



COMPUTER SCIENCE STREAM – I SEMESTER

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Core Course – I (CC)	Programming in Java	5	4	3	25	75	100
	Core Course – II (CC)	Database Systems	5	4	3	25	75	100
	Core Course – III (CC)	Data Structures and Algorithms	5	4	3	25	75	100
	Core Course – IV (CC)	Mathematical Foundations	5	4	3	25	75	100
	Core Elective – I (CE)		4	4	3	25	75	100
	Core Practical – I (CP)	Programming in Java	3	2	3	40	60	100
	Core Practical – II (CP)	RDBMS	3	2	3	40	60	100
	Total		30	24	-	-	-	700

**MANDATORY BRIDGE COURSE FOR STUDENTS OF
NON-COMPUTER SCIENCE STREAM – 1st SEMESTER**

Semester	Bridge Courses	Bridge Courses Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Bridge Course – I (BC)	Programming in C and C++		4	3	25	75	100
	Bridge Course – II (BC)	Information Technology		4	3	25	75	100
	Bridge Practical – I (BP)	Software Lab: Programming in C and C++		2	3	40	60	100
		Total		10	-	-	-	300

COMPUTER SCIENCE STREAM – II SEMESTER

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
II	Core Course – V (CC)	Accounting and Financial Management	5	4	3	25	75	100
	Core Course – VI (CC)	Operating Systems	5	4	3	25	75	100
	Core Course – VII (CC)	Distributed Technologies	5	4	3	25	75	100
	Core Course – VIII (CC)	Programming in Python	5	4	3	25	75	100
	Core Elective – II (CE)		4	4	3	25	75	100
	Core Practical – III (CP)	Distributed Technologies	3	2	3	40	60	100
	Core Practical – IV (CP)	Programming in Python	3	2	3	40	60	100
	Total		30	24	-	-	-	700

**MANDATORY BRIDGE COURSE FOR STUDENTS OF
NON-COMPUTER SCIENCE STREAM – 2nd SEMESTER**

Semester	Bridge Courses	Bridge Courses Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
II	Bridge Course – III (BC)	Web Design		4	3	25	75	100
	Bridge Course – IV (BC)	Introduction to Internet		4	3	25	75	100
	Bridge Practical – II (BP)	Software Lab: Web Design		2	3	40	60	100
		Total			10	-	-	-

COMPUTER SCIENCE STREAM – III SEMESTER

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
III	Core Course – IX (CC)	Programming Smart Devices	5	4	3	25	75	100
	Core Course – X (CC)	Compiler Design	5	4	3	25	75	100
	Core Course – XI (CC)	Principles of Data Science	5	4	3	25	75	100
	Core Course – XII (CC)	Organisational Behaviour	5	4	3	25	75	100
	Core Elective – III (CE)		4	4	3	25	75	100
	Core Practical – V (CP)	Software Lab: Programming Smart Devices	3	2	3	40	60	100
	Core Practical – VI (CP)	Software Lab: R – Programming	3	2	3	40	60	100
		Total		30	24	-	-	-

**MANDATORY BRIDGE COURSE FOR STUDENTS OF
NON-COMPUTER SCIENCE STREAM – 3rd SEMESTER**

Semester	Bridge Courses	Bridge Courses Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
III	Bridge Course – V (BC)	Open Source Technologies		4	3	25	75	100
	Bridge Course – VI (BC)	Internet Programming		4	3	25	75	100
	Bridge Practical–III (BP)	Software Lab: PHP and MySQL		2	3	40	60	100
		Total			10	-	-	-

COMPUTER SCIENCE STREAM – IV SEMESTER

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
IV	Core Course – XIII (CC)	Internet of Things	5	4	3	25	75	100
	Core Elective – IV (CE)		4	4	3	25	75	100
	Project Work	Dissertation=100 Marks [2 reviews -20+20=40 marks Report Valuation = 40 marks] Viva = 20 Marks	-	10	-	-	-	100
		Total		9	18	-	-	-

List of Elective Courses (For 2020–21)

Core Elective I		Core Elective II	
A.	Digital Computer Fundamentals	A.	Probability and Statistics
B.	Computer Organization and Architecture	B.	Resource Management Techniques
C.	Software Engineering	C.	Theory of Computation
Core Elective III		Core Elective IV	
A.	Big Data Analytics	A.	Software Project Management
B.	Computer Network and Security	B.	Artificial Intelligence and Machine Learning
C.	Cloud Computing	C.	Soft Computing

COMPUTER SCIENCE STREAM

Core Course – 13
 Core Elective – 04
 Core Practical – 06
 Major Project – 01

NON-COMPUTER SCIENCE STREAM

Core Course – 13
 Core Elective – 04
 Core Practical – 06
 Major Project – 01
 Bridge Course – 06
 Bridge Practical – 03

CORE COURSE – I (CC)

PROGRAMMING IN JAVA

Objectives:

On completion of the course the student will be able to understand and explain the purpose of Object Oriented Programming concepts; understand the applicability of Packages, Interfaces and write simple Applets in Java; design User Interfaces using SWING Components and able to handle errors in programs; develop Threaded applications and perform Data Access using JDBC; develop distributed applications using RMI, Servlets and Cookies

Unit - I: Classes And Objects: General Form of A Class - Creation of Objects - Usage of Constructors - 'this' Keyword- Constructor Overloading-Copy Constructors-Static Data Members - Static Methods- Finalize Method. INHERITANCE AND POLYMORPHISM: Inheriting Variables in a Class - Inheriting Methods in a Class - Inheritance And Constructors – Abstract Classes - Final Classes.

