

**DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE,  
SCHOOL OF BASIC SCIENCES  
BABU BANARASI DAS UNIVERSITY, LUCKNOW**

**M. Sc. Computer Science  
(Under Choice Based Credit System)**

**Course Structure & Evaluation Scheme  
(effective from 2020-21)**

Course	Code	Title	Teaching			Evaluation				Credits	
						Theory		Lab/ Seminar/ Viva Voce/ Thesis			Total
			L	T	P	CIA	ESE	CIA	ESE		
<b>SEMESTER – I</b>											
Core	MC1101	Discrete Mathematical Structures	3	1	-	40	60	-	-	100	4
Core	MC1102	Principles of Programming Language	3	1	-	40	60	-	-	100	4
Core	MC1103	Theory of Automata	3	1	-	40	60	-	-	100	4
Core	MC1104	Computer Organization and Architecture	3	1	-	40	60	-	-	100	4
Core	MC1105	Operating Systems	3	1	-	40	60	-	-	100	4
Lab	MC1151	Programming in C Lab	-	-	4	-	-	40	60	100	2
Lab	MC1152	Computer Organization and Architecture Lab	-	-	4	-	-	40	60	100	2
										<b>24</b>	
<b>SEMESTER – II</b>											
Core	MC1201	Design and Analysis of Algorithm	3	1	-	40	60	-	-	100	4
Core	MC1202	Computer Network	3	1	-	40	60	-	-	100	4
Core	MC1203	Object Oriented Programming using JAVA	3	1	-	40	60	-	-	100	4
Core	MC1204	Relational Database Management System	3	1	-	40	60	-	-	100	4
DSE		Discipline Specific Elective-I	3	1	-	40	60	-	-	100	4
Lab	MC1251	Relational Database Management System Lab	-	-	4	-	-	40	60	100	2
Lab	MC1252	Object Oriented Programming using JAVA Lab	-	-	4	-	-	40	60	100	2
Lab	MCS12	Seminar	-	-	-	-	-	100	-	100	1
										<b>25</b>	
<b>SEMESTER – III</b>											
Core	MC1301	Artificial Intelligence	3	1	-	40	60	-	-	100	4
Core	MC1302	Software Engineering	3	1	-	40	60	-	-	100	4
DSE		Discipline Specific Elective – II	3	1	-	40	60	-	-	100	4
DSE		Discipline Specific Elective – III	3	1	-	40	60	-	-	100	4
Lab	MC1351	Artificial Intelligence Lab	-	-	4	-	-	40	60	100	2
Lab	MCP13	Mini Project	-	-	-	-	-	100	-	100	4
										<b>22</b>	
<b>SEMESTER – IV</b>											
Lab	MCP14	Major Project	-	-	-	-	-	50	50	100	20
Lab	MCV14	Comprehensive Viva Voce	-	-	-	-	-	-	100	100	2
										<b>22</b>	

## Discipline Specific Elective Courses, M. Sc. Computer Science

Course	Title	Teaching			Evaluation				Credits	
					Theory		Lab/ Seminar/ Viva Voce/ Thesis			Total
		L	T	P	CIA	ESE	CIA	ESE		
<b>Discipline Specific Elective – I</b>										
MCE1201	Web Technology	3	1	-	40	60	-	-	100	4
MCE1202	Soft Computing	3	1	-	40	60	-	-	100	4
MCE1203	Internet of Things	3	1	-	40	60	-	-	100	4
MCE1204	Distributed Computing	3	1	-	40	60	-	-	100	4
<b>Discipline Specific Elective – II</b>										
MCE1301	Software Project Management	3	1	-	40	60	-	-	100	4
MCE1302	Wireless and Mobile Networks	3	1	-	40	60	-	-	100	4
MCE1303	Operations Research	3	1	-	40	60	-	-	100	4
MCE1304	Information Security and Cryptography	3	1	-	40	60	-	-	100	4
<b>Discipline Specific Elective – III</b>										
MCE1321	Fundamentals Big Data Analysis	3	1	-	40	60	-	-	100	4
MCE1322	Machine Learning	3	1	-	40	60	-	-	100	4
MCE1323	Virtualization and Cloud Computing	3	1	-	40	60	-	-	100	4
MCE1324	Artificial Neural Network	3	1	-	40	60	-	-	100	4

Semester	First		
Course Name	<b>Discrete Mathematical Structures</b>		
Category: Core	Code: <b>MC1101</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module 1: Sets and Mathematical Logic**-Set Theory- Types of sets, Set Operations, Principles of Inclusion Exclusion. Mathematical Propositional Logic, Connectives, Conditional and Bi-conditional, Equivalence of Formula, Well Formed Formula, Tautologies, Duality Law, Functionally Complete Sets of Connectives, Normal Forms, Theory of Inference for the Statement Calculus, **Predicate Calculus**-Statement Functions, Variables and Quantifiers, Free and Bound Variables, Theory of Inference. Predicate Calculus.

