# MASTER OF COMPUTER APPLICATIONS (MCA)

## Two Year Programme

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

# Guidelines, Scheme and Course details

*for the students to be admitted in the sessions*

*2021-22, 2022-23, 2023-24*

DEPARTMENT OF COMPUTER SCIENCE & IT

University of Jammu

JUNE 2021

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Deptt. of Computer Sc & IT
University of Jammu
Jammu-180006

# MASTER OF COMPUTER APPLICATIONS (MCA)

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# GUIDELINES AND SCHEME

### ABOUT MCA PROGRAMME

The Department of Computer Science & IT has been running three-year MCA degree programme since 1994. From the academic session 2021-22, the Department is introducing two-year MCA programme divided into four semesters. The programme consists of four components - Core Courses, Elective Courses, Open Courses, and Project Work. The programme is under the **Choice Based Credit System** and the maximum duration for the completion of the programme is FOUR years. The programme has been designed as per **RUSA** ( Rashtriya Uchchatar Shiksha Abhiyan ) curriculum recommendations keeping in view the latest requirements of the corporate & IT industry, academics and research.

### ELIGIBILITY

A candidate seeking admission to MCA programme must have passed/appeared in the final year of BCA/ BSc (Computer Science) or any similar stream discipline having passed Mathematics as one of the subjects at 10+2 level with at least 50% of the aggregate marks (45% for the candidates belonging to SC/ST).

However, candidate who has not studied computer science subjects at UG level and/or have not passed mathematics paper at 10+2 level, are also eligible to apply. Such candidates need to **enroll and compulsorily pass the Bridge Course- PSCSATB100 of four credits in addition to the passing regular Semester I courses** given in the syllabus during Semester-I, **in order to get eligible for admission to Semester – III of MCA 2-years programme**. This course will be of qualifying nature only, needs to be completed and passed in first year of MCA to become eligible for subsequent Semester-III, and will not be included in the total credits earned by the student against MCA final degree. The bridge course exam will be conducted twice a year.



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## MCA PROGRAMME STRUCTURE (Two years)

*(for the students to be admitted in the sessions 2021-22, 2022-23, 2023-24)*

# SCHEME

## Semester I

| Course No. | Title | Credits | Contact hours per week L-T-P |
|---|---|---|---|
| **PSCSATC 121** | **Principles of Operating System** | 4 | 4-0-0 |
| **PSCSATC 122** | **Computer Architecture & VLSI Design** | 4 | 4-0-0 |
| **PSCSATC 123** | **Database Management System** | 4 | 4-0-0 |
| **PSCSATC 124** | **Discrete Mathematics** | 4 | 4-0-0 |
| **PSCSALC 180** | **Practical** ***(based on above courses using C++, Unix, SQL,andVHDL)*** | 6 | 0-0-10 |
| | **Total:** | **22** | **16-0-10** |

*Experts from industry shall be invited for interactions/talks/lectures/workshop etc., where possible.*

## BRIDGE COURSE

Students admitted to MCA programme who have not studied computer science subjects at UG level and/or have not passed mathematics paper at 10+2 level, are required to **enroll and compulsorily pass the Bridge Course- PSCSATB100 of four credits in addition to the passing regular Semester I course** given above during Semester-I, **in order to get eligible for admission to Semester – III of MCA 2-years programme**. This course will be of qualifying nature only, needs to be completed and passed in first year of MCA to become eligible for subsequent Semester-III, and will not be included in the total credits earned by the student against MCA final degree. The bridge course exam will be conducted twice a year. Rest of the students, are not required to take the Bridge Course. The exam of Bridge Course shall be conducted twice a year. The details of the Bridge Course are given below-

| Course No. | Title | Credits | Contact hours per week L-T-P |
|---|---|---|---|
| **PSCSATB 100** | **Programming in C and Fundamental of Mathematics** | 4 | 4-0-0 |
| | **Total:** | **4** | **4-0-0** |



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## Semester II

| Course No. | Title | Credits | Contact hours per week L-T-P |
|---|---|---|---|
| PSCSATC 221 | Data Structures | 4 | 4-0-0 |
| PSCSATC 222 | Computer Networks | 4 | 4-0-0 |
| PSCSATC 223 | Object Oriented Programming in Java | 4 | 4-0-0 |
| PSCSATC 224 | Algorithm Design & Analysis | 4 | 4-0-0 |
| | Elective I (*Anyone of the following courses)* | | |
| PSCSATE 255 | Artificial Intelligence | 4 | 4-0-0 |
| PSCSATE 256 | Cyber Security | | |
| PSCSATE 257 | Data Mining & Warehousing | | |
| PSCSATE 258 | Cloud Computing and Internet of Things | | |
| PSCSALC 280 | Practical *(based on all the above courses)* | 6 | 0-0-10 |
| | **Total:** | **26** | **20-0-10** |

*Experts from industry shall be invited for interactions/talks/lectures/workshop etc., where possible.*

## Semester III

| Course No. | Title | Credits | Contact hours per week L-T-P |
|---|---|---|---|
| PSCSATC 321 | Theory of Computation and Complier Design | 4 | 4-0-0 |
| PSCSATC 322 | Web Technologies | 4 | 4-0-0 |
| PSCSATC 323 | Machine Learning using Python | 4 | 4-0-0 |
| PSCSATC 324 | Big Data Analytics Using R | 4 | 4-0-0 |
| | Elective II *(Anyone of the following courses)* | | |
| PSCSATE 355 | Computer Graphics | | |
| PSCSATE 356 | Image Processing and Computer Vision | | |
| PSCSATE 357 | Mobile Computing | 4 | 4-0-0 |
| PSCSATE 358 | Numerical & Statistical Computing | | |
| PSCSATE 359 | Software Engineering | | |
| PSCSATE 360 | Fuzzy Logic | | |
| | *Open Course-I | 4 | 4-0-0 |
| PSCSALC380 | Practical *(based on all the above courses)* | 6 | 0-0-10 |
| | **Total:** | **30** | **24-0-10** |

**All the students must mandatorily complete on or before completion of 3rd semester, one PG MOOC course of four credits from SWAYAM UGC portal as per the existing guidelines and requirements of University of Jammu regarding SWAYAM course.*



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*Experts from industry shall be invited for interactions/talks/lectures/workshop etc., where possible.*

## Semester IV

| Course No. | Title | Credits | Contact hours per week L-T-P |
|---|---|---|---|
| **PSCSATC 480** | **Project** | 18 | 0-0-27 |
| | **Open Course-II*** | 4 | 4-0-0 |
| | **Total:** | **22** | **4-0-27** |

**All the students must enroll and successfully complete one open course of four credits offered by various departments of the University of Jammu. This list of open courses is notified from time-to-time by the office of Dean Academic Affairs (DAA).*

The project in fourth semester shall be of 450 marks as per the following distribution:

| Project Components | | Marks |
|---|---|---|
| Mid-Semester Presentation & Internal Evaluation | | 150 |
| End-Semester Evaluation | Project Evaluation | 200 |
| | Project Viva-voce | 100 |
| | **Total:** | **450** |

**NOTE:**

1. The students of the Department shall register for one course of 4 credits in 3rd semester at SWAYAM/ MOOCS portal and one course of 4 credits in 4th semester in other Departments of University of Jammu.
2. The Department of CS&IT shall offer following one open course of 4 credits for students of other departments of the University other than the Department of CS&IT, University of Jammu.

OPEN COURSE

PSCSATO 452 Problem Solving & Programming in C

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## SCHEME FOR PAPER SETTING OF MAJOR EXAMINATION

The question paper shall be divided into two sections (A&B). No question shall be repeated in the question paper.

**Section A** There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions. *(3 x 5 = 15 marks)*

**Section B** There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 15 marks. *(3 x 15 = 45 marks)*

## REQUIREMENTS FOR EARNING THE MCA DEGREE

Credit requirements for earning two-year MCA degree are 100. The credits are distributed over three categories:

| CATEGORIES | DESCRIPTION | CREDITS | |
|---|---|---|---|
| Post-graduate Semester Core Courses (PSCA) | Core Departmental Courses | 84 | 92 |
| Post-graduate Semester Elective Courses (PSEC) | Elective Departmental Courses | 08 | |
| Post-graduate Semester Open Category Courses (PSOCC) | MOOC/ Other Department Courses | 08 | |
| **TOTAL CREDITS REQUIRED TO COMPLETE MCA PROGRAMME** | | **100** | |

**Course credits assignment**

***Lectures and Tutorials***: One lecture or tutorial hour per week per semester is assigned one credit.

***Practical/Laboratory***: One and half laboratory hour per week per semester is assigned one credit.

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*for the students to be admitted in the sessions 2021-22, 2022-23, 2023-24*

# COURSE DETAILS

# MCA - FIRST SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Principles of Operating System** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC121** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2021, 2022, and 2023*

## Course objectives & learning outcomes:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and their communication.
3. To learn the mechanisms involved in memory management in OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
5. To brief the students about basic concepts of Unix & Linux and programs using shell programming.

### UNIT-I Introduction to Operating Systems

Evolution of operating systems, Operating systems concepts, Types of operating systems, Different views of the operating system, Operating system services, System calls, Types of system calls. Operating system Structure, Layered Approach, Microkernels, Virtual machines.

### UNIT-II Process Management

Process concept, Operation on processes, Inter-process communication, Mutual exclusion, Introduction to Process scheduling, Scheduling algorithms, Process Synchronization, Inter process Synchronization, Critical section problem, Semaphores, Monitors, Message passing. Deadlocks, System Model, Deadlock characterization, Deadlock prevention, Deadlock avoidance.

