schildt, Java Complete Reference
2. Sharanam Shah,Vaishali Shah, JavaEE 7 for Beginners
3. Cay S. Horstmann, Gray Coronell, Core Java Vol.II–Advanced Features, 7th Edition, Prentice Hall, 2004.

**COURSE OUTCOMES:**
At the end of the course students will be able to:

**CS101 CO1:** Develop window-based applications using AWT and Swing.
**CS101 CO2:** Develop programs using Java Servlets and Java Server Pages
**CS101 CO3:** Develop programs using JDBC and Hibernate.
**CS101 CO4:** Develop programs using JNDI, Java Beans and JSF.

**Employability aspect: It is employable course into software development.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: OPERATING SYSTEMS**

**PAPER CODE: CS102** **PPW: 4**
**YEAR/SEMESTER: I/I** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** To enable students with the concepts of Operating Systems and their features comparing with other operating system features.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To inculcate the knowledge of OS structure, System structure and Process management.
**COb2:** To demonstrate Threads, Process Synchronization and different CPU scheduling algorithms.
**COb3:** To inculcate the knowledge on Deadlocks, Memory management and Virtual memory.
**COb4:** To illustrate the Mass-Storage Structure and file systems.

**UNIT–I** **15Hrs.**

**Introduction:** Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection Security, Kernel Data Structures, Computing Environments, Open-Source Operating Systems.

**Operating-System Structures**: Operating-System Services, User Interface for Operating System (CLI and GUI), System Calls, Types of System Calls (fork, exec, wait, kill, exit).

**Process Management:** Process Concept, Process Scheduling, Operations on Processes (Process creation-fork system call, process termination), Inter Process Communication, Types of IPC (Shared memory, message passing, signals, socket, pipes) Zombie and orphan processes.

**(Book1: Ch: 1.3 – 1.11, 2.1 – 2.3, 3.1-3.8)**

**UNIT–II** **15Hrs.**

**Threads:** Overview, Multithreading Models, Threading Issues.

**Process Synchronization:** Concept, Critical-Section Problem, Peterson's Solution, Synchronization, Classic Problems of Synchronization, Semaphores, Monitors.

**CPU Scheduling:** Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.

**(Book1: Ch: 4.1,4.3, 4.6, 6.1, 6.2, 6.3, 6.4, 6.6,6.7, 7.1,5.1 – 5.4, 5.6, 5.8)**

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**UNIT–III** **15Hrs.**

**Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

**Memory Management:** Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

**Virtual Memory:** Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

**(Book1: Ch: 8.1, 8.3, 8.4 – 8.8, 9.1- 9.5, 10.1,10.2,10.4,10.5, 10.6), (Book2: Ch: 8.4)**

**UNIT–IV** **15Hrs.**

**Mass-Storage Structure:** Overview, Disk Structure, Disk Scheduling(HDD Scheduling), Disk Management(storage device management), Swap-Space Management, RAID Structure.

**File Systems:** File Concept, Access Methods, Directory and Disk Structure, File -System Mounting, Protection. File-System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Recovery, Network File System (NFS).

**(Book1: Ch:11.1, 11.2, 11.5, 11.6, 11.8, 13.1, 13.2,13.3,13.4,14.1,14.3,14.4,14.5,14.7,15.1,15.8)**

**Prescribed Books:**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts. (10e)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts. (9e).

**Reference Books:**

1. Thomas W. Doeppner, *Operating systems in depth*
2. Andrew S. Tanenbaum, *Modern Operating Systems*
3. William Stallings, *Operating Systems–Internals and Design Principles*
4. Dhananjay M. Dhandhere, *Operating Systems-A Concept Based Approach*
5. Modern Operating Systems -By Andrew S. Tanenbaum (PHI)

**COURSE OUTCOMES:**

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

**CS102 CO1:** Understand the OS structure ,System structure and Process management.
**CS102 CO2:** Acquire knowledge on Threads, Process Synchronization and different CPU scheduling algorithms.
**CS102 CO3:** Comprehend the Deadlocks, Memory management and Virtual memory.
**CS102 CO4:** Analyze different Mass-Storage Structure and file systems.

**Employability aspect: Foundational knowledge necessary for a wide range of roles in software development, system administration, and IT management.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-2025)**

**COURSE NAME: SOFTWARE ENGINEERING**

**PAPER CODE: CS103** | **PPW: 4**
**YEAR/SEMESTER: I/I** | **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** To impart knowledge of software concepts, importance of software development within time and budget.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To enable students, learn the basics of software, its process and types of process Models.
**COb2:** To enable students, learn about Requirements Engineering, design concepts and Architectural styles of Software Engineering.
**COb3:** To enable students, learn about Software Quality and software testing strategies.
**COb4:** To enable students, learn about Software Configuration Management process, software Risks and reverse engineering.