Unit - II: Interfaces And Packages: Interfaces-Structure of an Interface - Implementation of an Interface - Interface Inheritance. Packages - Placing the Classes in a Package - Package Hierarchy - Access Control Modifiers. APPLET: The Life Cycle of an Applet -The Applet Class – Development and Execution of a Simple Applet - Syntax Of Applet Tag- Methods in the Graphic Class.

Unit - III: Swing: JApplet class - Icons - JLabel Control - JOptionPane Class – JTextField Control - JButton Control - JCheckBox Control - JRadioButton Control Menus. EXCEPTION HANDLING: Default Exception Handling – Exception and Error Classes - Catch Block Searching Pattern - Custom Exceptions. I/O STREAMS: Text And Binary Formats of Data - Input Stream and Output Stream Classes - Reader and Writer Classes - Data Output Stream and Data Input Stream Classes.

Unit - IV: Threads: Life Cycle Of A Thread - Creating And Running Threads – Method In The Thread Class - Setting The Priority Of A Thread - Synchronization. NETWORKING:TCP Server Socket Class - TCP Socket Class.JAVA DATABASE CONNECTIVITY: Establishing a Connection - Creation Of Data Tables Entering Data Into The Tables - Table Updating.

Unit - V: Remote Method Invocation: Remote Interface-Java.Rmi. Server Package The Naming Class - Creating RMI Client And Server Classes. SERVLET: Servlet and Dynamic Webpages Life Cycle of a Servlet a Simple Servlet Javax. Servlet Package Retrieving the Values Of Parameters. COOKIES : Creating a Cookie and Sending it to the Client - Retrieving the Stored Cookies.

Text book(s):

1. C. Muthu, Programming with JAVA, Vijay Nicole Imprints Pvt Ltd, 2nd Ed, Chennai, 2011.

Books for Reference :

1. Herbert Schildt, "Java 2: Complete Reference", Tata McGraw Hill, 5thEd., 2009.
2. Cay Horstmann, "Big Java", John Wiley & Sons, Inc., 4th Ed., 2010.
3. Sagayaraj, Denis, Karthik and Gajalakshmi, "Java Programming - for Core and Advanced Users", Universities Press, Hyderabad, 2017.

Outcomes:

The students will be able to work efficiently in the following areas. Object Oriented Programming, Packages, Interfaces and write simple Applets in Java, design User Interfaces using SWING Components and able to handle errors in programs, develop Threaded applications and perform Data Access using JDBC and develop distributed applications using RMI, Servlets and Cookies.

CORE COURSE – II (CC)

DATABASE SYSTEMS

Objectives:

On completion of the course the student will be able to understand the workings of a relational database system, develop E-R diagrams, and normalize data; write SQL queries to access data; normalize the data up to BCNF; write PL/SQL routines to process the data in the database; implement concurrency and parallelism in a database.

Unit – I: Introduction: Database System Applications – Database Systems vs File Systems – View of data – Data Models – Database Languages – Database Users and Administrators – Transaction Management – Database System Structure – Application Architectures. **Entity – Relationship model:** Basic Concepts – Constraints – Keys – Entity – Relationship Diagram – Weak entity Sets – Extended E–R Features. **Relational Model:** Structure of Relational Database – Relational Algebra–Extended Relational Algebra Operations.

Unit – II: Integrity and security: Domain Constraints Referential Integrity – Assertions – Security and Authorization – Authorization in SQL – Encryption and Authentication. **Relational Database Design:** First Normal Form – Pitfalls in Relational Database Design – Functional Dependencies – Decomposition – Desirable Properties of Decomposition – Boyce-Codd Normal Form – Third Normal Form – Fourth Normal Form – More normal Forms .

Unit – III: Storage and File Structure: RAID – File Organization – Organization of Records in Files – Dictionary Storage. **Indexing and Hashing:** Basic Concepts – Ordered Indices – B+ – Tree Index Files – Static Hashing – Dynamic Hashing.

Unit - IV: Transaction Management: Transactions Concept – Transaction state – Implementation of Atomicity and Durability – Concurrent Executions–Serializability –**Concurrency control:** Lock Based Protocols – Timestamp Based Protocols – Validation Based Protocols – **Recovery system:** Failure classification – Storage Structure – Recovery and Atomicity – Log Based Recovery–Shadow Paging.

Unit – V: Introduction to Oracle: Classification of SQL Commands – Data Types – Operators – Built in functions – Sorting – Joins – Special Operators: Set Operators. **Indexing:** Removing Index – Creating Index on Multiple Columns. **Views:** Creating and Accessing – Classification of Views. **PL/SQL:** Introduction – Advantages of PL/SQL – Structure of PL/SQL Block – Conditional Statement – Stored Functions: Structure of Function – Compiling a Function – Calling a Function. **Stored Procedures:** Advantages of Procedures – Why Called “Stored Procedures”? – Differences between Procedures and Functions – Compiling a Procedure – Executing a Procedure. **Cursors:** What is

Cursor? – Purpose of Cursors – Classification of Cursors. **Database Triggers:** Components of Trigger–Types of Triggers.