### UNIT-III Memory Management

Memory management, Swapping, Contiguous memory allocation, Relocation & protection, Memory management, Paging, Segmentation, Intel Pentium Segmentation, Intel Pentium Paging, Virtual memory, Demand paging, Performance of demand paging, Page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

### UNIT-IV File & I/O Management

File & I/O Management Files system structure, File system implementation, Directory Implementation. Allocation Methods, contiguous allocation, linked allocation, Indexed allocation Disk organization, Disk space management, Disk scheduling, Disk Management, RAID Structure.

### UNIT -V Introduction to LINUX/UNIX

Files and Directories: pathname; Directory Tree; current working directory; Relative pathname; Referring to home directories; Device files; File permissions; Pipes; Trees; mount, init, Files, Directories, Processes,
Commands: pwd, mkdir, rmdir, ls, cat, more, mv, cp, rm, diff, wc, pwd, wc, who write, who am i, passwd, ps, kill, date, cal, man, gzip, df, chmod, mkdir, cd. Filters: pr, head, tail, cut, paste, sort, uniq, nl, tr.
Regular Expression: grep; egrep; fgrep; Vi-Editor, adding and replacing text, commands in Command mode, Deletion, navigation, pattern search, repeating commands, Shell Programming, Logical Operators, If else Statement, Case structure, Looping.

## Suggested readings/ references:


1. *Silberschart, Galvin, Gagne, "Operating System Concepts", 9th Edition, WSE Wiley, 2016.*
2. *Andrew. S. Tanenbaum, "Modern operating systems", 4th Edition, Pearson Prentice Hall, 2018*
3. *Milan Milenkovic, "Operating system-concepts and design", 2nd Edition, McGraw Hill International Edition, 2005*
4. *A. S. Godbole, "Operating systems", 3rd Edition. Tata McGraw hill, 2017. 5. Deitel H. M., "Operating System", 3rd Edition, Pearson Publications, 2012.*
5. *Madnick& Donovan, "Operating Systems", Tata McGraw Hill, 2003.*
6. *Sumitabha Das, "UNIX Concepts and Application", 4th Edition, Tata McGraw Hill, 2017. 8. Richard L. Petersen, "The Complete Reference Linux", 6th Edition, Tata McGraw Hill, 2010.*


NOTE FOR PAPER SETTERS FOR MAJOR EXAMINATIONS -

The question paper shall be divided into sections A & B as below. No question shall be repeated in the question paper.

**Section A** - There shall be FIVE short answer type questions of THREE mark each. In this section, questions shall be covered from each unit and the candidates shall be required to answer all the questions. *(3 x 5 = 15 marks)*

**Section B** - There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

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# MCA - FIRST SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Computer Architecture & VLSI design** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC122** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2021, 2022, and 2023*

**Course objectives & learning outcomes:**

1. To familiarize students with the components of digital electronics, logical organization and the computer arithmetic.
2. To study memory organization and the functions of each element of a memory hierarchy.
3. To familiarize students with the design of a Hardware descriptive language.
4. To help the students in understanding and analyzing different hardware designs, mathematical models and design integrated applications on different software platforms.
5. Overview of the VHDL language and its use in logic design.
6. Understand the basic parts of a VHDL model the basic VHDL constructs used in both the synthesis and simulation.

**UNIT-I Digital Systems and Number Representation**

**Digital systems:** Von Neumann architecture, digital and analog systems. **Number Systems**: Number system, their types & conversions; Decimal, Binary, Octal, Hexadecimal; **Binary Arithmetic:** Binary arithmetic operations. **Representation of negative numbers**; 1's complement and 2's complement. **Code Representation**: BCD code & Excess-3 and their rules of arithmetic operations.

**UNIT-II Logic Gates and Boolean Algebra**

**Logical Gates:** AND, OR, NOT, NAND, XOR, NOR, XNOR gates. **Boolean algebra:** Boolean laws and their Expressions. **Boolean Expressions:** Representation in SOP, POS form and their simplifications, K-map, code converters. **Error detection & correction**: Hamming code.

**UNIT-III Combinational and sequential Circuits**

**Combinational circuits**: Half & Full adders & subtractors, parallel adders, Encoder, decoder, Multiplexer De-Multiplexer. **Sequential circuits:** Flip-flops and their types, level clocking and edge triggered clocking, Registers and their types, bi-directional register.

**UNIT-IV Memories and bus structure**

**Memories:** Basic memory cell, Memory hierarchy, characteristics, memory types and accessing techniques, static and dynamic Memory, cache memory. Memory address map to CPU, bus structure, memory-mapped and I/O mapped technique. Modes of I/O transfers, instruction & interrupt life cycle.

**UNIT -V VHDL components and tools**

Introduction to VHDL, need and importance of VHDL, characteristics, basic components of VHDL -entities, architectures, configuration, package, library, simple VHDL program. Understanding tools and environments – GHDL VHDL simulator, Xilinx ISE (FPGA synthesis tool set), IMAGE simulation accelerator (FPGA based co-simulation environment).

**Suggested readings/ references:**


1. *Mano, M.M.: Computer System Architecture, Prentice-Hall.*
2. *Malvino, A.P., Leach, D.P.: Digital Principles and Applications, Tata McGraw-Hill.*
3. *Millman and Halkias: Integrated Electronics, McGraw-Hill.*
4. *Strangio, C.E.: Digital Electronics – Fundamental Concepts and sons.*
5. *Anrew S. Tanenbaum, Structured Computer Organization, 5th edition, Pearson Education Inc.*
6. *Khambata, J.: Microprocessor and Microcomputer, John Wiley and Applications, PHI.*
7. *Liu, Y.Gibson, G.A.: Microcomputer Systems: The 8086/808, Family, PHI 2nd Edn..*
8. *AlexandridisNikitas, A.: Microprocessor System Design Concepts, Galgotia Publications.*
9. *Stone, S.: Introduction to Computer Architecture, Galgotia Publications,2nd Edn.*
10. *Volnei A. Pedroni: Circuit design with VHDL.*


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NOTE FOR PAPER SETTERS FOR MAJOR EXAMINATIONS -

The question paper shall be divided into sections A & B as below. No question shall be repeated in the question paper.

**Section A -** There shall be FIVE short answer type questions of THREE mark each. In this section, questions shall be covered from each unit and the candidates shall be required to answer all the questions. *(5 x 3 = 15 marks)*

**Section B -** There shall be THREE long answer type questions each set from Unit - III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

# MCA - FIRST SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Database Management System** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC123** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2021, 2022, and 2023*

**Course objectives & learning outcomes:**

1. To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve-efficiently, and effectively-information from a DBMS.
2. Design ER-models to represent simple database application scenarios and convert them into relational tables
3. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
4. To familiarize students with the basic issues of transaction processing and concurrency control.
5. Construct simple and moderately advanced database queries using Structured Query Language (SQL).

**UNIT-I Database Concepts**

Traditional file-based system, Conventional file organizations, Need of Database Management System, Components of DBMS, Introduction to hierarchical and network data models. Schemas and Instances, Data independence, three level Architecture of Database, Centralized and client server architecture for DBMS

**UNIT-II Relational Data Model**

Entity relationship model, Relational Database Design using ER to Relational Mapping, EER Model, Joins, Relational Algebra and Relational Calculus Concepts, Queries using Relational Algebra and Calculus.

**UNIT-III Normalization**

Concept of keys, Functional dependencies, Inference rules, Covers, Closure, Equivalence of functional dependencies, Multivalued dependencies, Theory of normalization, Normal forms (1st to 5th), BCNF, Join dependency, Domain key normal form.

**UNIT-IV Concurrency Control**

Transaction processing, Deadlocks, Concurrency control, Locking techniques, Timestamp ordering, Recovery techniques, Distributed Database Concepts.

**UNIT-V SQL**

SQL query processing, Table creation and management, Inbuilt functions, Data integrity constraints, Views, Joins, Operators, Privileges, roles and security policies.

**Suggested readings/ references:**


1. *Bipin C. Desai, "An Introduction to Database Systems", West-publishing company.*
2. *RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education,*
3. *Date, C. J., "An Introduction to Database Systems", Addison Wesley Pearson Education, 2014.*
4. *Narayan S. Umanath, Richard W. Scamell, "Data Modelling and Database Design", Thomson Course Technology India Edition.*
5. *R. A. Parida, Vinod Sharma, "The power of Oracle 9i", Firewall Media Publications*


NOTE FOR PAPER SETTERS FOR MAJOR EXAMINATIONS -

The question paper shall be divided into sections A & B as below. No question shall be repeated in the question paper.

**Section A -** There shall be FIVE short answer type questions of THREE mark each. In this section, questions shall be covered from each unit and the candidates shall be required to answer all the questions. *(3 x 5 = 15 marks)*

**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

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# MCA - FIRST SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Discrete Mathematics** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC124** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2021, 2022, and 2023*

## Course objectives & learning outcomes:

1. To learn and solve counting problems by applying various counting techniques. Solving and implementing various problems such as finding Fibonacci numbers, Tower of Hanoi problems etc. using recurrence relations
2. Learning role of Relations and Functions in computer science
3. Learning graph theory and its application in Computer Science. Students will be able to model problems in Computer Science using graphs and trees and implement various algorithms pertaining to graphs and trees.
4. The students will learn and use basic terminology of mathematical logic, apply logical reasoning to solve a variety of problems.
5. The students will learn the basic properties of trees, graph coloring and their applications. They will be able to model problems in Computer Science using, trees and Graph coloring.