**UNIT – I** **15 Hrs**

**Software Engineering:** The Nature of Software, Changing Nature of Software, Defining the Discipline, Software Process, Software Engineering Practice.

**The Software Process**: A Generic Process Model, Defining a Framework Activity, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, Unified Process, Personal and Team Process Models. Defining Agility, Agile Process, Extreme Programming, Psychology of Software Engineering, Software Team Structures, Software Engineering Using the Cloud, Global Teams. **(Ch: 1, 2, 3, 4, 5, 6)**

**UNIT –II** **15 Hrs**

**Requirements:** Core Principles of Modeling, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Requirements Analysis, UML Models That Supplement the Use Case, Identifying Analysis Classes, Specifying Attributes, Defining Operations, Class-Responsibility- Collaborator Modeling, Associations and Dependencies, Analysis Packages. **(Ch: 8, 9, 10)**

**Design Concepts:** Design within the Context of SE, Design Process, Design Concepts, Design Model, Software Architecture, Architectural Styles, Architectural Considerations, Architectural Design, Component, Designing Class-Based Components, Conducting Component-Level Design, Component- Based Development, User Interface Design Rules. **(Ch: 12, 13, 14, 15)**

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**UNIT – III** **15 Hrs**

**Quality Management:** Quality, Software Quality, Software Quality Dilemma, Achieving Software Quality, Defect Amplification and Removal, Reviews, Informal Reviews, Formal Technical Reviews, Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics, Software Reliability, A Strategic Approach to Software Testing, Test Validation Testing, System Testing, Debugging, Software Testing Fundamentals, White- Box Testing, Black-Box Testing, Path Testing, Control Structure Testing, Object-Oriented Testing Strategies & Methods, Security Engineering Analysis, Security Assurance, Security Risk Analysis.

**(Ch: 19, 20, 21, 22, 23, 24, 26, 27)**

**UNIT – IV** **15 Hrs**

**Software Configuration Management, SCM Process**, Product Metrics for Requirements Model, Design Model, Source Code, Testing and Maintenance.

**Managing Software Projects:** The Project Management Spectrum, W5HH Principle, Metrics in the Process and Project Domains, Software Measurement, Metrics for Software Quality, Integrating Metrics within the Software Process, Software Project Estimation, Decomposition Techniques.

**Project Scheduling** – basics, scheduling, Software Risks, Risk Mitigation, Monitoring, and Management, Software Maintenance, Software Reengineering, Reverse Engineering, Forward Engineering

**(Ch: 29, 30, 31, 32, 33, 34, 35, 36)**

**Prescribed Book:**

*Roger S Pressman, B R Maxim, Software Engineering – A Practitioner's Approach (8th edition)*

**Reference Books:**

1. Ian Sommerville, Software Engineering
2. Hans Van Vliet, Software Engineering
3. D. Bell, Software Engineering for Students
4. K.K. Aggarwal, Y. Singh, Software Engineering
5. R. Mall, Fundamentals of Software Engineering
6. Pankaj Jalote, An Integrated Approach to Software Engineering

**COURSE OUTCOMES:**

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

**CS103 CO1:** Understand the basics of software, its process and types of process models
**CS103 CO2:** Interpret about Requirements Engineering, design concepts and Architectural styles of Software Engineering.
**CS103 CO3:** Analyze about Software Quality and software testing strategies.
**CS103 CO4:** Explain about Software Configuration Management process, software risks and reverse engineering

**Employability aspect: Software engineer, System analytics.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: DISCRETE MATHEMATICS**

**PAPER CODE: CS104** **PPW: 4**
**YEAR/SEMESTER: I/I** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** Students will acquire a solid understanding of discrete mathematics, including logic, Boolean algebra, basic structures, recursion, counting principles, and graph theory.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1**: To familiarize the students with concepts of propositions, logic, truth tables and Boolean Algebra.
**COb2**: To familiarize the students with basic structures and recursion.
**COb3**: To familiarize the students with basic principles of counting.
**COb4:** To familiarize the students with graph theory.