Books for Study:

1. Abraham Silberchatz, Henry F. Korth and S. Sudharshan,“Data Base System concepts” McGraw Hill, Fifth Edition, 2006.
2. Satish Asnani, “Oracle Database 11g –Hands–on SQL and PL/SQL”, PHI Learning, 2010.

Books for Reference:

1. C.J. Date, A. Kannan, S. Swamynathan, “Introduction to Database Systems”, Pearson Education, Eighth Edition 2006.
2. Ramez Elmasri, “Fundamentals of Database Systems”, Pearson Education, 2008.

Outcomes:

Excellent understanding of basic concepts of database systems and fundamental relational algebraic operations. Explain, Apply SQL queries, Create ER model for any database applications. Explain the normalization techniques, compare the file organization techniques; compare Indexing & Hashing techniques and Discuss the concepts of Transaction and Concurrency control.

CORE COURSE – III (CC)

DATA STRUCTURES AND ALGORITHMS

Objectives:

Understand the basics of Data Structures and its applications. Apply the real time applications in Linear Data Structures. Analyze the different types of Trees and its basic operations. Evaluate the various types of algorithms in finding the complexities of the algorithms. Analyze and design algorithms for various applications.

Unit – I: Linear Data Structures: Concepts Of Non-Primitive Data Structures - Storage Structure For Arrays - Stacks - Operations On Stacks - Queues - Priority Queues.

Unit – II: Linked Linear Lists: Operations On Linked Linear Lists - Circularly Linked Lists - Doubly Linked Linear Lists. **Non-Linear Data Structure:** Trees - Binary Trees –Tree Traversal - Operations On Binary Trees - AVL Trees - Storage Representation And Manipulations Of Binary Trees..

Unit - III: Algorithms: Algorithm Specification - Pseudo Code Conventions, Recursive Algorithms. **Divide And Conquer:** General Method - Sequential Search - Binary Search - Finding The Maximum And Minimum - Merge Sort-Quick Sort- Insertion Sort - Selection Sort.

Unit - IV: (a) **Greedy Method:** General Method - Knapsack problem - Job Sequencing With Deadlines - Optimal Merge Patterns – Spanning Tree - Minimum Cost Spanning Trees. (b) **Algorithm Design Methods:** Sub goals - Hill Climbing and Working Backward - Heuristics - Backtrack Programming - Branch and Bound.

Unit – V: Dynamic Programming: General Method - Multistage Graphs – Single-Source Shortest Paths: General Weights - All Pair Shortest Path - Optimal Binary Search Trees - 0/1 Knapsack - Travelling Salesperson Problem.

Text Books:

1. Jean-Paul Tremblay and Paul G. Sorenson, “An introduction to data structures with applications”, 2nd Ed, Tata McGraw Hill Publishing Company Limited, New Delhi, 1995. Units I and II.
2. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Computer Algorithms”, Galgotia Publications, New Delhi, 2007. Units III, IV(a) and V.
3. S.E. Goodman and S.T. Hedetniemi, “Introduction to the Design and Analysis of Algorithms”, Tata McGraw Hill, International Edition, 1987. Unit: IV(b).

Reference Books:

1. An Introduction to Data Structures and Algorithms, James A Store, Springer Science, 2012.
2. Data Structures and Algorithms made easy, Narasimha Karumanchi, Create Space Independent Publishing Platform, 2011.
3. Data Structures Using C - Langsam, Augenstein, Tenenbaum, PHI
4. Data structures and Algorithms, V. Aho, Hopcroft, Ullman , LPE
5. Introduction to Design and Analysis of Algorithms - S.E. Goodman, ST.Hedetniemi- TMH

Outcomes:

Understand the fundamentals of Data Structures and basic concepts of String Processing, Linear Arrays. Analyze the representation of Linked Lists in memory, Stack, Queues and implement real time applications in Stack and Queues. Explore the structure of Trees, basic operations of Trees, analyze and illustrate the algorithms. Analyze the various algorithm designs and implementations. Develop solutions using advanced algorithms for various kinds of problems.

CORE COURSE – IV (CC)

MATHEMATICAL FOUNDATIONS

Objectives:

To provide the basic knowledge of mathematics so as to enable them to apply in designing appropriate algorithms and mathematical models to solve problems. Understand sets, relations, relations, functions, and discrete structure and know the properties of lattices and Boolean Algebra. Ability to apply mathematical logic to solve problems and apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

Unit – I: Set: Definition- Inclusion and Equality of sets– Power set– Operations on Set– Ordered pairs and n-tuples – Cartesian products. **Relation:** Definition – Properties – Relation Matrix – Graph of a Relation – Partition and covering of a set – Equivalence relation – Compatibility relations – Partial ordering. **Functions:** Definition – Composition of function – Inverse functions – Binary and n-ary Operations – Characteristic Function of a Set – Hashing Function.

Unit – II: Propositions : Fully parenthesized propositions – Evaluation of constant propositions – Evaluation of propositions in a state – Precedence rules for operators – Tautologies – Propositions as sets of states – Transforming English sentence to propositional form – Laws of Equivalence – Rules of substitution and Transitivity.