**Unit –I Overview of Counting:**
Basic principles of counting, pigeon-hole principle, generating functions, recurrence relations, linear recurrence relations with constant coefficients, Modeling various problems as recurrence relations. Homogenous recurrence relations and their solutions, particular solutions and total solution. Problems of Fibonacci numbers and tower of Hanoi and their solution using recurrence relation.

**Unit –II Relations and Functions:**
Domain, range and inverse of Relation, Composition of relations, Types of relations, Closure of relations etc. Relation Vs Function, Types of functions, Sum and product of functions, functions used in Computer Science (Floor and Ceil function, Remainder, characteristic and hash function),

**Unit –III Theory of Graphs:**
Basic terminology of graphs, multigraphs, directed and weighted graphs, paths and circuits, Types of graphs, Computer representation of graphs, Operations on Graphs, spanning trees using BFS, DFS and their applications, shortest path in weighted graphs and planar graphs, Detection of planarity. Eulerian paths and circuits, Hamiltonian paths and circuits.

**Unit –IV Trees and Graph Coloring:**
Tree and its properties, Center of a tree and rooted trees, tree traversals, minimal spanning trees, cut sets, etc. Coloring of graphs, dual graph; Vertex coloring, Chromatic number; Chromatic polynomial, The four colour problem, edge coloring, Coloring algorithms. Applications of trees and graph coloring.

**Unit –V Mathematical Logic:**
Propositions, connectives, conditionals and biconditionals, well-formed formulas, tautologies, equivalence of formulas, duality law, normal forms, inference theory for propositional calculus; predicate calculus: predicates, free and bound variables, inference theory of predicate calculus. Introduction to algebraic structures, groups.

## Suggested Readings/References


1. *C.L. Liu, Elements of Discrete Mathematics, McGraw-Hill Education,1986.*
2. *K H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill Education, 1999.*
3. *R.L. Graham, D.E. Knuth, O. Patashnik, Concrete Mathematics (2nd ed.), Addison Wesley, 1994.*
4. *Trembly, J.P. and Manohar, R.P.: Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill.*
5. *Deo, N.: Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall Inc..*
6. *Doerr, A. and Levasseur, K.: Applied Discrete Structures of Computer Science, Galgotia Publications Pvt. Ltd.*


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**Section A -** There shall be FIVE short answer type questions of THREE mark each. In this section, questions shall be covered from each unit and the candidates shall be required to answer all the questions. *(3 x 5 = 15 marks)*

**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

# BRIDGE COURSE

*Students admitted to MCA programme who have not studied computer science subjects at UG level and/or have not passed mathematics paper at 10+2 level, are required to enroll and compulsorily pass the Bridge Course- PSCSATB100 with four credits in addition to the passing regular Semester I course given above during Semester-I, in order to get eligible for admission to Semester – III of MCA 2-years programme. This course will be of qualifying nature only, needs to be completed and passed in first year of MCA to become eligible for subsequent Semester-III, and will not be included in the total credits earned by the student against MCA final degree. The bridge course exam will be conducted twice a year. Rest of the students, are not required to take the Bridge Course. The exam of Bridge Course shall be conducted twice a year.*

*For examinations to be held in Dec- 2021, 2022, and 2023*

| | | | |
|---|---|---|---|
| Course title: | **Programming in C and Fundamental of Mathematics** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATB100** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

## Course Objectives & Learning Outcomes:

1. The course aims to fill in the Knowledge gaps for students from non-Computer Science background, to enable them to be on par with others students.
2. The course aims to develop basic understanding of the Computer System & programming skills.
3. Familiarity with the mathematical concepts and terminologies that are essential to the study of many Computer Science areas.
4. Student can write and execute programs, and hence use computers effectively for problem solving.
5. Students will be able to choose the right programming constructs & data representation formats based on the requirements of the programming task in hand.
6. The knowledge & skills developed will enable them to understand and approach the Computer Science subjects in a better way.

**UNIT-I Computer Fundamentals & C Basics**

Introduction to Computer System, Architecture, Memory Organization, CPU Organization, Software concepts, steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Psuedo code and Flowchart Designing.
History of C, Characteristics of C, Executing C-program, C Program Structure, Data Types, Variables and Constants, Input Output statements, Type-Casting, Operators and Expressions.

**UNIT-II Control Statements, Functions & Arrays**

Selection statements, Repetitive statements, Errors, Functions, Recursion, Storage classes, Arrays, Strings.

**UNIT-III Preprocessor, User Defined Data types & Files**

Standard C Preprocessor Directives, Pointers, Dynamic Memory Allocation, Structures, Unions, Concepts of File Management, Working with text and Binary Files.

**UNIT-IV Set Theory & Calculus**

Sets, Relations and Functions, Limits and Continuity; Differentiation and Integration; Differential Equations of first Order and first degree.

**UNIT-V Matrices, Probability & Vector Algebra**

Matrices & Determinants, Solution of linear equations, Basic concepts of Probability, Permutation & Combination and Progressions, Vector Algebra concepts, vector addition & products.

## SUGGESTED READINGS/ REFERENCES:


1. *V. Rajaraman and N Adabala, "Fundamentals of Computers",6th Edition, Prentice Hall India, 2014.*
2. *Peter Norton, "Introduction to Computers", Tata McGraw Hills, 2005.*
3. *B. Kernighan and D. Ritchie, "The ANSI C Programming Language", 2nd Edition, Pearson, 2015.*
4. *Yashwant Kanetkar, "Let us C", 17th Edition, BPB Publications, 2020.*
5. *R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.*
6. *E. Balagurusamy, "Programming with ANSI-C", Sixth Edition, Tata McGraw Hill, 2012.*
7. *J. R. Hanly and E. B. Koffman, "Problem Solving and Programming in C", 8th Edition, Pearson, 2015.*
8. *H. M. Deitel and P. J. Deitel, "How to program", 7th edition, Pearson Education, 2010.*
9. *John Vince, "Foundation Mathematics for Computer Science- A Visual Approach", 1st Ed Springer International Publishing, 2015.*
10. *Trembley, J.P. and Manohar, R.P., "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill Education; 1st edition, 2017.*
11. *Seymour Lipschutz and Marc Lipson, "Schaum's Outline of Linear Algebra", Sixth Edition, McGraw-Hill Education; 6th Ed, 2017*
12. *R. Gupta, "Vector Algebra", Fourth edition, Laxmi Publications, 2005.*


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**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

# MCA –SECOND SEMESTER

Course title: **Data Structures**
Course no: **PSCSATC221**
No. of credits: **04**
Total marks: **100**

Minor Test 1: **20 Marks of 1.5 hours duration**
Minor Test 2: **20 Marks of 1.5 hours duration**
Major Test: **60 Marks of 3.0 hours duration**

*For examinations to be held in May- 2022, 2023, and 2024*

## Course objectives & learning outcomes:

1. To impart the basic concepts, implementations and analysis of data structures.
2. To introduce various techniques for representation of the data in the real world.
3. To strengthen the ability to solve problems with the help of fundamental data structures.
4. Student will be able to implement appropriate data structure in various domains.

### UNIT–I Fundamental Notations

Primitive and composite data types, self-referential structures, Algorithms, Types of data structures, Operations, Time and space complexity of algorithms, Asymptotic notation.

### UNIT–II Linear Data Structures

Arrays, Linked lists, Stacks, Queues, operations and their complexities, Implementations, Applications.

### UNIT–III Non-Linear Data Structures

Trees, Binary Trees, traversing binary trees, threaded binary trees, Binary search trees, heaps, Graphs, Traversing graphs.

### UNIT–IV Indexing Structures

ISAM, m-way trees, B–trees, B+–trees, Hashing techniques for direct access, Collision in hashing, Collision resolution.

### UNIT–V Sorting & Searching

Internal and External sorts, Bubble sort, Insertion sort, Selection sort, Shell sort, Quick sort, Radix sort, Merge sort, Types of merging. Searching-linear and binary search methods, Comparison of sorting and searching methods.

## Suggested readings/ references:


1. *Seymour Lipschutz, "Data Structures with C", Schaum Outlines, 2011.*
2. *Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press (India) Pvt. Ltd, 2008.*
3. *Jean-Paul Tremblay and Paul G. Sorenson, "Introduction to Data Structures with Application", 2nd Edition, Tata McGraw-Hill, 2001.*
4. *Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education India, 2001.*
5. *GAV Pai, "Data Structures and Algorithms", Tata McGraw Hills, 2017.*
6. *Peter Brass, "Advanced Data Structures", 1st Edition, Cambridge University Press, 2008.*
7. *YedidiahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd Edition, Pearson Prentice Hall, 2007.*
8. *Adam Drozdek, "Data Structures and Algorithms in C++", 2nd Edition, Thomson Asia Pvt. Ltd, 2001.*


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# MCA –SECOND SEMESTER

Course title: **Computer networks**
Course no: **PSCSATC222**
No. of credits: **04**
Total marks: **100**

Minor Test 1: **20 Marks of 1.5 hours duration**
Minor Test 2: **20 Marks of 1.5 hours duration**
Major Test: **60 Marks of 3.0 hours duration**

*For examinations to be held in May- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To study the basic taxonomy and terminology of the computer networking model and architecture.
2. To study the fundamentals of data communication and protocols.
3. To study network design and performance issues.
4. To explore the basic knowledge of cryptography and network security.

**UNIT–I Fundamentals of Communication**

Fundamentals of Communication, Modulation, Data Encoding, OSI reference model, TCP/IP model, network standardization, Inter-networking. Physical layer, Switching Technique, Transmission media, Co-axial, Twisted Pair and Fiber Optic Cables, Transmission Impairments, Electromagnetic Spectrum, Radio waves, Microwaves, Satellites, Wireless Mobile Telecommunications Technology.