**Module II: Functions and Relations**-Functions – Types of Functions, Composition of Functions and Inverse Functions. Relations- Relations and Their Properties, Functions as Relations, Closure of Relations, Composition of Relations, Equivalence Relations and Partitions. Partial Ordering, Hasse Diagram. The Pigeon Hole principle.

**Module III: Lattices and Boolean Algebra**-Lattices and Algebraic Systems, Principles of Duality, Basic properties of Algebraic Systems defined by Lattices, Distributive Lattices and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Boolean Expressions. **Group Theory** – Definition and Elementary Properties- Permutation Groups, Cyclic Groups- Subgroups- Cosets and Lagrange's Theorem, Semi-group and Monoid. Homeomorphism and Isomorphism. Rings, Integral Domains and Fields.

**Module IV: Graph Theory**- Graph Definition, Applications of Graph, Basic Properties of Graph Paths, Cycles and Connectivity, Sub Graphs, Types of Graphs, Representation of Graphs, Graph Isomorphism, Bipartite Graphs, Sub graphs, Eulerian and Hamiltonian Graphs. Trees – Spanning Trees, Cayley's Theorem. Prims and Kruskal's Algorithm – Shortest Path Problem – Dijkstra's Algorithm.

**Text Book:**

1. Kenneth Rosen, Discrete Mathematics and Its Applications, Sixth Edition, McGraw Hill 2006.

**Reference Books:**

1. H. Coremen, C.E Leiserson, R. L Rivest, Introduction to algorithms, 3rd edition Prentice Hall on India, 2009.
2. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms, John Wiley Publication, 1988.
3. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Edition, Jones and Bartlett Publishers, 2009.
4. D.J. Hunter, Essentials of Discrete Mathematics, Jones and Bartlett Publishers, 2008.
5. C.L. Liu, D.P. Mahopatra, Elements of Discrete mathematics, 2nd Edition, Tata McGraw Hill, 1985.

Semester	First		
Course Name	<b>Principles of Programming Language</b>		
Category: Core	Code: <b>MC1102</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Introduction to Problem Solving** -Problem solving Techniques (Trail and Errors, Brain Storming, Divide and Conquer). Steps in Problem Solving (Define Problem, Analyze Problem, Explore Solution). **Algorithm and Flowcharts** - Definition , Characteristics and Symbols, Program, Characteristics of a good Program, Modular Approach, Programming Style, Documentation and Program Maintenance, Compilers and Interpreters , Running and Debugging Programs, Syntax Errors, Run-Time Errors, Logical Errors, Concept of Structured Programming.

**Module II: Introduction to C Programming**-Overview and Importance of C, C Program Structure, Creation and Compilation of C Programs.Character Set, Tokens, Keywords, Identifier, Data Types, Constants, Variables, Data Input and Output.**Operators in C**-Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Special Operators, Precedence and Associativity, Arithmetic Expressions, Type Conversion in Expressions, Mathematical Functions - I/O Operations.

**Module III: Decision making** – IF Statement, IF ELSE Statement, Nesting of IF ELSE, SWITCH Statement, BREAK Statement, CONTINUE Statement, GOTO Statement, Return Statement. **Looping**- WBHILE, DO-WHILE, and FOR Loops, Nesting of Loops, Skipping & Breaking Loops, Arrays, Single Dimension Arrays, Initializing an Array, Accessing Array Elements, Two Dimensional & Multi-Dimensional Arrays, Memory Representation, Strings Processing, String Manipulation Functions.

**Module IV: The Concept of Modularization**–Defining Function, Types of Functions, User Defined Functions, Function Prototype and Definition, Arguments, Passing Parameters, Call by Reference, Call by Value, Nesting of Functions , Recursion , Storage Class, Structures and Unions, **Pointers**: - Pointer operator, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing. Pointer to Pointer, Array of Pointers, Pointer to Function. **Files Handling** - Defining & Opening a file, Closing a File, Input/output Operations on Files.

#### **Text Books:**

1. E Balaguruswamy, Computer Concepts and Programming in C, TataMcGraw Hill Publications
2. Jeri R. Hanly, Elliot B.Koffman, Problem Solving and Program Design in C, Pearson Addison-Wesley.