Unit – III: A formal system of Axioms and inference rules : Introduction to deductive proofs – Inference rules – Proofs and subproofs– Developing Natural deduction proofs.

Unit – IV: Graph: Basic Terminology – Multigraphs and weighted graphs – Paths and Circuits – Shortest paths in weighted graph – Euler graph – Hamiltonian Paths and circuits. **Tree:** Definition – Rooted trees – Path Lengths – Prefix codes – Binary Search Trees – Minimum Spanning Trees.

Unit – V: Manipulation of Numeric functions : Numeric functions– Generating functions –Recurrence Relation – Liner Recurrence Relations with constant coefficients – Homogeneous solutions – Particular solutions – Total solutions – Solution by the method of generating functions – Sorting algorithms.

Text books:

1. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill.[Unit I]

2. David Gries, 'The Science of Programming' Narosa Publishing House, 1981 [**Units II&III**]
3. C.L. Liu, Elements of Discrete Mathematics, Second Edition, Tata McGraw-Hill book Company [**Units IV and V**]

Reference books:

1. Gersting J.L., Mathematical Structure for Computer Science, 3rd Edition W.H. Freeman and Co.,
2. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.
3. Leon S. Levy, 'Discrete structures of Computer Science', Wiley Eastern Ltd., 1980.

Outcomes:

Learners would be able to apply the mathematical knowledge in designing appropriate algorithms and mathematical models to solve problems. Understand sets, relations, relations, functions, and discrete structure and know the properties of lattices and Boolean Algebra. Would have gained the ability to apply mathematical logic to solve problems and apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

CORE ELECTIVE – I (CE)

A: DIGITAL COMPUTER FUNDAMENTALS

Objectives:

Apply digital number conversion from decimal to binary, octal, hexadecimal and vice versa. Use logic gates and evaluate the Boolean expressions using Karnaugh maps. Evaluate the combinational circuits and to apply them in digital circuits. Construct the sequential circuits using Flip Flops and evaluate them using truth tables Distinguish the technical specifications and applications of RAM and ROM.

Unit – I: Digital Logic: The Basic Gates-NOT, OR, AND - Universal Logic Gates- NOR, NAND - AND-OR-Invert Gates. Combinational Logic Circuits: **Boolean Laws and Theorems** - Sum-of-Products Method - Truth Table to Karnaugh Map - Pairs, Quads, and Octets - **Karnaugh Simplifications** - Don't-care Conditions - Product-of-sums Method - Product-of-sums Simplification.

Unit – II: Data-Processing Circuits: Multiplexers - Demultiplexers - 1-of-16 Decoder - BCD-to-decimal Decoders - Seven-segment Decoders - Encoders - Exclusive-OR Gates. **Number Systems and Codes:** Binary Number System - Binary-to-decimal Conversion - Decimal-to-binary Conversion- Octal Numbers - Hexadecimal Numbers - The ASCII Code - The Excess-3 Code - The Gray Code.

Unit – III: Arithmetic Circuits: Binary Addition - Binary Subtraction - Unsigned Binary Numbers - Sign-magnitude Numbers - 2's Complement Representation - 2's Complement Arithmetic- Arithmetic Building Blocks - The Adder-subtractor - Arithmetic Logic Unit - Binary Multiplication and Division. **Flip-Flops:** RS FLIP-FLOPs - Gated FLIP-FLOPs - Edge-triggered RS FLIP-FLOPs – Edge triggered D FLIP-FLOPs - Edge-triggered JK FLIP-FLOPs - JK Master-slave FLIP-FLOPs.

Unit – IV: Registers: Types of Registers - Serial In-serial Out - Serial In-parallel Out - Parallel In-serial Out - Parallel In-parallel Out - Universal Shift Register - Applications of Shift Registers. **Counters:** Asynchronous Counters - Decoding Gates - Synchronous Counters.

Unit-V: Memory: Basic Terms and Ideas - Magnetic Memory - Optical Memory - Memory Addressing - ROMs, PROMs, and EPROMs - RAMs-Virtual Memory-Cache Memory.

Books for Study:

1. Donald P. Leach and Albert Paul Malvino, “Digital Principles and Application”, Seventh Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011.

Books for Reference:

1. Thomas C. Bartee, “Digital Computer Fundamentals”, McGraw-Hill International Edition, New Delhi, 1985.
2. Morris Mano and Michael D Ciletti, “Digital Design”, 4th Edition, Pearson publications, 2008.

Outcomes:

Capability to apply digital number conversion from decimal to binary, octal, hexadecimal and vice versa; Use logic gates and evaluate the Boolean expressions using Karnaugh maps; Ability to evaluate the combinational circuits and to apply them in digital circuits; Construct the sequential circuits using Flip Flops and evaluate them using truth tables Distinguish the technical specifications and applications of RAM and ROM.

CORE ELECTIVE – I (CE)

B: COMPUTER ORGANIZATION AND ARCHITECTURE

Objectives:

To provide knowledge about various types of data, types and working of flip-flops, CPU and its inner details of how CPU works by instructions; ideas about variety of memory modules and how they work, I/O processing and about interrupts and their use.