**Unit – I** **15Hrs.**

**Mathematical Logic:** propositional logic, propositional equivalences, predicates & quantifiers, rule of inference, direct proofs, proof by contraposition, proof by contradiction.
**Boolean Algebra**: Boolean functions and its representation, logic gates, minimizations of circuits by using Boolean identities and K-map. **[Ch : 1.1,1.2,1.3,1.5,1.6,10.1 to 10.4]**

**Unit – II** **15Hrs.**

**Basic Structures:** Sets representations, set operations, functions, sequences and summations. Division algorithm, modular arithmetic, solving congruences, applications of congruences.
**Recursion:** Proofs by mathematical induction, recursive definitions, structural induction, generalized induction, recursive algorithms. **[Ch : 2.1 –2.3, 3.4, 3.5, 3.6, 4.1,4.3]**

**Unit – III** **15Hrs.**

**Counting:** Basic counting principle, inclusion-exclusion for two-sets, pigeonhole principle, permutations and combinations, Binomial coefficient and identities, generalized permutations and combinations.
**Recurrence Relations:** introduction, solving linear recurrence relations, generating functions, principle of inclusion-exclusion, applications of inclusion-exclusion.
**Relations:** relations and their properties, representing relations, closures of relations, equivalence relations, partial orderings. **[Ch : 5.1 to 5.5, 6.1, 6.2, 6.4,6.5,7.1, 7.3, 7.4,7.5,7.6]**

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**Unit – IV** **15Hrs.**

**Graphs:** Graphs definitions, graph terminology, types of graphs, representing graphs, graph isomorphism, connectivity of graphs, Euler and Hamilton paths and circuits, Dijkstra's algorithm to find shortest path, planar graphs–Euler's formula and its applications, graph coloring and its applications.

**Trees:** Trees definitions–properties of trees, applications of trees –BST, Haffman Coding, tree traversals: pre-order, in-order, post-order, prefix, infix, postfix notations, spanning tress–DFS, BFS, Prim's, Kruskal's algorithms. **[Ch: 8.1 to 8.8,9.1 to 9.5]**

**Prescribed Book:**

Kenneth H. Rosen, Discrete Mathematics and its Applications (7th edition)

**Reference Books:**


1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics
2. Stein, Drysdale, Bogart, Discrete Mathematics for Computer Scientists
3. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science
4. Joe L. Mott, Abraham Kandel, Theoder P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians


**COURSE OUTCOMES:**

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

**CS104 CO1**: Acquire knowledge the concepts of logics and laws of Boolean Algebra.
**CS104 CO2**: Get Acquainted with sets, division algorithm, mathematical induction.
**CS104 CO3**: Analyze the differences between permutations and combinations. They will be able to solve recurrence relations.
**CS104 CO4**:Analyze the graph theory which is of great use in computers.

**Employability aspect: Data analytics or logic developer.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-2025)**

**COURSE NAME: ADVANCED JAVA LAB**

**PAPER CODE: CS101P** | **PPW: 4**
**YEAR/SEMESTER: I/I** | **NO. OF CREDITS: 2**

**COURSE OBJECTIVE:** Enable students to acquire knowledge and develop Client/Server based applications.

**COb1:** To demonstrate the concepts of AWT, Swing API, Java Servlets and Java Server Pages.

**COb2:** To impart knowledge on JDBC, Hibernate and JSF.

**Week-1:**
1. Create GUI to present a set of choices for a user to select stationary products and display the price of Product after selection from the list.

**Week-2:**
2. Create GUI to demonstrate typical Editable Table which describing Employee for a software company.
3. Create GUI to demonstrate swing components using student registration form.

**Week-3:**
4. Create a Remote Object for simple arithmetic operators. Use AWT/SWING to create user interface.

**Week-4:**
5. Write a program to demonstrate InetAddress.
6. Write a program to demonstrate Sockets.
7. Write a program to demonstrate URLConnection.

**Week-5:**
8. Develop Servlet Question-Answer Application using HttpServlet Request and HttpServlet Response interfaces.

**Week-6:**
9. Develop Servlet application to accept HTNO of a student from client and display the memorandum of marks from the server

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**Week-7:**

10. JSP Programs
    a. Create a JSP page that prints temperature conversion (from Celsius to Fahrenheit)chart
    b. Create a JSP page to print current date and time
    c. Create a JSP page to print number of times page is referred after the page is loaded.

**Week-8:**

11. Write a simple JSP application to demonstrate the use of implicit object (at least5).

**Week-9:**

12. Develop a Hibernate application to Store Feedback of Website Visitors in MySQL Database.

**Week-10:**

13. Develop a JSP Application to accept Registration Details from the user and store database table.

**Week-11:**

14. Develop a JSP Application to Authenticate User Login as per the Registration Details. If Login Success then forward User to Index Page otherwise show Login failure Message.