#### **Reference Books:**

1. R G Dromey, How to Solve by Computer, Pearson Education, Fifth Edition 2007.
2. J.B Dixit, Computer Fundamentals and Programming in C, Laxmi Publications
3. Gottfried, Programming with C, Schaums Outline Series, TMH Publications.
4. Kernighan & Ritchie, C Programming Language.
5. Kanetkar, Let Us C, BPB Publications.

Semester	Second		
Course Name	<b>Theory of Automata</b>		
Category: Core	Code: <b>MC1103</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Languages**-Alphabets, String, Language, Basic operations on language, Concatenation, Kleene Star. Preliminaries, Finite State Systems, Non-deterministic Finite Automata (NFA), Deterministic Finite Automata (DFA), NFA to DFA Conversion, State Minimization Applications.

**Module II: Finite Automata and Regular Languages**-Regular Expressions, Transition Graphs, Deterministic and Non-Deterministic Finite Automata, NFA to DFA Conversion, Regular languages and their relationship with Finite Automata, Pumping Lemma and Closure Properties of Regular Languages. Chomsky Hierarchy, Unrestricted Grammars, Interconversions between Regular Grammars and Finite Automata.

**Module III: Context Free Languages**-Context Free Grammar's, Parse Trees, Ambiguities in Grammars and Languages, Pushdown Automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of Context Free Languages, Normal Forms. Interconversions into the Normal Forms.

**Module IV: Turing Machines and Models of Computation:** Turing Machine as a model of computation, Universal Turing Machine, Language Acceptability, Decidability, Halting Problem, Recursively Enumerable and Recursive Languages, Unsolvability Problems. Universal Turing Machine, Post Correspondence Problem. Decidable and Undecidable Problems, Universal Turing Machine.

**Text Book:**

1. Peter Linz-An Introduction to Formal Languages and Automata - 5<sup>th</sup> Edition.

**Reference Books:**

1. Daviell. A. Cohen- Introduction to Computer Theory- (John Wiley, IInd Edition)
2. Introduction to Languages and Theory of Computation By - John C. Martin (Second Edition TMH)
3. Chandra Sekharan & Misra-Theory of Computation By - PHI
4. Introduction To Automata Theory, Languages & Computation - Je Hopcroft, R. Motwani, JD Ullman (Pearson)
5. Bernard M Moret-The Theory of Computation-Pearson
6. M Sipser-Introduction to Theory of Computation -Thomson

Semester	First		
Course Name	<b>Computer Organization and Architecture</b>		
Category: Core	Code: <b>MC1104</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Register Transfer and Micro Operations-**Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Module. **Basic Computer Organization and Design-**Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

**Module II: Micro programmed Control-** Control Memory, Address Sequencing, Micro Program Example, and Design of Control Module. **Central Processing Module-**Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).

**Module III: Input/output Organization-** Peripheral Devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), and Serial Communication. **Memory Organization-** Memory Hierarchy, Main Memory, Auxiliary Memory, Associate Memory, Cache Memory, and Virtual Memory, Memory Management Hardware.

**Module IV: Overview of Computer Architecture:** Evolution of Computer Systems, Parallelism in Uni-processor System, Parallel Computer Structures, Architectural Classification Schemes, Parallel Processing Applications. A case study of Pentium Processors.

#### **Text Books:**

1. M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008
2. William Stallings, Computer Architecture and Organization, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

#### **Reference Books:**

1. Kai Hwang and Faye A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill, International Edition 1985
2. John. P. Hayes-Computer System Architecture.
3. John L. Hennessy & David A. Patterson Morgan Kufmann, Computer Architecture A quantitative approach 3rd edition (An Imprint of Elsevier).

Semester	First		
Course Name	<b>Operating Systems</b>		
Category: Core	Code: <b>MC1105</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Operating System Overview** - Evolution of Operating System, Types of Operating System, Objectives and Functions of Operating System, Process Description and Control, Process, Creation & Termination of Processes, Process States, Suspended Process, Process Control – Modes of Execution, Process Creation, Processes Vs Threads, Multithreading, Thread States, Types of Threads, Multi-Core and Multi-Threading.

**Module II: Process Management** – System view of Processes and Resources, PCB, Race Condition, Critical Section, Process Interaction, Methods for Inter-Process Communication, Cooperation by Sharing, Mutual Exclusion, Hardware Primitives for Synchronization, Semaphores, Monitors, Message Passing, Synchronization, Classical problems in Synchronization , Producer Consumer Problem, Readers/Writers Problem, Dining Philosophers Problem.

**Module III: Process Scheduling & Memory Management** – Types of Scheduling Algorithms, Pre-emptive and Non-preemptive, FCFS, SJF, Priority, Round Robin, Real Time Scheduling, Characteristics of Real Time OS. Address binding, Logical Vs Physical Address Space, Memory Allocation Strategies, Fixed and Variable Partitions, Concepts of Paging, Segmentation, Virtual Memory, Demand Paging, Page Replacement, Thrashing.