Unit – I: Data representation-Data types-Logic gates-Flip flops-Functional Units of a PC- Basic operational concepts

Unit – II: CPU registers- Counters-Register transfer-Instruction formats- System buses- Addressing modes- Instruction cycle.

Unit - III: Processing unit- Design of a Simple CPU- Fetching Instructions-branching-Design of a control unit-multiple buses in CPU-Micro program-Micro sequencer.

Unit – IV: Memory-Memory hierachy-Speed-Size-RAM-ROM-Cache memory-HIT Ratio-Multilevel organization of Cache memory.

Unit – V: Input -Output operations-Accessing Input-Output devices-Asynchronous data transfers-Handshaking-Programmed Input -Output -Polling-Interrupts- Types of Interrupts-Processing Interrupts-Priority-Interrupt hardware.

Text book(s):

1. M. Morris Mano. 'Computer System Architecture', Third edition, Pearson education.
2. John. P. Hayes, 'Computer Architecture and organization', Fourth edition, McGraw Hill publishers.
3. Carpinelli, John.D, 'Computer system organization and Architecture', Pearson education.

Book(s) for Reference:

1. Carl Hamacher, Vranesic, Zaky," Computer organization", Fourth edition, McGraw Hill publishers.

Outcomes:

Students would have gained knowledge about various types of data, types and working of flip-flops, CPU and its inner details of how CPU works by instructions; ideas about variety of memory modules and how they work, I/O processing and about interrupts and their use.

CORE ELECTIVE – I (CE)

C: SOFTWARE ENGINEERING

Objectives:

To acquire knowledge in various software development models, Extract and analyze software requirements specifications for different projects; Develop skills in basic architecture/design and apply standard coding practices; Ability to define the basic concepts and importance of software project management concepts like cost estimation, scheduling and reviewing progress; Identify and implement of the software metrics; Apply different testing and debugging techniques and analyzing their effectiveness; Critically analyse and provide; recommendations to improve the operations of the development of the project; Demonstrate the need for appropriate decision making, control and performance evaluation of a project.

Unit – I: Software Product and Process – Role of Software – Software – software myths - Software process – Software process models – Linear sequential model – Prototyping model – RAD Model - Evolutionary software process models – Incremental model – Spiral Model – Win WIN spiral model – concurrent model - format method models – fourth generation techniques – process technology

Unit – II: Software Project Planning – Project Planning Objectives – Software Scope – Resources – Software project estimation – Decomposition techniques – Empirical Estimation Techniques – Software Risk Analysis – Software Risk – Risk Identification – Risk Projection – Risk Refinement – Risk Mitigation – Software Quality Assurance – Quality concepts – SQA activities – Software reviews – Formal technical reviews – Approaches to SQA – Software Reliability – SCM Process – version control – change control – SCM standards.

Unit – III: Design concepts and principles – Design Process – Design Principles – Design Concepts – Effective Modular Design – Design Model – Design Documentation – Architectural Design – Software Architecture – Data Design – Architectural styles – Architectural Design – Mapping requirements – Transform Mapping – Transaction Mapping – User Interface Design – Interface Design activities.

Unit – IV: Software Testing Techniques – Testing Objectives – Principles – Testability – Test case Design – White-Box Testing – Basis path Testing – Control structure Testing – Black-Box Testing – Software Testing Strategies – Strategic approach – Strategic issues – Integration Testing – Validation Testing – System Testing – Art of Debugging.

Unit – V: Component –Based Software Engineering – CBSE process - Domain Engineering – Component-Based development – Economics of CBSE – Client / Server Software Engineering - Structure of Client/Server system – Design for

C/S system – Web Engineering – Attributes of Web-Based applications – Framework of WebE – Design of WebE.

Text Books:

1. Roger S. Pressman, “Software engineering- A practitioner’s Approach”, McGraw-Hill International Edition, 5th edition, 2001.
2. Ian Sommerville, “Software engineering”, Pearson education Asia, 6th edition, 2000.
3. Richard E. Fairley, “Software Engineering Concepts “, McGraw-Hill edition, 2002.

Reference Book:

1. Jibithesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, 2011.

Outcomes:

Students would have acquired knowledge in various software development models, Capable of extracting and analyzing software requirements specifications for different projects; Develop skills in basic architecture/design and apply standard coding practices; Ability to define the basic concepts and importance of software project management concepts like cost estimation, scheduling and reviewing progress; Identify and implement of the software metrics; Apply different testing and debugging techniques and analyzing their effectiveness; Critically analyse and provide; recommendations to improve the operations of the development of the project; Demonstrate the need for appropriate decision making, control and performance evaluation of a project.

CORE PRACTICAL – I (CP)

PROGRAMMING IN JAVA

Objectives:

To provide hands on training to solve real world problems using OOP techniques; design GUI based applications using SWING; to develop Applets and Servlets for distributed web applications, to perform Database Operations using JDBC, to design and Develop a Java Application for real time environment.

1. Classes & Objects
2. Inheritance & Polymorphism
3. Packages & Interfaces
4. Applet & Swing
5. Exception Handling
6. I/O Streams
7. Multithreading
8. Networking & JDBC
9. RMI
10. Servlets
11. Cookies
12. JDBC

Outcomes:

The learners would have had training in solving real world problems using OOP techniques; design GUI based applications using SWING; to develop Applets and Servlets for distributed web applications, to perform Database Operations using JDBC, to design and Develop a Java Application for real time environment.