**Week-12:**

15. Develop a web Application to add items in the inventory using JSF.

**Week-13:**

16. Write EJB applications using stateless session beans and state-full session beans.

**Week-14:**

17. Develop a Room Reservation System Application using Entity Beans.
18. Create Three-tire application using Servlets, JSP, EJB.

**COURSE OUTCOMES:**

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

**CS101P CO1:** Develop applications using AWT, Swing, Java Servlets and Java Server Pages.

**CS101P CO2:** Implement programs using JDBC, Hibernate and JSF.

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: OPERATING SYSTEMS LAB**

**PAPER CODE: CS102P** **PPW: 4**
**YEAR/SEMESTER: I/I** **NO. OF CREDITS: 2**

**COURSE OBJECTIVE:** To understand the Shell script programming, Process Management, Memory Management, File System Implementation and Network Operating System.

**COb1:** To write programs in Linux environment using system calls.

**COb2:** To implement the scheduling algorithms, page replacement algorithms, file allocation methods and network operating system.

**Week-1:**
1. Write shell programs using 'case', 'then' and 'if' & 'else' statements.

**Week-2:**
2. Write shell programs using while, do-while and for loop statements.

**Week -3:**
3. Write a program to create a child process using fork(), exec() system calls and use other system calls.

**Week-4:**
4. Write a program to convert upper case to lower case letters of a given ASCII file.
5. Write a program to program to search the given pattern in a file.

**Week-5:**
6. Write a program to implementation of Signals in UNIX.

**Week-6:**
7. Write a program to simulate UNIX commands like ls, grep, cp.
8. Write a program to demonstrate FCFS and SJF process schedules on the given data.

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**Week-7:**

9. Write a program to demonstrate CPU Priority and Round Robin Scheduling on the given burst time and arrival times.
10. Write a program to simulate Inter Process Communication using pipes.

**Week- 8:**

11. Write a program to implementing Producer and Consumer problem using Semaphores.

**Week-9:**

12. Write a program to simulate Bankers Algorithm for Dead Lock Avoidance

**Week-10:**

13. Write a program to simulate Bankers Algorithm Dead Lock Prevention.

**Week-11:**

14. Write a program to simulate Paging Techniques of memory management.

**Week-12:**

15. Write a program to simulate FIFO, LRU, LFU Page replacement algorithms.

**Week-13:**

16. Write a program to simulate Sequential, Indexed, and Linked file allocation strategies.
17. Creating and managing the user accounts in Network operating system.

**Week-14:**

18. Creating and managing shared folders in Network operating system.
19. Develop a simple "Hello World" app using both iOS and Android SDKs.

**COURSE OUTCOMES**:

At the end of the course students are able to:

**CS102P CO1**: Ability to develop application programs using system calls in Unix.

**CS102P CO2**: Ability to simulate and implement operating system concepts such as scheduling, file management, memory management and network operating system.

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: PROGRAMMING IN PYTHON**

**PAPER CODE: CS201** **PPW: 4**
**YEAR/SEMESTER: I/II** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** To enable students with the concepts of programming to develop python scripts.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To explain conditional and looping statements.
**COb2:** To demonstrate the concepts of functions, modules, files and exceptions.
**COb3:** To describe the functionalities of lists, tuples, strings, dictionaries and sets.
**COb4:** To illustrate object-oriented concepts and GUI controls.

**Unit – I** **15 Hrs.**

**Introduction to Python Programming:** How a Program Works, Using Python, Why Python, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations (Operators, Type conversions, Expressions), More about Data Output, Indentation.
**Decision Structures and Boolean Logic:** if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.
**Repetition Structures:** Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.
**(Book1: Ch: 1, 2, 3, 4)**

**Unit – II** **15 Hrs.**

**Functions:** Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value -Returning Functions-Generating Random Numbers, Writing Our Own Value-Returning Functions.
**Modules-**Importing module, creating and exploring modules: math module, NumPy module -Working with Arrays using NumPy, Slicing and Indexing in numpyArrays, Matrices in NumPy, random module, Storing Functions in Modules.
**File and Exceptions:** Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.
**(Book1: Ch: 5, 6, Book2: Ch: 7)**

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**Unit – III** **15 Hrs.**

**Lists and Tuples:** Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

**Strings:** Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

**Dictionaries and Sets:** Dictionaries, Sets, Serializing Objects.

**(Book1: Ch: 7, 8, 9)**

**Unit – IV** **15 Hrs.**

**OOPs Concept:** Introduction to OOP, Classes and objects, Inheritance, Method overloading and Method overriding, Abstract method and Abstract class, Interfaces in python, Abstract class vs Interfaces, constructor, instance methods, class methods, static methods.