**UNIT–II Data Transmission and Media access Methods**

Data Link layer, Design issues, Frame, Error detection and correction, Flow Control, Elementary Data link protocols, Character-oriented and Bit-oriented Protocols, Sliding window protocols.
Channel allocation methods, TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision free protocols, IEEE standard 802 for LANS, Ethernet, Token Bus, Token ring.

**UNIT–III Network Establishment Concepts**

Network Layer, Store and Forward Packet Switching, Connectionless and Connection-oriented services, Virtual Circuit, Routing Algorithms, Shortest path, Flooding, Link State, Distant vector, Hierarchical, Broadcast and Multicast Routing. OSPF, BGP, Congestion, Congestion control algorithms.

**UNIT–IV Internet Protocols**

TCP/TP Protocol, IP Addresses, Classes of IP Addresses, Subnets, IPv6, Network layer in the Internet, Internet Control Protocols, ARP, RARP, BOOTP, DHCP, Transport Layer, Protocol Stack, TCP and UDP, Transport Services Primitives, Sockets, Socket Programming concept.

**UNIT–V Network Application and Network Security**

Application layer, Name service (DNS), Domain Hierarchy, Name servers, Name resolutions, Traditional applications, Telnet, FTP, SMTP, MIME, World wide web-HTTP, HTTP Methods.
Cryptographic Algorithms, DES, AES, RSA, Key exchange methods, Authentication Protocol, Digital Signatures.

**Suggested readings/ references:**


1. *Andrew S. Tanenbaum, "Computer Networks", 5 e, 2013, Pearson Education Asia.*
2. *Behrouz A. Forouzan, "Data Communications and Networking", 4e, 2004, Tata McGraw Hills.*
3. *William Stallings. "Data and Computer Communication", 7e, 2016, Pearson Education Asia.*
4. *Prakash C. Gupta, "Data Communications and Computer Networks", PHI*
5. *Michael A. Miller, "Data and Network Communications", 2e, Delmar Thomson Learning.*
6. *James F. Kurose and Keith W. Ross, "Computer Networking", 3e, Pearson Education.*
7. *William A. Shay, "Understanding Data Communications and Networks", 2e, Thomson Asia Pvt. Ltd.*


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# MCA –SECOND SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Object Oriented Programming in Java** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC223** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To gain knowledge about Java language.
2. To understand the fundamentals of object-oriented programming in Java.
3. To understand the basic principles of web application programming.
4. Students will be able to design dynamic web application using database connectivity.

**UNIT-I Java Language Basics**

Features, Object Oriented concepts, Java Virtual Machine Concepts, Primitive Data Type and Variables, Java Keywords, Java Operators, Expressions, Control Statements and Arrays. Class and Objects, Static methods, Constructors, Method Overloading

**UNIT-II Inheritance, Packages and Interfaces**

Inheritance, Access Control, Method Overriding, Garbage Collection, Abstract Classes, Polymorphism, Packages, Interfaces, Exceptions Handling, Types of Exceptions, Writing Exception Subclasses, Multithreading, Synchronization in Java.

**UNIT-III I/O, Files and Applets Programming**

I/O in Java, Byte Stream Classes, Character Stream Classes, Reading and Writing to Console, Reading and Writing Files, The Transient and Volatile Modifiers, String and String Buffer Class, Applet Class, An Applet Skeleton, adding images & sound, Passing parameters to an applet.

**UNIT-IV Events and AWT**

AWT Components, Building User Interface with AWT, Handling Events of Mouse and Keyboards, Event Delegation Model (Events, Listeners, interfaces), Layouts and Layout Manager

**UNIT-V Regular Expression and JDBC**

Regular Expressions; JDBC implementation, Connection class, Statements, Types of statement objects, (Statement, Prepared Statement and Callable Statement), Types of result set, Result Set Metadata, Catching Database Results, Handling database Queries, JDBC and AWT.

**Suggested readings/ references:**


1. *Herbert Schildt– "Java The Complete Reference", Tata McGraw Hill, Tenth edition, 2017.*
2. *K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.*
3. *Shubhnandan S. Jamwal, "Java 9", The Team, Shroff Publishers and Distributor Pvt Ltd, 2018.*
4. *E. Balagurusamy, "Programming with JAVA", Tata McGraw Hill, Fifth edition.*
5. *Dietel&Dietel, "Java How to Program", Pearson Education, Eleventh edition.*
6. *Steven Holzner, "Java2 Black Book", Dreamtech Press.*
7. *George Reese, "Database Programming with JDBC and Java", 2nd Edition, O'Reilly. 8. Bruce Eckel, "Thinking in Java", PrenticeHall.*


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# MCA –SECOND SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Algorithm Design & Analysis** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC224** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To teach the various aspects of development of algorithms.
2. To demonstrate a familiarity with the design and analysis of various algorithms.
3. Students will have the ability to apply important algorithmic design paradigms.
4. Students would be able to analyze and compare the algorithms on the basis of asymptotic complexity.

**UNIT–I Review of Algorithms and Data Structures**

Introduction to algorithm analysis: Introduction to algorithms, Algorithm Specifications, performance analysis. Recursion and Induction: recursive procedures, recurrence relations, induction proofs, proving correctness. Randomized Algorithms: Basic of Probability Theory, Description of Randomized algorithms, Identifying the repeated Elements, Partiality Testing, Advantages and Disadvantages of using randomized algorithms.

**UNIT–II Basics of Analysis**

Asymptotic Bounds, Concept of Efficiency of an Algorithm, Well Known Asymptotic Functions & Notations, Well Known Sorting Algorithms, Comparison of Sorting Algorithms, Best-Case and Worst-Case Analyses, Average-Case Analysis, Amortized Analysis

**UNIT–III Design Techniques-I**

Divide-and-Conquer, General Method, Multiplication of two n-bit numbers, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix multiplication, Exponentiation.

Dynamic Programming, General Method, The Problem of Making Change, The Principle of Optimality, Chained Matrix Multiplication.

**UNIT–IV Design Techniques-II**

Backtracking, General method, n-queen's problem, Sum of subsets problem.

Greedy Algorithms, General Method, Knapsack problem, Job sequencing with deadlines, Minimum Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Single Source Shortest Path Algorithm

**UNIT–V Classification of Problems & Graphs Algorithms**

Non-Deterministic Algorithms, Complexity classes, Introduction to NP-Completeness, Establishing NP-Completeness of Problems, NP-Completeness Proofs, NP-Hard Problems.

Graphs Algorithms: Traversing Trees, Depth-First Search, Breadth-First Search, Best-First Search & Topological Sort.

**Suggested readings/ references:**


1. *Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, 2009.*
2. *E. Horowitz, S. Sahni, S. Rajasekaran, "Computer Algorithms", 2nd Edition, Universities Press, 2008.*
3. *Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", 3rd Edition, Pearson Education, 2008.*
4. *SaaraBaase and Allen Van Gelder, "Computer algorithms- Introduction to Design and Analysis", 3rd Edition, Pearson Education, 1999.*
5. *R. C. T. Lee, S. S. Tseng, R. C. Chang & Y. T. Tsai, "Introduction to the Design and Analysis of Algorithms: A Strategic Approach", 2nd Edition, Tata McGraw-Hill, 2009.*
6. *M. T. Goodrich and R. Tomassia, "Algorithm Design Foundations, Analysis and Internet examples", 1st Edition, John Wiley and sons, 2006.*


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# MCA –SECOND SEMESTER

Course title: **Artificial Intelligence**
Course no: **PSCSATE255**
No. of credits: **04**
Total marks: **100**

Minor Test 1: **20 Marks of 1.5 hours duration**
Minor Test 2: **20 Marks of 1.5 hours duration**
Major Test: **60 Marks of 3.0 hours duration**

*For examinations to be held in May- 2022, 2023, and 2024*

## Course Objectives & Learning Outcomes

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
4. To use different machine learning techniques to design AI machine and enveloping applications for real world problems.

## UNIT-I Introduction

Introduction to AI: History of AI, Basic Elements of AI, Introduction to Turing Machine, Turing Test and Rational Agent Approaches; State Space Representation of Problems, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures. Introduction to Expert system, Expert System Life Cycle, Study of existing expert systems like MYCIN and DENDRAL.

## UNIT-II Searching Techniques

Heuristic Search techniques-Hill Climbing, Best first search: OR graph, A* algorithm, Problem Reduction: AND-OR graph, The AO* Algorithm. Constraint satisfaction: Introduction and algorithm.

## UNIT-III Knowledge Representation

Knowledge Representation Structures: Prepositional Logic, First Order Predicate Logic, CNF, DNF, Prenex Normal Form, Resolution, Unification, Inference Mechanisms Semantic Nets, Frames, Scripts, conceptual dependences, Procedural & Declarative knowledge, Reasoning, Uncertainty.

## UNIT-IV Multi Agent Systems and Genetic Algorithms

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.
Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

## UNIT-V Understanding Natural Languages

Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammar; grammar-free analyzers, sentence generation.