**Module IV: Embedded Operating Systems** - Embedded Systems, Types, and Characteristics of Embedded OS & Applications.**Client/Server Computing** – Definition, Characteristics & Applications.**Deadlock** – Principles, Prevention, Avoidance, Detection and Recovery.

#### **Text Books:**

1. William Stallings, Operating Systems, Internals and Design Principles, Seventh Edition, Pearson.
2. Abraham Silberschatz, Peter Baer Galvin; Greg Gagne, Operating System Concepts, Seventh Edition, John Wiley & Sons, 2004.

#### **Reference Books:**

1. Mukesh Singhal and Niranjana G. Shivaratri, Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems, Tata McGraw-Hill, 2001.
2. Ann McIver McHoes, Ida M. Flynn, Understanding Operating Systems, 6<sup>th</sup> Edition, Cengage Learning, 2010.

Semester	First		
Course Name	<b>Programming in C Lab</b>		
Category: Core	Code: <b>MC1151</b>	Credits: 2	
L-0 T-0 P-4	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

### List of Lab Exercises

1. Write a Program to perform following actions on an array entered by the user:
  - i) Print the even and odd -valued elements.
  - ii) Calculate and print the sum and average of the elements of array.
  - iii) Remove the duplicates from the array.
2. Write a Program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
3. Write a Program to create an array and arrange all its element in ascending order using Bubble Sort technique.
4. Write a Program to create an array and arrange all its element in descending order using selection Sort technique.
5. Write a program to create an array and perform linear search.
6. Write a program to create an array and perform binary search.
7. Write a program that swaps two numbers using pointers.
8. Write a program in which a function is passed address of two variables and then alter its contents.
9. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
10. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() /calloc() functions or new operator.
11. Write a menu driven program to perform following operations on strings:
  - i) Concatenate two strings without using strcat() function.
  - ii) Concatenate two strings using strcat() function.
  - iii) Compare two strings
  - iv) Calculate length of the string (use pointers)
  - v) Convert all lowercase characters to uppercase
  - vi) Calculate number of vowels
  - vii) Reverse the string
12. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
13. WAP to display Fibonacci series (i) using recursion, (ii) using iteration.
14. WAP to calculate Factorial of a number (i) using recursion, (ii) using iteration.
15. Write a menu-driven program to perform following Matrix operations (2-D array implementation):
  - a) Sum b) Difference c) Product d) Transpose.
16. Write a function that checks whether a given string is Palindrome or not.
17. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
18. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
19. Write a program to retrieve the student information from file created in previous question and print it in following format: Roll No. Name Marks.
20. Copy the contents of one text file to another file, after removing all whitespaces.



21. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.
22. Write a program that will read 10 integers from user and store them in an array. Program will print the array elements in ascending and descending order.
23. Write a Program to Create a File & Store Information.
24. Write a C Program to Illustrate Reading of Data from a File.
25. Write a C Program to Append the Content of File at the end of another.

Semester	First		
Course Name	<b>Computer Organization &amp; Architecture LAB</b>		
Category: Core	Code: <b>MC1152</b>	Credits: 2	
L-0 T-0 P-4	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**List of Lab Experiments:**

1. Bread Board Implementation of Flip-Flops.
2. Experiments with clocked Flip-Flop.
3. Design of Counters.
4. Bread Board implementation of counters & shift registers.
5. Implementation of Arithmetic algorithms.
6. Bread Board implementation of Adder and Subtractor (Half, Full).
7. Bread Board implementation of Binary Adder.
8. Bread Board implementation of Seven Segment Display.

Semester	Second		
Course Name	<b>Design and Analysis of Algorithms</b>		
Category: Core	Code: <b>MC1201</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Introduction:** Algorithm Definition and Characteristics, Design and Analysis, Notion of Algorithm, Analysis of algorithms, Designing of Algorithms, Growth of Functions, Master's Theorem, Advanced Design and Analysis Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming: Matrix chain multiplication Problem, Optimal Binary search tree, Knapsack 0/1, Greedy Algorithms: Fractional Knapsack; Amortized Analysis

**Module II: Searching and Sorting:** Internal and External, Sorting Techniques, Elementary sorting techniques – Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques - Heap Sort, QuickSort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques: Linear Search, Binary Search, complexity analysis.

**Module III: Graph Algorithms and Advanced Data Structures:** Terminology, Representation of Graph, Graph Algorithms – Breadth First Search, Depth First Search and Minimum Spanning Trees: Prim's and Kruskal's, Shortest Path: Dijkstra's Algorithm.