CORE PRACTICAL – II (CP)

RDBMS

Objectives:

To impart knowledge of creating tables with all possible integrity constraints; Write complex SQL queries; Generate reports by using SQL plus commands; Use cursors, functions, procedures, packages and triggers in the back end; Design and Develop forms to interact with the database

1. SQL – Data Definition Language

1.1 Table Creation with Constraints

1.2 Table Alteration (Add Column, Modify the size and data type, Drop Column)

1.3 Drop Table

2. SQL – Data Manipulation Language

2.1 Data Insertion

2.2 Data Updating

2.3 Data Deletion

2.4 Ordering Tuples

2.5 Tuple Variable

2.6 Pattern Matching

2.7 Build-in Function

2.8 Set Operations

2.9 Join Operations

2.10 Nested Subqueries Views

3. PL/SQL

3.1 Reverse the string.

3.2 Delete any record and count it.

3.3 Student Mark Sheet Preparation

3.4 Pay Roll preparation.

3.5 Excess record stored in separate files.

3.6 Split a table in to two tables.

3.7 Joining two tables in to one table.

3.8 Find factorial number using recursive function.

3.9 Find Fibonacci series using recursive function.

4. SQL Forms

4.1 Student Mark System

4.2 Pay Roll Preparation

4.3 Income Tax Calculation

4.4 Train Reservation System

Outcomes:

On completion of the course the student will be able to create tables with all possible integrity constraints; write complex SQL queries; generate reports by using SQL plus commands; use cursors, functions, procedures, packages and triggers in the back end; design and Develop forms to interact with the database

BRIDGE COURSE – I (BC)

PROGRAMMING IN C AND C++

Objectives:

To provide knowledge of basics elements of C and C++ languages, their specifications, functions, passing of parameters, control constructs; Special features of C language such as Structures and Unions, Pointers and types of files and processing them; Classes and objects in C++ language and the features of C++ and to use them effectively to solve problems.

Unit – I: History, Execution of C Program, Constants, Variables and Keywords, Data types, Expressions, constants, variables, Operators, Operator Precedence and associativity, data input and output, Formatted Console I/O Functions, Conversion Specifications, assignment statements, conditional statements, Looping Statements, Storage Classes

Unit – II: Array and Modular Programming: Introduction to Function, Functions with Simple Output Parameters, Passing Values between Functions, Multiple Calls to a Function, Parameter Passing by Value v/s Parameter Passing by Reference, Recursion. Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Multidimensional Arrays, Passing arrays as arguments

Unit – III: Structures, Unions, Strings, Pointers and files: Structures & Unions- definition, Processing structures – Passing structures to a function. Pointers: Operations on Pointers – Pointers to Functions, Functions Returning Pointers, Arrays of pointers. String handling - Text and data file processing.

Unit – IV: Evolution of OOP, OOP Paradigm, advantages of OOP, Comparison between functional programming and OOP Approach, characteristics of object oriented language. Introduction to C++, Identifier and keywords, constants, C++ operators, type conversion, Variable declaration, statements, expressions, input and output, Conditional expression, loop statements, breaking control statements.

Unit – V: Classes and objects, constructors and destructors, function and operator overloading, inheritance, Virtual Function, friend function, this pointer, dynamic type information and polymorphism. C++ streams, console stream classes, formatted and unformatted console I/O operations, manipulators, File streams, classes file modes file pointers and manipulations file I/O, Exception handling, dynamic memory allocation.

Text books:

1. E. Balagurusamy, “Programming in ANSI C”, Tata McGraw Hill, New Delhi, 8th Edition, 2019.

2. E. Balagurusamy, "Object-oriented Programming with C++", Tata McGraw Hill, New Delhi, 7th Edition, 2017.

Books for reference:

1. Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education India, 4th Edition, 2017.
2. Herbert Schildt, "C: The Complete Reference", McGraw Hill Education India, 4th Edition, 2017.

Outcomes:

The students would have gained knowledge of basics elements of C and C++ languages, their specifications, functions, passing of parameters, control constructs; Special features of C language such as Structures and Unions, Pointers and types of files and processing them; Classes and objects in C++ language and the features of C++ and to use them effectively to solve problems.

BRIDGE COURSE – II (BC)

INFORMATION TECHNOLOGY

Objectives:

To provide the foundations of data, numbers, ideas of acquisition of variety of data including image, video and audio; structure of CPU, elements of WAN and LAN, Operating systems and Data organisation.