**GUI Programming:** Graphical User Interfaces, Using the tkinter Module, display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

**(Book2: Ch: 12, 13, 14, 15, Book1: Ch: 13)**

**Prescribed Books:**

1. Tony Gaddis, Starting Out With Python, 4th Edition, Pearson Education, 2019.
2. Dr. R Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech Press, 2020.

**Reference Books:**


1. Kenneth A. Lambert, Fundamentals of Python, Cengage Publications, 2022.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox Publication, 2010.
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3, Sharoff / O'Reilly Publications, 2018.
4. Charles Dierach, Introduction to Computer Science using Python, Wiley Publication, 2015.
5. Clinton W. Brownley, Foundations for Analytics with Python, Sharoff /O'Reilly Publications, 2016.


**COURSE OUTCOMES:**

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

**CS201 CO1:** Develop programs using conditional and looping statements.
**CS201 CO2:** Develop programs using functions, modules, files and exceptions.
**CS201 CO3:** Develop programs using lists, tuples, strings, dictionaries and sets.
**CS201 CO4:** Develop programs using object-oriented concepts and using GUI controls.

**Employability aspect: Data Analyst/Software Developer.**

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**Department of Computer Science**

**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: COMPUTER NETWORKS**

**PAPER CODE: CS202** **PPW: 4**
**YEAR/SEMESTER: I/II** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** This course provides the overview of networking. It deals with the seven layers of OSI/ISO Model in detail and gives an idea to a student as how the Message reaches to the recipient handset device from the handset device.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To illustrate some basic concepts of networks in hardware and software terminologies and describe some of the functionalities of Physical Layer.
**COb1:** To describe the various functionalities of Data Link Layer and switching devices.
**COb3:** To describe the various functionalities of Network Layer.
**COb4:** To describe the various functionalities of Transport Layer and few services provided by the Application Layer.

**Unit – I** **15 Hrs.**

**Computer Networks Fundamentals**: Network Hardware, Network Software, Reference models– OSI Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Model.
**Physical Layer**: Guided Transmission Media, Wireless Transmission, Multiplexing – Frequency Division Multiplexing, Time Division Multiplexing, Switching.
**(Book1: Ch:1.2, 1.3, 1.4.1, 1.4.2, 1.4.4, 2.2, 2.3, 2.5.3, 2.5.4, 2.6.5)**

**Unit – II** **15 Hrs.**

**Data Link Layer**: Design Issues, Error Detection, Elementary Data Link Protocols, Sliding Window Protocol.
**Multiple Access Sub layer**: ALOHA, CSMA, Collision Free Protocols, Ethernet – Classic Ethernet Physical Layer, Classic Ethernet MAC Sub layer Protocol, Fast Ethernet.
**Data Link Layer Switching**– Repeaters, Hubs, Bridges, Switches, Routers, Gateways.
**(Book1: Ch: 3.1, 3.2.2, 3.3, 3.4, 4.2.1, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 4.3.5, 4.8.4)**

**Unit – III** **15 Hrs.**

**Network Layer:** Design Issues, Routing Algorithms – Shortest path, Flooding, Distance Vector Routing, Link State Routing, Hierarchical, Broadcast Routing, Multicast Routing; Congestion Control Algorithms - Traffic Throttling, Load Shedding.
**Internetworking:** Tunneling, Internetwork Routing, Packet Fragmentation, IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols–ICMP, ARP, RARP, DHCP.
**(Book1: Ch: 5.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.3.4, 5.3.5, 5.5.3, 5.5.4, 5.5.5, 5.6.1 to 5.6.4)**

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**Unit – IV** **15 Hrs.**

**Transport Layer:** Services provided to the upper layers, Elements of Transport Protocols.
**The Internet Transport Protocols:** Introduction to UDP&RPC, The Internet Transport Protocols– TCP, TCP Service Model, TCP protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management, TCP Sliding Window, TCP Time Management.
**Application Layer:** DNS - Name Space, Domain Name Space, Distribution of Name Space, DNS in the internet, Resolution, DNS Messages, Types of Records.
TELNET, E-Mail, FTP.
**(Book1: Ch: 6.1.1, 6.2, 6.4.1, 6.4.2, 6.5.1 to 6.5.9)**
**(Book2: Ch: 25.1, 25.2, 25.3, 25.4, 25.5, 25.6, 25.7, 26.1, 26.2, 26.3)**