**Module IV: Advanced Data Structures:** AVL Tree, Red-Black Trees, Binomial Heaps, Fibonacci Heaps, String Matching: String Matching Algorithms: Naïve, Rabin Karp, KMP.

#### Text Books:

1. Coreman, Rivest, Lisserson, "Algorithm", PHI.
2. Horowitz & Sahani, "Fundamental of Computer Algorithm", Galgotia.

#### Reference Books:

1. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addison Wesley.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, The design and Analysis of Computer Algorithms, Addison Wesley, 1974.
3. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmic, Prentice-Hall of India, 2007.
4. Goodman S E and Hedetniemi, Introduction to the Design & Analysis of Algorithms, TMH - 2002.
5. Horowitz E & Sahni S, Fundamentals of Computer Algorithms, Galgotia Publications Pvt. Ltd, 2004.
6. Sahni, Data Structures, Algorithms and Applications in C++, Tata Mcgraw Hill.

Semester	Second		
Course Name	<b>Computer Networks</b>		
Category: Core	Code: <b>MC1202</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Introduction to Computer Networks** – Introduction, Topology, Categories of Networks, Internetwork, Internet, Network Models, Layered Model, OSI and TCP/IP Models, Transmission Media, Wired and Unwired Media. Computer Networks and Internet, History of Computer Networking and Internet.

**Module II: Application Layer Protocols**– Principles, WWW, HTTP, FTP, TELNET E-mail, SMTP, POP, DNS. **Transport Layer**-Services of Transport Layer, Connection Oriented and Connection-Less Services, TCP, UDP, Connection Establishment, TCP Header, Concept of Socket and Ports.

**Module III: Network Layer:** Services, Introduction, Protocols, Internet Protocol, ARP, RARP, ICMP, IGMP, IP Address, Classes of IP Address, IP Header, Relationship between Transport and Network layer, Routing, **Data Link Layer**- Error Detection and Error Correction Techniques, Data-link control, Framing and Flow control; Error Recovery Protocols- Stop and wait ARQ, Go-back-N ARQ; Point to Point Protocol on Internet.

**Module IV: Link Layer Services** - Error Detection and Correction, Multiple Access Protocols, LAN Address, Ethernet, Hubs, Bridges, Switches, Wireless Links. **Security in Networks**–Principles of Cryptography, Authentication, Integrity Key Distribution and Certification, Firewalls, Attacks and Counter Measures.

#### Text Books:

1. B. A. Forouzan, Data Communications and Networking, Fourth Edition -McGraw-Hill reprint, 2011.
2. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI, 2002

#### Reference Books

1. Computer Network and Internet by Douglas E Comer
2. Peterson L.L. & Davie B .S. Computer Networks, A Systems Approach, 3/E, Harcourt Asia, 2003.

Semester	Second		
Course Name	<b>Object Oriented Programming with JAVA</b>		
Category: Core	Code: <b>MC1203</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: The overview of Java:** Introduction of Java and Object Oriented Programming, Comparison of Java with C and C++, Java Data types, Variables, Literals, Type Conversion and Casting, Operators and Expressions Arrays, Control Statements (if, switch, while, do-while, for, break, continue, return).

**Module II : Introduction to Classes:**Class Fundamentals, Declaring Objects, Introduction of Methods and Constructors, Finalize() Method, This Keyword, Overloading of methods and Constructors, Exploring the String Class,Nested and Inner Classes, Command Line Arguments. Inheritance (basics, use of super keyword, Multilevel Inheritance, Method Overriding, Abstract Classes, Use of Final with Inheritance.).

**Module III: Interfaces Exception Handling and Multithreading-**Packages (defining a package, understanding of Class, Path, Access Protection, Importing packages). Interfaces (Defining an Interface, Implementation, Inheritance in Interfaces). Exception Handling (Fundamentals, Exception Types, Try and Catch, Multiple Catch Clauses, Nested try, Throw, Throws, Finally, Creation of your own exception sub classes).

**Module IV:** Multithreaded Programming (main thread, creating a thread), Implementing Runnable Interface and Extending Thread class, Thread methods.Applets, Basics of AWT and Event Handling. Introduction of Java Beans and Servlets.

**Text Book:**

1. Patrick Naughton and Herbert Schildt - The complete reference Java 2.

**Reference Books:**

1. Ivor Horton, Beginning Java 2 by (Wrox Publication).
2. Mastering Java 2 by BPB Publication.

Semester	Second		
Course Name	<b>Relational Database Management System</b>		
Category: Core	Code: <b>MC1204</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Overview of Database Management:** Data, Information and Knowledge, Increasing use of data as a Corporate Resource, Data processing Versus Data management, File-oriented Approach Versus Database-oriented Approach; Data Independence, Database Administrator & its roles, DBMS Architecture, Different kinds of DBMS users, Importance of Data Dictionary, Contents of Data Dictionary and Types of Database Languages. Data Models: Network, Hierarchical, Relational. Introduction to Distributed Databases.