Unit – I: Data and Information: Types of Data - Simple Model of a Computer - Data Processing Using a Computer - Desktop Computer Acquisition of Numbers and Textual Data: Input Units - Internal Representation of Numeric Data - Representation of Characters in Computers - Error-Detecting Codes - Acquiring Image Data: Acquisition of Textual Data - Acquisition of Pictures - Storage Formats for Pictures - Image Compression – Fundamentals - Image Acquisition with A Digital Camera

Unit – II: Acquiring Audio Data: Basics of Audio Signals - Acquiring and Storing Audio Signals - Compression of Audio Signals - Acquisition of Video: Capturing a Moving Scene with a Video Camera - Compression of Video Data - MPEG Compression Standard - Data Storage: Storage Cell - Physical Devices Used as Storage Cells - Random Access Memory - Read Only Memory - Secondary Storage - Compact Disk Read Only Memory - Archival Store

Unit – III: Structure of a Central Processing Unit - Specifications of a CPU - Interconnection of CPU with Memory and I/O Units - Embedded Processors. Computer Networks: Local Area Network - Applications of LAN - Wide Area Network (WAN) – Internet - Naming Computers Connected to Internet- Future of Internet Technology. Output Devices: Video Display Devices - Touch Screen Display - E-Ink Display – Printers - Audio Output

Unit - IV: Operating System - Programming Languages - Classification of Programming Languages - Classification of Programming Languages Based on Applications Data Organization: Organizing a Database - Structure of a Database - Database Management System - Example of Database Design - Non-Text Databases - Archiving Databases. Processing Numerical Data: Use of Spreadsheets - Numerical Computation Examples. Processing Multimedia Data: Graphics Processing - Audio Signal Processing

Unit – V: Some Internet Applications – Email - World Wide Web - Information Retrieval from the World Wide Web - Other Facilities Provided by Browsers - Audio on the Internet - Accessing Pictures and Video via Internet. Business Information Systems: Types of Information Needed by Organizations - Why Should We Use Computers in Businesses? -

Management Structure and their Information Needs - Design of an Operational Information System - System Life Cycle - Computer System for Transaction Processing Electronic Commerce: Introduction - Business to Customer E-Commerce - Business to Business E-Commerce - Customer to Customer E-Commerce - Advantages and Disadvantages of e-Commerce - E-Commerce System Architecture - Digital Signature - Payment Schemes in e-Commerce - Electronic Clearing Service in e-Commerce - Cash Transactions in e-Commerce - Payment In C2C e-Commerce - Electronic Data Interchange - Intellectual Property Rights and Electronic Commerce - Information Technology Act. Societal Impacts of Information Technology: Introduction - Social Uses of World Wide Web - Privacy, Security and Integrity of Information - Disaster Recovery - Intellectual Property Rights - Careers in Information Technology

Text Book:

1. V. Rajaraman, "Introduction to Information Technology", PHI Learning Pvt. Ltd., New Delhi, Second Edition, 2018.

Book for Reference:

1. Pelin Aksoy, "Introduction to Information Technology", Cengage Learning, 2009.

Outcomes:

Learners would have understood the foundations of data, numbers, ideas of acquisition of variety of data including image, video and audio; structure of CPU, elements of WAN and LAN, Operating systems and Data organisation.

BRIDGE PRACTICAL – I (BP)
PROGRAMMING IN C AND C++

Objectives:

To provide hands on training to handle various data types in C language; use control structures, strings and arrays; functions, pointers and their combinations. To define and create classes and objects, to understand the ideas of call by value, references; create and use all types of constructors and to use the ideas of inheritance, virtual functions and polymorphism. To learn to operate with files in C and C++ languages.

C-language:

1. Data types & Expressions, Constants & Variables, Operators, Operator Precedence and associativity, Storage Classes
2. Conditional statements, Looping Statements, Array and Modular Programming,
2. Basic Array programs using for loop, User defined functions, Recursion.
3. Programs on Two dimensional Arrays, Passing arrays as arguments, String handling based on String Functions and Character Operation
4. Programs based on an array of Pointers to Strings, Structure and Pointers, Programs based on Structures & Unions
5. Programs based on pointers (arithmetic operations on Pointer, arrays with pointers), Programs of Pointers to structures and Array of structures.

C++ - language:

6. Program using functions, functions with default arguments, implementation of call by value, address, reference.
7. Simple classes for understanding objects, member functions & constructors, classes with primitive data members, classes with arrays as data members, classes with pointers as data members, classes with constant data members, classes with static member functions.
8. Compile time polymorphism: operator overloading, function overloading,
9. Run time polymorphism, inheritance, virtual functions, virtual base classes, templates.
10. File handling, sequential access, random access.

Outcomes:

The learners would have learnt to handle various data types in C language; use of control structures, strings and arrays; functions, pointers and their combinations; to define and create classes and objects, to understand the ideas of call by value, references; create and use all types of constructors and to use the ideas of inheritance, virtual functions and polymorphism; learnt to operate with files in C and C++ languages.

CORE COURSE – V (CC)
ACCOUNTING AND FINANCIAL MANAGEMENT

Objectives:

To provide knowledge to analyze and record transactions, construct financial statements, and close the books for the accounting period and will have the ability to adjust and correct errors in the process of accounting; understand the fall in value of assets and use of accounting packages; identify and analyze the costing systems adopted in the business organizations and can demonstrate mastery of costing systems, cost management systems; appreciate budgeting systems and performance and critically analyze and provide recommendations to improve the operations of organizations; demonstrate the need for appropriate decision making, control and performance evaluation of an organization.

Unit – I: Accounting Principles and Concepts – Double entry book keeping- Income and expenditure- Accounting record and system- assets and liabilities- Depreciation, Depletion and Amortization - Accounting for depreciation.