**Prescribed Books:**

1. Andrew S. Tanenbaum, David J Wetherall, Computer Networks, (5e)
2. Behrouz A. Forouzan, *Data Communication and Networking, 4th Edition.*

**Reference Books:**

1. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet
2. Fred Harshall, Data Communications, Computer Networks and Open systems, 4/e, Pearson Education,2005.
3. William Stallings, Data and Computer Communications, 8/e, Pearson Education.,2013.
4. Behrouz A Forouzan, Firouz Mosharraf, *Computer Networks A Top-Down Approach*
5. S.S. Shinde, Computer Networks

**Course Outcomes:** By the end of the course, student will be able

**CS202 CO1:** To relate the different network operations with the related layers of OSI and TCP Protocol and analyze the responsibilities of Physical Layer.
**CS202 CO1:** To analyze different Data Link Layer operations and access how the Multiple Access sub layer protocols.
**CS202 CO3:** To identify the nomenclature used in IP Addresses and analyze the IP Header Format, different Routing Algorithms and Congestion Control Techniques used on the Internet.
**CS202 CO4:** To analyze how Transport Layer exactly implements a reliable end to end delivery of messages and analyze TCP Header format and how Transport Layer overcomes Congestion control at its level. To analyze the different services provided by Application Layer

**Employability aspect: Network Administrator, System Administrator**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: DESIGN AND ANALYSIS OF ALGORITHMS**

**PAPER CODE: CS203** **PPW: 4**
**YEAR/SEMESTER: I/II** **NO. OF CREDITS: 4**

**COURSE OBJECTIVE:** It helps the student to learn different Sorting- Searching algorithms, Divide and Conquer, Dynamic Programming and Backtracking algorithms.

**UNIT-WISE COURSE OBJECTIVES:**
**COb1:** To acquire the knowledge of different sorting and searching techniques.
**COb2:** To describe different problems related to divide and conquer, decrease and conquer & transform and conquer.
**COb3:** To describe the alternative methods for optimality of Dynamic Programming, Greedy Technique and Iterative Improvement.
**COb4:** To aware of problems related to Backtracking, Branch and Bound techniques.

**Unit – I** **15 Hrs.**
**Introduction:** Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types.
**Fundamentals of the Analysis of Algorithm:** The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive & Recursive Algorithms.
**Brute Force Search:** Selection Sort, Bubble Sort, Sequential Search, Brute-Force String Matching, Exhaustive Search, Depth-First Search, Breadth-First Search.
**(Ch: 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1 – 3.5)**

**Unit – II** **15 Hrs.**
**Decrease–and-Conquer:** Insertion Sort, Topological Sorting, Binary Search, Interpolation Search.
**Divide-and-Conquer:** Merge Sort, Quick Sort, Multiplication of Large Integers, Strassen's Matrix Multiplication.
**Transform-and-Conquer:** Presorting, Balanced Search Trees, Heaps and Heap Sort, Problem Reduction.
**Space and Time Trade-Offs:** Hashing, B-Trees.
**(Ch: 4.1, 4.2, 4.4, 4.5, 5.1, 5.2, 5.4, 6.1, 6.3, 6.4, 6.6, 7.3, 7.4)**

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**Unit – III** **15 Hrs.**

**Dynamic Programming:** Knapsack Problem, Optimal Binary Search Trees, Warshall's and Floyd's Algorithms.

**Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

**Iterative Improvement:** Simplex Method, Maximum-Flow Problem.

**(Ch: 8.2 - 8.4, 9.1- 9.4, 10.1, 10.2)**

**Unit – IV** **15 Hrs.**

**Limitations of Algorithm Power:** Lower-Bound Arguments, Decision Trees, P, NP, and NP - Complete Problems.

**Backtracking:** N-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem.

**Branch-and-Bound:** Assignment Problem, Knapsack Problem, Traveling Salesman Problem, Approximation Algorithms for the Knapsack Problem.