**Module II: Relational Model:** Entity - Relationship model as a tool for Conceptual Design-Entities Attributes and Relationships. ER diagrams; Concept of keys: Candidate key, Primary key, Alternate key, Foreign key; Strong and Weak Entities, Referential Integrity, ER Modeling Generalization; Specialization and Aggregation.

**Module III: Relational Database Design:** Normalization, Pitfalls in Database Design, Functional Dependencies, Join Dependencies, Normal Forms (1NF, 2NF, 3NF). Boyce-Codd Normal Form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Concepts of Indexes, File Organization for Relational Tables.

**Module IV: Structured Query Language:** Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING...ORDERBY), INSERT, DELETE, UPDATE, VIEW Definition and Use, Nested Queries. Introduction to PL/SQL. **Relational Algebra:** Select, Project, Cross Product, Different types of joins (Inner join, Outer joins, Natural join); Set Operations.

**Text Book:**

1. H. Korth and A. Silberschatz, Database System Concept - Tata Mc. Hill.
2. Evan Bayross –Database concept and systems - Shroff Publishers & Distributors Pvt. Limited, 2009

**Reference Books:**

1. Bipin Desai, An Introduction to Database Systems -2011 ed., Galgotia Publication.
2. A. K. Majumdar & P. Bhattacharya, Database Management System By TMH.
3. James Matin. Data Base Management System By
4. Elmasri & Navathe, Fundamental of Database Systems, Pearson Education, 2010

Semester	Second		
Course Name	<b>RDBMS Lab</b>		
Category: Core	Code: <b>MC1251</b>	Credits: 2	
L-0 T-0 P-4	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

### RDBMS Lab Exercises

1. Consider the following Relational Database Schema and write the SQL statement for query as given below::

**EMP**( Emp\_no, Varchar2(4) Primary key, E\_Name Varchar2(20) , Desig Varchar2(10), Hiredate Date, Sal Number(10,2), Comm Number(8,2), Emp\_age Number(2), Dept\_no Number(2));

**DEPT**(Dept\_no Number(2), Dept\_name Varchar2(10))

- Write a query to create the above tables. Apply appropriate constraints to verify the Emp\_age, must be less than 65 years and greater than or equals to 22 in table EMP.
- Modify table DEPT table and make the Dept\_no as primary key.
- Make dept\_no as foreign key in the EMP table referring the dept\_no of Dept table.
- Write the queries to insert the data in each table.
- Write a query to add one more column in EMP table as Location.
- Write a query to change the salary as Rs. 20000 whose Emp\_no is equals to 1101.
- Display the salary and name of the employee whos salary is not in the range of Rs. 15000 and Rs. 25000.
- List the maximum, minimum, average salary of employees working in department no 30.
- Display sum of salaries in the EMP table for each job.
- Create a view displaying the columns Emp\_no, E\_name, Desig, , Location only.

2. Create the following tables,with constraints:

**(a) SALES\_MASTER**

COLUMN NAME	CONSTRAINT
Salesman_no	Primary key
Sal_name	Not null
Address	Not null
City	
State	
Pincode	
Sal_amt	Not null, cannot be 0
Tgt_to_get	Not null, cannot be 0
Ytd_sales	Not null, cannot be 0
Remarks	

**b) SALES\_ORDER**

COLUMN NAME	CONSTRAINT
S_order_no	Primary/first letter must be 0
S_order_date	Primary key reference clientnoof client_master table
Client_no	

Dely_add	
Salesman_no	Foreign key references salesman_no ofsalesman_master table
Dely_type	Delivery part(p)/full(f),default f
Billed_yn	
Dely_date	Can not be less than s_order_date
Order_status	Values ('in process','fulfilled','back order','canceled