**SUGGESTED READINGS:**


1. *Kevin Knight, Elaine Rich, B. Nair, "Artificial Intelligence", McGraw Hill Education.*
2. *Charniak, E., "Introduction of Artificial Intelligence", Narosa Publishing House.*
3. *S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.*
4. *George F. Luger, "Artificial Intelligence", Pearson Education.*
5. *Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.*
6. *Barrat, James, "Our final invention: Artificial intelligence and the end of the human era", Macmillan, 2013.*


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# MCA –SECOND SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Cyber Security** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE256** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

## Course objectives & learning outcomes:

1. To prepare students with the technical knowledge and skills needed to protect and defend computer systems networks.
2. Students will be able to plan, implement, and monitor cyber security mechanisms information protection
3. Students will be able to identify, analyze, and remediate computer security breaches.
4. Students will be able to analyze and evaluate the cyber security needs of an organization.
5. Students will be able to conduct a cyber security risk assessment.
6. Students will be able to use cyber security, information assurance, and cyber/computer forensics software/tools.

**UNIT–I Introduction to Cyber Security**

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats: Cyber Warfare, Cyber Crime, Cyber Terrorism, Cyber Espionage. 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

**UNIT–II 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, Securing Web Application, Services and Servers. Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges

**UNIT–III 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, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

**UNIT–IV Cryptography and Network Security**

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPsec.

**UNIT–V Cyber Law and Cyber Forensics**

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013. Cyber Forensics: Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

## Suggested readings/ references:


1. *William Stallings, "Cryptography and Network Security", PearsonEducation/PHI, 2006.*
2. *V.K. Jain, "Cryptography and Network Security", Khanna PublishingHouse.*
3. *Gupta Sarika, "Information and Cyber Security", Khanna Publishing House,Delhi.*
4. *Atul Kahate, "Cryptography and Network Security", McGrawHill.*
5. *V.K. Pachghare, "Cryptography and Information Security", PHILearning.*
6. *Nina Godbole, "Information System Security",Wiley.*


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# MCA –SECOND SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Data Mining & Warehousing** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE257** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To introduce students to the basic concepts and techniques of Data Mining.
2. To develop skills of using recent data mining software for solving practical problems.
3. Students would gain experience of doing independent study and research in data mining.

**UNIT-I Motivation, Importance, Data type for Data Mining**

Data Mining: Introduction, Motivation, Importance, Knowledge Discovery Process, Data Mining vs. Query Tools, Mining Interesting Patterns.

**UNIT-II Data Preprocessing**

Advanced Database System and its Applications, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Concept Description, Data Generalization and Summarization Based Characterization, Analytical Characterization, Mining Frequent Patterns, Association and Correlations, Basic concepts and Methods-Apriori Algorithm.

**UNIT-III Data warehouse and OLAP technology for Data Mining**

Introduction to Data Warehouses, Differences between Operational Databases and Data Warehouses, Multidimensional Data Model, Three-tier Data Warehouse Architecture, Schemas - Stars, Snowflakes and Fact Constellations, Steps for the Design and Construction of Data Warehouses, Physical and Logical Data Models, Data Marts, Metadata, OLTP & OLAP, OLAP Operations, Categorization of OLAP Tools.

**UNIT-IV Data Mining Functionalities**

Concept/Class description, Association Analysis, Classification & Prediction, Decision Tree Induction, Bayes Classification Methods, Rule –Based Classification. Cluster Analysis, Types of data, Partitioning methods (K-means), Outlier Analysis.

**UNIT-V Data Mining applications and tools**

Introduction to data mining Applications: Business Applications. Medical Applications, Scientific Applications.
Introduction to Web Mining and its applications.
Introduction to Data Mining Tools: WEKA, PENTAHO, R, ORANGE

**Suggested readings/ references:**


1. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education*
2. *Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill.*
3. *Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education.*
4. *K. P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory and Practice", Easter Economy Ed, PHI.*
5. *G. K. Gupta, "Introduction to Data Mining with Case Studies", Prentice Hall of India.*
6. *Daniel T. Larose, "Data Mining Methods and Models", Wiley Interscience.*


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# MCA –SECOND SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Cloud Computing and Internet of Things** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE258** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. Students will be able to explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing
4. To understand building blocks of Internet of Things and characteristics
5. Students will be exposed to the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

**UNIT-I Introduction to Cloud Computing**

Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics. Elasticity in Cloud, On-demand Provisioning

**UNIT-II Cloud Architecture, Services and Storage**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture, Types of Cloud: Public, Private and Hybrid Clouds, Cloud services: IaaS – PaaS – SaaS.

Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Cloud Storage Providers, S3, Resource Provisioning Methods in Cloud

**UNIT-III Cloud Enabling Technologies and Security**

Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish Subscribe Model, Basics of Virtualization, Types of Virtualizations Implementation Levels of Virtualization. Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery.

Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards

**UNIT-IV Introduction to IOT and M2M**

IoT & Web Technology, Towards the IoT Universe, Internet of Things Vision, IoT Applications, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization.

M2M, difference between IOT and M2M, M2M AND IoT Value Chains, ETSI M2M SCL resource structure, Security in ETSI M2M framework.

**UNIT-V IOT Architecture & Platforms**

IOT architecture and different layers, IOT standards (RFID, NFC; IEEE 802. 15. 4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy) and protocols.

IOT sensors (Temperature, Pressure, Proximity etc.), Microcontrollers, Microprocessors, SoC, Introduction to Arduino, Pi, Spark, Intel Galileo.

**Suggested readings/ references:**


1. *Thomas Erl and Zaigham Mahmood, "Cloud Computing, Concepts, Technology and Architecture", Pearson Publication,2014*
2. *John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2017.*
3. *Kuilash Jayaswal, "Cloud Computing Black Book", DreamTech Press,2014.*
4. *Michael Miller, "The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World", Pearson, 2015.*
5. *Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on Approach", University Press, First Edition 2015.*
6. *Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things", First Edition, 2015.*


**Web resources**

1.*https://developer.ibm.com/technologies/iot/articles/iot-lp101-best-hardware-devices-iot-project/*

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**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

# MCA –THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Theory of Computation and Compiler Design** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC321** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computational systems.
2. To demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.
3. To understand the limitations of computers and know about unsolvable problems.
4. To understand different phases, intermediate representations, algorithms and principles of working of a compiler
5. Application of parsing techniques, error handling and understanding of various issues in compiler design for optimized performance.

**UNIT–I Regular languages and Expressions**

Symbols, Alphabet, Strings, Backus-Naur Form, Languages, Grammar, Classification of Grammars, Regular Set, Regular expressions, Algebra of Regular expressions, Regular grammar, Regular languages, Closure properties of Regular languages, Applications of regular expressions. Deterministic Finite Automata (DFA) Non-Deterministic Finite Automata (NFA), ε-NFA, Equivalence Finite Automata, Equivalence of Regular Expression and Finite Automata, Pumping Lemma for Regular Languages, Applications of finite automata, Mealy and Moore Machines.

**UNIT–II Context Free Grammar**

Production rules and derivation, Types of Productions, Reduction of Grammar, Chomsky Normal Form, Griebach Normal Form, Pushdown Automata (PDA), Equivalence between CFG and PDA, Context Free Language, Closure properties for context free languages, Pumping Lemma for Context free languages, Applications of Context Free Grammar.

**UNIT–III Turing Machines**

Description, Transition diagram, Roles of Turing machine, Church-Turing Thesis, Modular Construction of complex Turing machines, Extensions of Turing machines, Non-Deterministic Turing Machines. Universal Turing Machine, Turing acceptable and Turing decidable languages.

Decidable and Undecidable Problems, The Halting Problem, Reduction to Another Undecidable Problem, Undecidability of Post Correspondence Problem.

**UNIT–IV Compiler Structure & Front end**

**Compiler Structure**: Compilers and Translators, Analysis- Synthesis Model of Compilation, Various Phases of Compiler
**Lexical Analysis**: Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, Error Reporting, LEX., Capabilities of Lexical Analyzer.
**Basic Parsing Techniques**: Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Non-recursive Predictive Parsers

**UNIT–V Errors Detection and Recovery, Code generation & optimization**

Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers.
**Error Detection and Recovery**: Lexical phase errors, Syntactic phase errors, Semantic errors.
**Intermediate Code Generation**: Different Intermediate forms: three address code, Quadruples & Triples.
Sources of optimization, Local optimization, Peephole optimization
**Code Generation**: Issues in the design of Code Generator, Basic Blocks and Flow Graphs, Transformations on Basic Blocks, Code Generation Algorithm, Register Allocation and Assignment.