**(Ch: 11.1, 11.2, 11.3, 12.1, 12.2, 12.3)**

**Prescribed Book:**

Anany Levitin, Introduction to the Design and Analysis of Algorithms (3rd edition)

**Reference Books:**

1. Richard Neapolitan, Foundations of Algorithms
2. Thomas H. Cormen, Introduction to Algorithms
3. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms
4. A.V. Aho, J.V. Hopcroft, J.D. Ullmann, The Design and Analysis of Computer Algorithms
5. Donald E Knuth, The Art of Programming_Volumes–1, 2, 3, 4

**COURSE OUTCOMES:**

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

**CS203 CO1:** Develop programs using different Sorting and Searching methods.
**CS203 CO2:** Develop programs using different programs based on Divide and Conquer approach.
**CS203 CO3:** Develop programs related to Dynamic Programming concepts and Greedy Technique.
**CS203 CO4:** Develop programs related to backtracking, Branch and Bound related problems

**Employability aspect: Application program developer/Application designer.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-2025)**
**COURSE NAME: AUTOMATA THEORY**

**PAPER CODE:** CS204 **P.P.W: 4**
**YEAR/SEMESTER: I/II** **NO.OF CREDITS: 4**

**COURSE OBJECTIVE:** This course is intended to teach the fundamentals of DFA's and NFA's, Regular Languages, Context Free Grammars, Pushdown automata and Turing Machine.

**UNIT-WISE COURSE OBJECTIVES:**

**COb1:** To understand the behavior of DFA's and NFA's.
**COb2**: To construct finite automata for a given regular expressions.
**COb3**: To impart the knowledge of Context Free Grammars, Push Down Automata.
**COb4:** To design the Turing machines.

**Unit – I** **15Hrs.**

**Fundamentals** – alphabets, strings, languages, problems, graphs, trees.

**Finite State Systems**: definitions, Finite Automaton model, acceptance of strings, and languages, Deterministic finite automaton and Nondeterministic finite automaton, transition diagrams, transition tables, proliferation trees and language recognizers, equivalence of DFA's and NFA's. Finite Automata with -moves, significance, acceptance of languages, -closure, Equivalence of NFA's with and without - moves, Minimization of finite automata, Two-way finite automata, Finite Automata with output– Moore and Melay machines.

**Book2: Ch:1(1.1, 1.2), Ch: 2(2.1:2.5), Ch 3.3**

**Unit – II** **15Hrs.**

**Regular Languages:** regular sets, regular expressions, identity rules, constructing finite automata for a given regular expression, conversion of finite automata to regular expressions. Pumping lemma of regular sets and its applications, closure properties of regular sets.

**Grammar Formalism:** Regular grammars–right linear and left linear grammars, equivalence between regular linear grammar and finite automata, inter conversion, Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, ambiguity.

**Book2: Ch: 3 (3.1:3.2), Book1: Ch 5.1, 5.4**

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**Unit – III** **15Hrs.**

**Context Free Grammars:** Simplification of Context Free Grammars, Chomsky normal form, Greiback normal form, Pumping lemma for context free languages and its applications, closure of properties of CFL (proofs omitted).

**Push Down Automata:** PDA definition, model, acceptance of CFL, acceptance by final state and acceptance by empty state and its equivalence. Equivalence of PDA's and CFL's, inter-conversion. (Proofs not required).

**Book2: Ch:4 (4.1:4.6), Ch:6, Book1: Ch: 6 (6.1-6.3)**

**Unit – IV** **15Hrs.**

Membership Algorithm (CYK Algorithm) for Context Free Grammars.

**Turing Machine:** TM definition, model, design of TM, computable functions, unrestricted grammars, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs omitted). Linear bounded automata and Context sensitive language.

**Computability Theory:** Chomsky hierarchy of languages, Introduction to DCFL, DPDA, LR(0) grammar, decidability and undecidable problems. Definitions of P and NP problems, NP complete and NP hard problems.

**Book2: Ch:6.3, Ch:7: (7.1:7.6) , Ch:9 (9.1:9.3) , Ch:10: (10.1-10.7 ), Book1: Ch:10.1**

**Prescribed Books:**

1. J. E. Hopcroft, J. D. Ullman, Introduction to Automata Theory, Languages, and Computation (3e)
2. Introduction to Automata Theory, Languages, and Computation, J. E. Hopcroft, J. D. Ullman.

**Reference Books:**

1. Mishra, Chandrashekaran, Theory of Computer Science.
2. ZviKohav, Niraj K Jha, Switching and Finite Automata Theory.
3. Perter Linz, An Introduction to Formal Languages and Automata.
4. JohnC.Martin, Introduction to Languages and the Theory of Computation.

**COURSE OUTCOMES:**

At the end of the course students will be able to

**CS204 CO1:** Know the behavior of DFA's, NFA's.
**CS204 CO2:** Construct finite automata for a given regular expression.
**CS204 CO3:** Acquainted with Context Free Grammars, Push down Automata.
**CS204 CO4:** Familiar with the Turing machines.