1. Write Sql queries to implement or Joint Multiple Table (Equi Join).
2. Write Sql queries to implement Natural Join.
3. Write Sql queries to implement Cartesian product.
4. Write Sql queries to implement INNER JOIN.
5. Write Sql queries to implement LEFT OUTER JOIN.
6. Write Sql queries to implement RIGHT OUTER JOIN.
7. Write Sql queries to implement FULL OUTER JOIN.
8. Find out the product which has been sold to 'Ivan Sayross.'
9. Find out the product and their quantities that will have do delivered.
10. Find the product\_no and description of moving products.
11. Find out the names of clients who have purchased 'CD DRIVE'
12. List the product\_no and s\_order\_no of customer's having qty ordered less than 5 from the order details table for the product "1.44 floppies".
13. Find the products and their quantities for the orders placed by 'VandanSaitwal' and "Ivan Bayross".
14. Find the products and their quantities for the orders placed by client\_no "C00001" and "C00002"
15. Find the order No., Client No and salesman No. where a client has been received by more than one salesman.
16. Display the s\_order\_date in the format "dd-mm-yy" e.g. "12- feb-96"
17. Find the date, 15 days after date
18. Print the description and total quantity sold for each product.
19. Find the value of each product sold.
20. Calculate the average quantity sold for each client that has a maximum order value of 15000.
21. Find out the products which has been sold to Ivan.
22. Find the names of clients who have 'CD Drive'.
23. Find the products and their quantities for the orders placed by 'Vandana' and 'Ivan'.
24. Select product\_no, total qty\_ordered for each product.
25. Select product\_no, product description and qty ordered for each product.
26. Display the order number and day on which clients placed their order.
27. Display the month and Date when the order must be delivered.
28. Find the product\_no and description of non- moving products.
29. Find the customer name, address, city and pincode for the client who has placed order no "019001".
30. Find the client names who have placed order before the month of may 96.
31. Find out if product "1.44 Drive" is ordered by only client and print the client\_name to whom it was sold.
32. Find the names of client who have placed orders worth Rs.10000 or more.
33. Select the orders placed by 'Rahul Desai'
34. Select the names of persons who are in Mr. Pradeep's department and who have also worked on an inventory control system.
35. Select all the clients and the salesman in the city of Nagpur.



Semester	Second		
Course Name	<b>Object Oriented Programming with JAVA Lab</b>		
Category: Core	Code: <b>MC1252</b>	Credits: 4	
L-0 T-0 P-4	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

### List of Lab Exercises

1. Write a program to access the command line arguments.
2. Write a program to learn use of single dimensional array by defining the array dynamically.
3. Write a program to learn use of length () in case of a two dimensional array.
4. Write a program to convert a decimal to binary number.
5. Write a program to check if a number is prime or not, by taking the number as input from the keyboard.
6. Write a program to find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument.
7. Write a program that show working of different functions of String and String Buffer classes like setCharAt(), setLength(), append(), insert(), concat() and equals().
8. Write a program to create a —distance class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer.
9. Modify the —distance class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
10. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type)
11. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword.
12. Write a program to show the use of static functions and to pass variable length arguments in a function.
13. Write a program to demonstrate the concept of boxing and unboxing.
14. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).
15. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
16. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
17. Write a program —Divide by Zero that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
18. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
19. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of throwable).
20. Write a program to demonstrate priorities among multiple threads.
21. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
22. Write a program to create URL object, create a URLConnection using the openConnection() method and then use it examine the different components of the URLand content.
23. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.

24. Write a program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet's window.
25. Write a program to get the URL/location of code (i.e. java code) and document (i.e. html file).

Semester	Second		
Course Name	<b>Web Technology</b>		
Category: DSE-I	Code: <b>MCE1201</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Introduction to Web Programming** – Introduction to SGML features , HTML,XHTML, DHTML, XML, HTML Vs XML, Creating XML documents , Parsing an XMLdocument.Overview of HTML, Basic Formatting Tags, Navigation Links using AnchorTag, Lists ordered, Unordered and definition, IMG, Table Tag, HTML **Form controls** - Form,Text, Password, Textarea, Button, Checkbox, Radio button, Select box, Hidden controls,Frameset and frames. CSS.

**Module II: Client Server Architecture for the web.** Client Side Programming – Introduction, Java Script - Introduction, Identifiers, Operators, Functions, Event Handling, Array, Math, String, Window Object, Navigator DHTML Font, Text,Image change, JavaScript’s Object Model; Strengths and Weaknessesof JavaScript; Introduction to Cookies; Using Cookies inJavaScript & Storing user’s choices in Cookies, Object Oriented Programming in Java Script.

**Module III: Web Server** –Role, Apache Web Server ,Introduction , Architecture ,Features , Apache's Role in the Internet ,WAMP , Installation andConfiguration , Build and Install Apache, Apache's Role in theDynamic Web , Server Side Includes (SSIs) , Configure Apache Web Server to Support CGI, CGI Alternative Technologies. Virtual Hosts, Redirection, Indexing, VirtualHosting with Apache, Virtual Host Configuration Redirection, Directory Indexing. ProxyServers and Firewalls, Apache Proxy Configuring, Proxy Services Firewalls and Apache, Server Side Scripts, PHP Designing DynamicWeb Pages using PHP, Defining, PHP variables, Variable types, Operators, Control-flow Constructs in PHP.