**Suggested readings/ references:**


1. *H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India, 2nd Edition.*
2. *J. E. Hopcroft, R. Motwani and J. D Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education Asia, 3rd Edition, 2008.*
3. *Michael Sipser, "Introduction to the Theory of Computation, Thompson", Second Edition, 2006.*
4. *Jeffrey Shallit, "A Second Course in Formal Languages and Automata Theory", Cambridge University Press, 2008.*
5. *K. L. P. Mishra and N. Chandrasekaran, "Theory of Computer Science", Prentice Hall, 3rd Edition. 2006.*
6. *Rogers H., "Theory of Recursive Functions and effective computing", Mcgraw-Hill, 1987.*
7. *J. C. Martin, "Introduction to Languages and Theory of Computation", Tata Mcgraw Hill, 3rd Edition, 2007.*
8. *Alfred V Aho, Jeffery D. Ullaman, Principles of Compiler Design, Narosa Publishing House*
9. *Alfred V Aho, R. Sethi and J D Ullaman, Compiles: Principles, Techniques & Tools, Addison Wesley*
10. *Trembley & Sorenson, The Theory and Practice of Compiler Writing, Mc Graw Hill*
11. *Santanu Chatopadhayay, Compiler Design, Prentice Hall of India*


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**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

# MCA –THIRD SEMESTER

Course title: **Web Technologies**
Course no: **PSCSATC322**
No. of credits: **04**
Total marks: **100**

Minor Test 1: **20 Marks of 1.5 hours duration**
Minor Test 2: **20 Marks of 1.5 hours duration**
Major Test: **60 Marks of 3.0 hours duration**

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. Students are able to develop a dynamic webpage by the use of java script and DHTML.
2. Students will be able to write a well-formed web document.
3. Students will be able to write server application in java and JSP and to catch form data sent from client, process it and store it on database.
4. Students will be able to write client and server programming in .NET Technologies.
5. Students will be able to connect web applications to a DBMS and perform operations on Database

**UNIT–I HTML & CSS**

Text Formatting Tags, META Tag, Adding Lists, Table, embedding objects, Paragraphs, Formatting, Links, Head, Images, Tables, Lists, Blocks, Layout, Forms, Colors, Color values, Frame and Form, Form Controls, CSS, Defining Styles, Elements of Style, Linking a Style Sheet to an HTML Document, In-line Styles, External Style Sheets, Internal Style Sheets, Introduction to XML

**UNIT–II Java Script**

Variables, String manipulation, Mathematical Functions, Statements, Operators, Arrays, and Functions, Data and Objects, Regular Expressions, Built-in Objects, Events, Rollover, Buttons, Moving Images

**UNIT–III Servlet and JSP**

Servlet Life Cycle, Servlet Request and Response Disadvantages of Servlets, Reading Headers JSP: Scripting Elements, JSP Expression, JSP Declaration, Predefined variables/objects, using user defined functions, working with Databases Using JSP, Inserting, Updating, and Deleting Database Records

**UNIT–IV ASP Controls**

ASP. NET Standard Controls: Label, Textboxes, buttons, hyperlink, checkboxes, Regular expressions; Server pages: Creating Server pages, page Life Cycle, HTTP Request Object, HTTP Response Object, Postback, Tracing & Debugging ASP. NET page.

**UNIT–V State Management in ASP**

State Management and Types of State Management, HTTP Cookies, HTTP Session, HTTP Application, Query String Method, State Management using Postback URL, View State. Validation Controls, Data Bind Control and Types of Data Bind Controls Repeater, Data List etc.

**Suggested readings/ references:**


1. *H. M. Deitel, P. J. Dietel and A. B. Goldberg, "Internet and Worldwide Web", 4th edition, Pearson Education.*
2. *Chris bates, "Web Programming", 2nd Edition, Wiley Dreamtech India.*
3. *Ramesh Bangia,, "Multimedia and Web Technology", 2nd Edition, Firewall Media.*
4. *James Jaworski, "Mastering Javascript and Jscript", 2nd Edition, BPB.*
5. *Phil Hana, "JSP: The complete Reference", Osborne/McGraw-Hill, 2001.*
6. *Jeff Rule, "Dynamic HTML", 1st Edition, Dreamtech Press. Jose Annunziato and Stephanie FeslerKaminaris, "Java Server pages in 24 Hours", 1st Edition, Techmedia*


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# MCA –THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Machine Learning using Python** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC323** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To introduce students to state-of-the-art methods and modern programming tools for data analysis.
2. To understand complexity of Machine Learning algorithms and their limitations.
3. To understand modern notions in data analysis-oriented computing.
4. To understand the basic and advanced features of core language built-ins.
5. To implement various packages of python library.
6. Student will be able to perform experiments in Machine Learning using real-world data using python.

**UNIT–I Introduction to Machine Learning**

Types of machine Learning: supervised, unsupervised, semi supervised and reinforcement learning, Steps in the design of learning system, Training and testing, Cross Validation, Feature Reduction/Dimensionality reduction, Performance prediction parameters, Applications of machine learning.

**UNIT–II Types of Machine Learning**

Supervised Learning, Labelled data, Classification and its algorithms: Naive-Bayes classifier, Decision trees, Support vector machines, Principal component analysis: Eigen values, Eigen vectors, Orthogonality, Artificial Neural Networks and its types. Unsupervised Learning, Unlabeled data, Clustering and its types: Hierarchical, Fuzzy, Density based, Distance based, Model based, K-means clustering, Nearest Neighbor.

**UNIT–III Genetic Algorithm and Deep Learning**

Introduction, Q learning, Temporal Difference Learning, Learning from Examples, Reward Hypothesis. Genetic algorithm: Introduction, Steps involved in genetic algorithm, Applications of genetic algorithm. Introduction to Deep learning concepts. Tools and Platforms

**UNIT–IV Introduction to Python**

Data Types, variables and basic Operators. Understanding python blocks and complex data types: Strings, Sequence types: Tuples, named tuples, lists, Set Types: Sets, Frozen sets, Mapping types: dictionaries, iterating and copying collections and arrays.

Python Program Flow Control Conditional blocks if, else and else if, Simple for loops in python, for loop using ranges, string, list and dictionaries, Exceptions.

**UNIT–V Introduction to Machine Learning using python and Deep Learning**

Classification and Prediction, Text Identification, Introduction to Scikit Learn, Python libraries:Pandas, NumPy, Matplotlib etc.

Introduction to Deep learning concepts. Tools and Platforms (Tensor flow, Keras etc.).

**Suggested readings/ references:**


1. *Machine Learning, "A Probabilistic Perspective", MIT Press, 2012 by Kevin Murphy.*
2. *Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.*
3. *Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms".*
4. *Haykin, S. "Neural Networks and Learning Machines. Prentice Hall." New York (2008).*
5. *Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2010.*
6. *Mark Summerfield, "Programming in python 3: A Complete Introduction to Python Programming".*
7. *Mark Lutz, "Learning Python", O Reily, 4th Edition, 2009.*
8. *Brian K. Jones, "Python Cookbook".*
9. *Alex Martelli, "Python in a nutshell".*
10. *Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", 2009*


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# MCA –THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title. | **Big Data Analytics using R** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATC324** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.
3. To know about the research that requires the integration of large amounts of data.
4. To perform hands-on with big data tools using R language.
5. To analyze data by utilizing statistical and regression models

**UNIT-I Introduction to Big Data and Hadoop**

Introduction to Big Data and Big Data Analytics, Types of Digital Data, Big data characteristics and applications, Understanding Big Data Storage-A General Overview of High-Performance Architecture, HDFS, MapReduce and YARN, Map Reduce Programming Model, History of Hadoop, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.

**UNIT-II Hadoop File Distributed System (HDFS)& Map Reduce**

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

**UNIT-III Introduction to R programming**

Introduction and Overview, Installation of R studio, Data Types and Functions.
Data Structures: Vectors and Lists, Matrices, Arrays, Data frames, Factors, Data Transformations and Tables, Control Structures.

**UNIT-IV Data Visualization using R**

Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.
Data Cleaning operations like Slicing, filtering, Piping etc., Exploratory data analysis

**UNIT-V Statistical & Regression Models and Predictive Analysis**

Mean, median, Standard deviation, variance, correlation and covariance
Random Forest, Decision Trees, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression, Survival Analysis
Creating data for analytics through designed experiments, creating data for analytics through active learning, Creating data for analytics through reinforcement learning.

**Suggested readings/ references:**


1. *Raj Kamal and Preeti Saxena, "Big Data Analytics", Mc Graw Hill Education,2019*
2. *Hadley Wickham, Garrett Grolemund," R for Data Science", O'Reilly Media,2016*
3. *Simon Walkowiak," Dig Data Analytics with R", Packt Publishing,2016.*
4. *W. N. Venables, D.M. Smith and the R Development Core Team," An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. Version 3.0.1 (2013-05-16).URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf*
5. *Mark Gardener,"Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.*


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# MCA –THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Computer Graphics** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE355** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2022, 2023, and 2024*

## Course objectives & learning outcomes:

1. To introduce the components of a graphics system and make students familiar with building approach of graphics system components and algorithms related with them
2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping
3. To make students able to implement the application of computer graphics concepts in the development of computer games, information visualization, and business applications

### UNIT–I Introduction to Computer Graphics

Concept of Computer Graphics and its applications; Graphics input and output devices. Video display devices: Refreshing display devices, Random scan display device, Raster scan devices, Flat Panel Devices, color CRT, Direct View Storages Devices. Input Devices, Hard Copy Devices.

### UNIT–II Graphic Primitives

Concept of Graphic Primitives, points, lines etc., Line (DDA and Bresenham line algorithm), Circle (Polar, Bresenham and Mid-point circle algorithm), Ellipse (Polar and Midpoint ellipse algorithm), Area filling techniques (Boundary fill, Flood fill, scan line area fill algorithm), character generation; Aliasing, half toning, Sampling, Filtering Techniques.

### UNIT–III Geometric Transformations

2D Cartesian and Homogeneous co-ordinate system, Geometric transformations (translation, Scaling, Rotation, Reflection, Shearing), Composite transformations.

3D Cartesian and Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection), Composite transformations

### UNIT–IV Viewing and Clipping Transformations

Introduction, objectives of viewing transformation, Concept of projections: parallel projection, orthographic and oblique projections, isometric projections, perspective projections (concept of vanishing points, single point, perspective transformation, 2-point and 3-point perspective transformation and general perspective transformation with COP at the origin.

Point and Line clipping, Cohen-Sutherland and Cyrus-Beck Line Clipping algorithms.

### UNIT–V Three-Dimensional Object Representation

Polygon surfaces, Polygon tables, plain equation, polygon meshes, Bezier curves &Surfaces, properties of Bezier curves, Hermite Interpolation.