**Employability aspect: Compiler developer/Data Processing Officer.**

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**
**COURSE NAME: PYTHON LAB**

**PAPER CODE: CS201P** | **PPW: 4**
**YEAR/SEMESTER: II/II** | **NO. OF CREDITS: 2**

**COURSE OBJECTIVE:** To impart knowledge in students on the execution process of python applications.

**Week - 1**

1. Write a program to find the largest of three integers using if-else and conditional operator.
2. Write a program with a loop that asks the user to enter a series of positive numbers. The user should enter a negative number to signal the end of the series. The program should display the numbers in order and their sum.

**Week - 2**

3. Write a program to find the product of two matrices [A]mxp and [B]pxr.

**Week - 3**

4. Write recursive and non-recursive functions for the following:
   a. To find GCD of two integers.
   b. To find the factorial of positive integer
   c. To print Fibonacci Sequence up to given number n

**Week - 4**

5. Write a program to display two random numbers that are to be added, such as: 247 + 129, the Program should allow the student to enter the answer. If the answer is correct, a message of congratulations should be displayed. If the answer is incorrect, a message showing the correct answer should be displayed.

**Week - 5**

6. Write a function to demonstrate, default, positional, keyword, variable length arguments.
7. Write a program to demonstrate functions in tuples and dictionaries.

**Week - 6**

8. Write a program to demonstrate Arrays using NumPy, Slicing and Indexing in numpy Arrays, Matrices in numpy.

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**Week - 7**

9. Write a program to create file, write the content and display the contents of the file.
10. In a program, write a function that accepts two arguments: a list and a number n. The function displays all of the numbers in the list that are greater than the number n.

**Week - 8**

11. Write a program with a function that accepts a string as an argument and returns the no. of vowels that the string contains. Another function to return number of consonants.
12. Write a program that opens a specified text file and then displays a list of all the unique words found in the file. (Store each word as an element of a set.)

**Week - 9**

13. Write a program to analyze the contents of two text files using set operations.
14. Write a program to implement the inheritance and dynamic polymorphism.

**Week - 10**

15. Write a program to demonstrate time and OS modules,

**Week - 11**

16. Write a program to demonstrate calendar and sys., modules.

**Week - 12**

17. Write a program to demonstrate method overloading.
18. Write a program to demonstrate abstract class.

**Week -13**

19. Write a GUI program that converts Celsius temperatures to Fahrenheit temperatures.

**Week - 14**

20. Write a GUI program that displays your details when a button is clicked.

**COURSE OUTCOMES:**

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

**CS201P CO1:** Develop applications using conditional statements, loops, functions, files and modules.

**CS201P CO2:** Develop object-oriented and GUI applications.

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**PROGRAM NAME: M.Sc. (Computer Science) CBCS (w.e.f. 2024-25)**

**COURSE NAME: COMPUTER NETWORKS LAB**

**PAPER CODE: CS202P** **PPW: 4**
**YEAR/SEMESTER: I/II** **NO. OF CREDITS: 2**

**COURSE OBJECTIVE**: To understand the working principle of various communication protocols and analyze the various routing algorithms.

**COb1:** To illustrate the fundamentals of network programming.
**COb2:** To demonstrate practical skills in implementing various network protocols.

**Week - 1**

1. Program to identify the category of the IP address for the given IP address
2. Program to implement sliding window protocol

**Week - 2**

3. Program Socket pair system call usage in IPC
4. Program for Socket options using signals

**Week - 3**

5. Program to implement Echo concurrent Stream Server

**Week - 4**

6. Program to implement Echo concurrent stream client

**Week - 5**

7. Program to implement Listener and Talker

**Week - 6**

8. Program to implement TCP time service

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**Week - 7**

9. Program to implement UDP time service

**Week - 8**

10. Program to implement Ping service

**Week - 9**

11. Program to implement Route tracing program

**Week – 10**

12. Program to implement File Transfer Protocol

**Week - 11**

13. Program to implement any Shortest path routing Algorithm

**Week - 12**

14. Program to implement Distance Vector Routing Implementation

**Week - 13**

15. Program to implement ICMP Error Message simulations

**Week - 14**

16. Program to implement Reverse Address Resolution Protocol

**COURSE OUTCOMES:** At the end of the course students will be able to:

**CS202P CO1:** Develop the practical approach to network communication protocols.

**CS202P CO2:** Implement and troubleshoot common network services and protocols.

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