**Module IV: Server side Programming,-**Passing form data between pages in PHP,Managing MySQL Database, Establishing Connectionof PHP scripts with MySQL Database.Overview of Content Management System, Coding for Reusability, User Management, Article Publishing ,and Additional CMS features, Website development using Joomla.

**Text Book:**

1. Thomas A. Powell, the Complete Reference HTML

**References:**

1. E. Stephen Mack & Janan Platt, HTML 4.0 - No experience required.
2. Robert W. Sebesta, Programming with World Wide Web, 4th edition, PearsonEducation, 2009.
3. Xue Bal et. al, The Web Warrior Guide to Web programming, Thomson Learning.
4. Chris Bates, Web Programming: Building Internet Applications, 3rd ed, Wiley Academic Catalog.

Semester	Second		
Course Name	<b>Soft Computing</b>		
Category: Core	Code: <b>MCE1202</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I:** Introduction - Introduction to Statistical , Syntactic and Descriptive Approaches features and feature extraction , Learning , Bayes Decision Theory, Introduction Continuous Case–2, Category Classification, Minimum Error Rate Classification, Classifiers , Discriminant functions and Decision surfaces, Error Probabilities and Integrals, Normal Density , Discriminant functions for normal density.

**Module II:** Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues, Systems.

**Module III:** Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Back-propagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets and Applications of Neural Network.

**Module IV:** Introduction to Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering, Advanced Topics - Support Vector Machines, Evolutionary Computation (EC), Evolutionary Algorithms, Harmony Search, Swarm Intelligence.

**Text Book:**

1. J.S.R. Jang, C.T.Sun and E. Mizutani, Neuro-Fuzzy and Soft Computing, Pearson Education, 2004.

**References:**

1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.
2. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3. S. V. Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, IEEE Press - PHI, 2004.
4. S. Rajasekaran & G. A. Vijaya Lakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI, 2003.

Semester	Second		
Course Name	<b>Internet of Things</b>		
Category: Core	Code: <b>MCE1203</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Introduction to Internet of Things** –Definition and Characteristics of IoT, Physical Design of IoT. IoT Protocols, IoT Communication Models, IoT Communication APIs, IoT Enabled Technologies, Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs, Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

**Module II: IoT and M2M-** Software Defined Networks, Network Function Virtualization, Difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG, NETCONF, YANG, SNMP NETOPEER.

**Module III: Programming with Python-** Language features of Python, Data Types, Data Structures, Control of flow, Functions, Modules and Packaging, File Handling, Data/time Operations, Classes, Exception Handling. Python Packages, JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

**Module IV: IoT Physical Devices and Endpoints-** Introduction to Raspberry PI, Interfaces (serial, SPI, I2C). Programming – Python Program with Raspberry PI with focus of Interfacing External Gadgets, Controlling Output, Reading Input from Pins. **IoT Physical Servers and Cloud Offerings-** Introduction to Cloud Storage Models and Communication APIs. Webserver, Web Server for IoT, Cloud for IoT, Python Web Application Framework. Designing a RESTful Web API.

**TEXT BOOKS:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547 2.

**Reference Books:**

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: : 9789350239759

Semester	Second		
Course Name	<b>Distributed Computing</b>		
Category: Core	Code: <b>MCE1204</b>	Credits: 4	
L-3 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

**Module I: Distributed Computing System** - Introduction to Distributed Computing Systems, Examples, Trends, Design challenges, System Models, Networking and Internetworking, Inter Process Communication, Remote Invocation.

**Module II: OS Support** – Introduction, OS Layer, Protection, Processes and Threads, Communication, Invocation, Architecture. Distributed File System, File Service Architecture, Sun Network File System.

**Module III: Distributed Objects and Components-** CORBA, Object to Components, Enterprise Java Beans and Fractals, Peer-to-Peer Systems, Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

**Module IV: Web Services-** Service Descriptions and IDL for Web Services, A Directory Service for use with Web Services, XML Security, Coordination of Web Services, Applications of Web Services. Introduction, Overview of Security Techniques, Cryptographic Algorithms, Digital Signatures, Needham, Schroeder, Kerberos, TLS, 802.11 WiFi2.

**Text Book:**

1. George Coulouris, Jean Dollimore , Tim Kindberg , Gordon Blair, “ Distributed Operating Systems Concepts and Design”, 5th Ed, Addison Wesley, 2012

**Reference Books:**

1. A. S. Tanenbaum , “Distributed Operating Systems “ , Pearson, 2009.
2. ShubhraGarg , “Fundamentals of Distributed Operating Systems” , S.K. Kataria& Sons, 2013.