Hidden line and surface elimination, Z-buffer, scan-line, sub-division, Painter's algorithm. Illumination Models: Diffuse reflection, Specular reflection, refracted light, texture surface patterns, Halftoning, Dithering. Surface Rendering, Constant Intensity method, Gouraud Shading, Phong Shading.

**Suggested readings/ references:**


1. *Hearn, D. Baker, and P. M., "Computer Graphics", 2nd Edition Prentice-Hall, 2013.*
2. *A. P Godse, "Computer Graphics", 4th edition, technical publications Pune, 2015.*
3. *Newman, W. Sproul, R. F., "Principles of Interactive Computer Graphics", 2nd Edition, McGraw Hill, 2001.*
4. *Rogers, D. F, "Procedural Elements for Computer Graphics", 2nd Edition McGraw-Hill, 2003.*
5. *S. Harrington, " Computer Graphics: A Programming Approach", 2nd Edition, Tata McGraw- Hill, 1987.*
6. *Rogers, D. F., "Mathematical Elements of Computer Graphics", 2nd Edition, McGraw Hill Education, 2017.*
7. *R. A. Plastock and G. Kalley, "Computer Graphics", McGraw Hill, 2017.*


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# MCA –THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Image Processing & Computer Vision** | | |
| Course no: | **PSCSATE356** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| Total marks: | **100** | Major Test: | **60 Marks of 3.0 hours duration** |

*For examinations to be held in May- 2022, 2023, and 2024*

## Course Objectives & Learning Outcomes:

1. To study Fundamental concepts of a Digital Image Processing System.
2. To understand and review image transforms.
3. To analyze Compression Techniques and Morphological concepts

## UNIT I-Digital image fundamentals:

Introduction, an image model, sampling and quantization, basic relationships between pixels, image geometry.
Image enhancement: Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain.
Image Restoration: Basic model, estimating the degradation function, restoration techniques.

## UNIT II-Image Compression and Segmentation:

Image Compression: Fundamentals, information theory, compression techniques.
Image Segmentation: Edge Detection: Region, Crack Edge Detection, Edge Linking, Gradient operators, Compass and Laplace operators. Threshold detection methods, optimal thresholding, multi spectral thresholding, edge-based image segmentation, edge image thresholding, region-based segmentation, border tracing, border detection.

## UNIT III-Pattern Recognition Introduction:

Machine perception, pattern recognition example, pattern recognition systems, the design cycle, feature extraction, learning and adaptation.
Bayesian Decision Theory: Introduction, continuous features – two category classifications, minimum error-rate classification- zero-one loss function, classifiers, discriminate functions, and decision surfaces, Decision rule, maximum likelihood and Bayesian parameter estimation.

## UNIT IV-Un-supervised learning and clustering:

Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering, similarity measures, criteria function for clustering.

## UNIT V- Computer Vision:

Introduction and evolution of computer vision, applications of Computer Vision: Document Image Analysis, Biometrics, Object recognition, tracking, medical image analysis, content-based image retrieval, video data processing, multimedia, virtual reality and augmented reality
Motion Estimation: Regularization theory, Optimal computation, Stereo vision, Motion estimation and Structure of motion.

## Suggested readings/ references:


1. *R. C. Gonzalez and R. E. Woods, "Digital Image Processing", 3rd Edition, Addison Wesley,2014.*
2. *Sanjay Sharma, "Digital Image processing", 4th edition, 2016*
3. *Richard O. Duda, Peter E. Hart and David G. Stroke, "Pattern classifications", Wiley student edition.*
4. *A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India.*
5. *M. Anji Reddy, "Digital Image Processing", BS Publications.*
6. *Earl Gose, Richard John Baugh and Steve Jost, "Pattern Recognition and Image Analysis"PHI.*
7. *D. Frosyth and J. Ponc, "Computer Vision-A modern approach", TMH.*


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# MCA –THIRD SEMESTER

Course title: **Mobile Computing**
Course no: **PSCSATE357**
No. of credits: **04**
Total marks: **100**

Minor Test 1: **20 Marks of 1.5 hours duration**
Minor Test 2: **20 Marks of 1.5 hours duration**
Major Test: **60 Marks of 3.0 hours duration**

*For examinations to be held in Dec- 2022, 2023, and 2024*

## Course objectives & learning outcomes:

1. To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. To understand the typical mobile networking Infrastructure through a popular GSM protocol
3. To understand the ad hoc networks and related concepts.
4. Students will be able to develop new mobile application.

### UNIT-I Basic of Mobile Technology & Smart Client

Mobile Devices -Definition, m-commerce, m-business, component of wireless environment, wireless communication, mobile device classification, Wireless Network -WPANS, WLAN, WWANS (1 G, 2G, 2. 5G, 3G).
Introduction to Mobile Communications and Computing, Mobile Computing, novel applications, limitations and architecture;
Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, security in MANETs.

### UNIT-II Cellular Concept and Its Initial Implementations

The cellular concept, Multiple access technologies for cellular systems, Cellular system operation and planning (General principles, System Architecture, Location updating and call setup), Handoff and power control
Initial implementations of the cellular concept: The AMPS system, TACS system, NMT system, NTT system, Concluding remarks.

### UNIT-III Digital Cellular Mobile Systems

Introduction, GSM: The European TDMA digital cellular standard, GSM standardization and service aspects
GSM reference architecture and function partitioning, GSM radio aspects, Security aspects, GSM protocol model, Typical call flow sequences in GSM, Evolutionary directions for GSM, Introduction to GPRS, Architecture and Services.

### Unit-IV Mobile Data Communications and Protocols

Introduction, Circuit switched data on analog and digital cellular networks, high speed Circuit switched data in GSM, Packet switched data services on cellular networks, CDPD (cellular digital packet data), Packet data in digital and analog cellular, Evolution of cellular mobile data capabilities: The EDGE concept, Data over lower power wireless or cordless telecommunication networks, Data services over DECT (Digital enhanced cordless telecommunications).
**Protocols and Platforms for Mobile Computing**: WAP, Bluetooth. XML. J2ME. JavaCard. PalmOS, Windows CE. SymbianOS, Unix for Mobile Devices.

### UNIT-V Android Basic & Its components

Introduction to Android -The Open Handset Alliance, Android SDK installation, Android SDK & their codenames, The Android O/S Architecture, Overview of IDE for Android application, AVD, launching and starting, AVD (android virtual device) Managing Application Resources -What are resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus)
Android Application Components- Activities & its life cycle, Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter.

## Suggested readings/ references:


1. *Raj Kamal, "Mobile Computing", Oxford University Press-New Delhi, 2nd Edition.*
2. *Jochen Schiller, "Mobile Communications", Addison-Wesley, 2nd Edition.*
3. *Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley.*
4. *Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML".*
5. *Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional,2005.*
6. *Shane conder, Lauren darcey, "Android wireless application development", 2nd Edition, Addison-Welsey.*
7. *Rick Rogers, John Lombardo, "Android Application Development", O'Reilly.*
8. *Reto Meier, "Professional Android 2 application development", Wrox.*


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# MCA -THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Numerical & Statistical Computing** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE358** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

## Course objectives & learning outcomes:

1. To demonstrate understanding of numerical and statistical methods in support of the analysis, design and application for problem solving in the field of information technology.
2. Understand the theoretical workings of numerical techniques and consequence associated with representation of real numbers and handling of errors, significant digits and precision.
3. How to obtain approximate solutions to intractable mathematical complex problems using various numerical techniques. Interpret complex statistical findings using the understanding of inferential statistics.
4. To recognize elements and variable in statistics and summarize qualitative and quantitative data
5. Statistical study will provide how use different statistical methods in organizing, drawing inference about population/ sample, framing of hypothesis, data summarization, uncertainty evaluation.
6. Provide understanding of how design experiment, measures of surveyed data, understanding of parametric and non -parametric methods.
7. Applications of numerical techniques and statistical method in real life problems and importance in research.

**UNIT–I Errors and Solutions for System of Equations**

**Errors:** Truncation and rounding errors, Absolute and relative errors, significant digits, Fixed and floating-point arithmetic, pitfalls in floating point arithmetic.

**Iterative Methods:** Secant Methods, Newton-Raphson Method, Rate of Convergence of N-R method.

**Solutions of Simultaneous Linear equations**: Gauss elimination method and pivoting, IIL-conditioned equations and refinement of solutions; Gauss–Seidal Interactive Method, Gauss-Jacobi method, comparison of iterative methods

**Interpolation:** - Newton's Forward, Backward & Lagrange's interpolation.

**UNIT–II Numerical Differentiation and Integration**

**Numerical differentiation:** Euler's Method, Runga - Kuta method ($2^{nd}$and $4^{th}$ order), Automatic error monitoring.

**Numerical Integration**: Trapezoidal rule, Simpson's $1/3^{rd}$and $3/8^{th}$rule

**UNIT–III Basic Statistics**

**Measures of central tendencies**: -Mean, Median, Mode. **Measures of dispersion:** Range variance and standard deviation; Frequency distribution and cumulative frequency distributions

**UNIT–IV Probability Distributions and Sampling theory**

Discrete & Continuous Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution and Derivation of mean and variance in each of the distributions.

Sampling theory: Concept of Population, Sample; Importance of Sampling and its advantages, types of samplings. Conditional probability and entropy.

**UNIT–V Hypothesis Testing and Parametric and Non-Parametric Methods**

**Hypothesis testing:** concept of hypothesis, type-1 and type-2 errors, level of significance, one tailed and two tailed tests, Z-test, t-test.

**Parametric and Non-parametric Methods**: Linear regression, covariance & correlation analysis, Anova (One-way) and Chi-square (test of independence, testing of goodness of fit, population variance.

**Suggested readings/ references:**


1. *S.S Sastry, "Introductory methods of Numerical analysis", PHI,5th Edition, 2012*
2. *R. S Salaria, "Computer oriented Numerical Methods ", Khanna Book, 5th Edition, 2012*
3. *Jain, M. K., Iyengar, S. R. K. and Jain, R. K.," Numerical Methods (Problems and Solution)", New Age Int Publisher, Edition, 2019.*
4. *Krishnamurthy, E. V., Sen, S. K," Computer Based Numerical Algorithm", East West Press, 2nd Edition, 1984.*
5. *Rajaraman V, "Computer Oriented Numerical Methods", Prentice Hall India, 3rd Edition, 2005.*
6. *Balagurusamy E," Numerical Methods", Tata McGraw-Hill Publishing Co. Ltd., 3rd Edition, 1999.*
7. *Sancheti , D. S. & Kapoor ,V.K. , " Statistics Theory , Method & Application", Sultan Chand & sons, New Delhi, 7th Edition, 2017.*
8. *Anderson, T. W, "An Introduction to Multivariate Statistical Analysis", John-Wiley and Sons, 33rd Edition, 2009.*
9. *E. Balagurusamy," Computer Oriented Statistical and Numerical Methods", Macmillan India Ltd., 2000.*
10. *N. G. Das,"Statistical Methods", TMH. Edition, 2017*


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**Section A -** There shall be FIVE short answer type questions of THREE mark each. In this section, questions shall be covered from each unit and the candidates shall be required to answer all the questions. *(3 x 5 = 15 marks)*

**Section B -** There shall be THREE long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry FIFTEEN marks. *(3 x 15 = 45 marks)*

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# MCA -THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Software Engineering** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE359** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. To gain knowledge of basic SW engineering methods and their appropriate application.
2. To understand software testing approaches such as unit testing and integration testing.
3. To produce efficient, reliable, robust and cost-effective software solutions.
4. Students will be able to perform independent research and analysis.
5. Students will be able to analyze, design, verify, validate, implement, apply, and maintain software systems.

**UNIT-I Introduction**

Evolution of Software Engineering, Software Engineering: A layered technology, process frame work and software engineering paradigms, Software process technology, Software Requirements Analysis, Analysis Principles, Modeling the system architecture, Software prototyping and specification.

**UNIT-II Software Design**

Design Process, Concepts, Principles, Architectural Design, Data Design, Mapping requirements into Software Architecture, Effective modular design, Procedural Design, Interface design, HCI design.

**UNIT-III Software Quality Planning and Project Management**

Evaluation of individual projects: Technical assessment, cost-benefit analysis (Evaluation Techniques), and Risk evaluation, Concept of Software Project Management and its importance, software cost estimation techniques, different types of project metrics, Models for cost estimation (COCOMO, Putnam's, function point), Introduction to project scheduling, project schedules, project and activities, scheduling activities, Schedule development methods (Critical Path Method, Critical Chain Scheduling, PERT).

**UNIT-IV Software Quality Assurance**

Introduction, Quality Planning, Quality Assurance, Quality Control, Tools and Techniques of Quality Control, Pareto analysis, Six Sigma, Cost of Quality, software quality metrics (McCal's Quality Model, Boehm's Quality Model, Dromey's Quality Model), Capability maturity models.

**UNIT-V Software Testing and Maintenance**

Testing Issues, Testing Object-Oriented Systems, Testing Techniques: White Box Testing, Black-Box Testing, Testing Strategies: Unit Testing, Integration and Validation testing, System Testing, Introduction to maintenance, characteristics, maintenance task, Reverse Engineering, Re-engineering, Clean room Software engineering. **Case Study:** Selenium, Basic Terminology, Selenium Features Limitations, Tool Suite, Selenium IDE, TestNG with Selenium

**Suggested readings/ references:**


1. *Roger, S. Pressman, "Software Engineering: A practitioner's Approach", McGraw Hill, 5th Edition.*
2. *Walker Royce, "Software Project Management", Pearson Education. 2004.*
3. *Pankaj Jatlote, "An Integrated Approach to Software Engineering", Narosa Publication, 3rd Edition.*
4. *Shari Lawrence, PF Legger, "Software Engineering Theory and Practice", Pearson Education, 2nd Edition.*
5. *R. E. Fairley, "Software Engineering Concepts", McGraw Hill.*
6. *Ian Sommerville, "Software Enginering", Pearson Education.*
7. *Robert S. Arnold, "Software Re-engineering", IEEE Comp. Society, 2003.*
8. *Lorenz and Kidd, "Object Oriented Software Metrics", Prentice Hall.*
1. *Booch, "Object-Oriented Analysis and Design with Applications", Addison-Wesley, 3rd Edition, 2007.*


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# MCA -THIRD SEMESTER

| | | | |
|---|---|---|---|
| Course title: | **Fuzzy Logic** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSATE360** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in Dec- 2022, 2023, and 2024*

**Course objectives & learning outcomes:**

1. Develop the skills to gain a basic understanding of fuzzy logic theory.
2. To comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
3. To make student Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
4. To make student understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.
5. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.

**Unit I: Fuzzy Logic and Fuzzy Sets**

Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function, Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers, Fuzzy Linear Regression.

**Unit-II Classical Relations and Fuzzy Relations**

Cartesian Product, Crisp Relations- Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

**Unit-III Fuzzy Rule-Based System and Decision Making**

Introduction, Formation of Rules, Decomposition of Rules, Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Fuzzy Inference System, Fuzzy c-Means Clustering, Introduction to Decision making, Fuzzy Ordering, Individual Decision Making, Multi-Person Decision Making, Type 1 and Type 2 Fuzzy system

**Unit-IV Fuzzy Classification**

Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering

**Unit V: Fuzzy Optimization and Neuro Fuzzy Systems**

Fuzzy optimization –one-dimensional optimization. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

**Suggested readings/ references:**


1. *Simon Haykin, "Artificial Neutral Networks".*
2. *Yegna Narayanan," Artificial Neural Networks".*
3. *Timothy J. Ross, "Fuzzy Logic with Engineering Applications".*
4. *S.N.Sivanandam, S.N Deepa, "Principles of Soft Computing"*


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# OPEN COURSE

*(Offered as Open Course by the Department of Computer Science & IT for the students in 4th semester of other departments of the University)*

| | | | |
|---|---|---|---|
| Course title: | **Problem Solving & Programming in C** | Minor Test 1: | **20 Marks of 1.5 hours duration** |
| Course no: | **PSCSAT0452** | Minor Test 2: | **20 Marks of 1.5 hours duration** |
| No. of credits: | **04** | Major Test: | **60 Marks of 3.0 hours duration** |
| Total marks: | **100** | | |

*For examinations to be held in May- 2023, 2024, and 2025*

**Course Objectives & Learning Outcomes:**

1. The course aims to provide exposure to problem-solving through programming.
2. It aims to train the student to the basic concepts of the C-programming language.
3. To compare the various programming constructs and choose the right one for the task in hand.
4. Choose the right data representation formats based on the requirements of the problem.
5. By learning the basic programming constructs, they can easily switch over to any other language in future.

**UNIT-I Problem Solving & C Basics**

Steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Pseudocode and Flowchart Designing.
History of C, Characteristics of C, Introduction to GCC, compiling, linking and running a C–program, Using MAKE Utility.
C Program Structure, Data Types, Variables and Constants, Printing Out and Inputting Variables, Constants, Type-Casting, Operators and Expressions, Order of Precedence.

**UNIT-II Control Statements & Arrays**

Conditional Statements, Program Loops and Iteration, Library functions. Syntax, semantic, linker, logical and runtime errors.
Single and Multi-dimensional Arrays, Strings, Basic String Handling Functions.

**UNIT-III Functions & Further Data Types**

Functions, Passing Parameters, Recursion, Storage classes. Standard C Preprocessor Directives. Standard Formatted & unformatted I/O Functions;
Defining New Data Types, Structures, Unions, Enumerated Types, Bitwise Operators, Bit Fields.

**UNIT-IV Pointers & Files**

Pointers: Pointer arithmetic, constant void pointers. Dynamic Memory Allocation, Pointers to Pointers, Pointer to array, Array of pointers, Commandline input, Pointers to a Function.
Files Character and Line Based I/O, Formatted I/O, Block I/O, File Positioning.

**UNIT-V File Accessibility & Graphics Programming**

File Accessibility and Directories (access, stat, chmod, chown, chdir, chroot), Process Control: (Running Linux Commands from C, fork(), the exec family, wait(), exit() )
Graphics Programming: OpenGL Basics, OpenGL Utility Toolkit (GLUT), Defining window, Display mode, OpenGL Functions, Primitives (Points, Lines, Polygons) and Attributes, Simple graphics programs.

**Suggested readings/ references:**


5. *B. Kernighan and D. Ritchie, "The ANSI C Programming Language", PHI., 2000.*
6. *Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3rd Edition, 2007.*
7. *Jeri R. Hanly and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 5th Edition 2007.*
8. *Yashwant Kanetkar, "Let us C", BPB Publications, 2002.*
9. *Edward Angel, "OpenGL- A primer", 3rd Edition, Addison-Wesley 2007.*
10. *Kurt Wall, Mark Watson, and Mark Whitis, "Linux Programming Unleashed", SAMS.*
11. *Mark Mitchell, Jeffrey Oldham, and Alex Samuel, "Advanced Linux Programming", New Riders Publishing, 2001.*
12. *Edward Angel, "Interactive Computer Graphics", 5th Edition, Addison-Wesley 2009.*


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