Unit – II: Journal – Ledger- Trial Balance- Trading, Manufacturing and profit and Loss account – Balance sheet.

Unit – III: Analysis and interpretation of financial statements with ratios.

Unit – IV: Cost Accounting- Methods and Techniques of Cost Accounting- classifications of cost - Material Cost- Labour Cost – Overhead- fixed and variable cost- Cost volume – profit analysis - marginal costing and decision making.

Unit – V: Budgeting and budgetary control – types of budgets- Preparation of various functional budgets- Preparations of cash budgets- flexible budgets- Advantages of Budgeting and Budgetary control.

Text Book(s):

1. T.S. Grewal, “Double Entry Book Keeping”, All India Sultan Chand (Recent Edition)
2. S.N. Maheswari “Principles of Management Accounting”, Sultan Chand, New Delhi (Recent Edition)
3. Shukla, Grewal & Gupta, “Advanced Accounts” Sultan Chand Publications

Reference(s):

1. S.K. Gupta & R.K. Sharma- Practical Problems in Management Accounting (Recent edition)
2. Khan and Jain “Financial Management” Tata McGraw Hill (Recent Edition).

Outcomes:

On completion of the course the student will be able to analyze and record transactions, construct financial statements, and close the books for the accounting period and will have the ability to adjust and correct errors in the process of accounting; Understand the fall in value of assets and use of accounting packages. Identify and analyze the costing systems adopted in the business organizations and can demonstrate mastery of costing systems, cost management systems; Appreciate budgeting systems and performance and critically analyze and provide recommendations to improve the operations of organizations; Demonstrate the need for appropriate decision making, control and performance evaluation of an organization.

CORE COURSE – VI (CC)

OPERATING SYSTEMS

Objectives:

To provide knowledge to understand the fundamental concepts of an Operating systems; design and solve synchronization, deadlock problems; understand and analyse theory concepts of Memory Management; ability to analyse the structure and basic architectural components involved in file System; acquire knowledge about protection and security mechanisms in Operating system

Unit – I: Operating Systems Objectives and functions – Operating System and User Computer Interface, Operating System as a Resource Manager: Evaluation of Operating Systems– Serial Processing, Sample Batch Systems, Time Sharing Systems.

Unit – II: Process Description, Process Control – Processes and Threads. Concurrency – Principles of Concurrency, Mutual Exclusion – Software support, Dekker’s Algorithm – Mutual Exclusion – Hardware support, Mutual Messages – Deadlock – Deadlock prevention, Deadlock Detection, Deadlock Avoidance – An Integrated deadlock Strategy.

Unit – III: Memory Management – Memory Management Requirements – Fixed Partitioning, Placement Algorithm, Relocation in a Paging System – Sample Segmentation. Virtual Memory – Paging – Address Translation in a Paging System. Segmentation – Organization, Address Translation in a Segmentation System – Combined Paging and Segmentation – Virtual Memory – Operating System Software – Fetch Policy, Placement Policy and replacement Policy, Page buffering resident set Management.

Unit – IV: Scheduling – Types of Scheduling, scheduling Algorithms, scheduling criteria, FIFO, Round Robin, Shortest Process next, Shortest Remaining Time, Highest response ratio and Feedback scheduling Performance comparison – Fair – Share Scheduling. I/O Management and disk scheduling – Organization of the I/O function – the Evaluation of the I/O function, Logical structure of the I/O function, I/O Buffering, Disk Cache.

Unit – V: File Management – Files, File Management Systems, File System Architecture, Functions of File Management File Directories – File Sharing – Secondary Storage Management – File allocation.

Text Books:

1. William Stallings, “Operating Systems”, Second edition, Maxwell McMillan, International Editions, 1997.
2. Charles Crowley, “Operating Systems-A Design Oriented Approach”, IRWIN Publications Chicago, 1997.

Books for Reference:

1. Ann McIver McHoes and Ida M. Flynn, Understanding Operating Systems, Sixth Edition, Course Technology, CengageLearningm2011
2. Ann McHoes, Ida M. Flynn, **Understanding Operating Systems, Seventh Edition**, Cengage Learning, 2013.
3. Deital H.M. “An Introduction to Operating Systems”, Addison Wesley Publishing
4. Silberchatz A., Peterson J.L., Galvan P. “Operating System Concepts”, ThirdEdition, Addison Wesley Publishing Co.,1992.

Outcomes:

The student will be able to Understand the fundamental concepts of an Operating systems; Design and solve synchronization, deadlock problems; understand and analyse theory concepts of Memory Management; ability to analyse the structure and basic architectural components involved in file System; acquire knowledge about protection and security mechanisms in Operating system

CORE COURSE – VII (CC)

DISTRIBUTED TECHNOLOGIES

Objectives:

To provide ideas to be able to compare the architectures of distributed systems; to be able to differentiate the technologies associated with presentation and interaction services; to have sound knowledge in developing applications with components; to know the art of developing ASP.NET pages with web server and HTML controls; familiar with the disconnected data access technology in ADO.NET.

Unit – I: Introduction to distributed Computing – Challenges involved in establishing remote connection – Strategies involved in remote computation – Current Distributed computing practices through Dot Net and Java technologies - Client server architecture: 2-tier model - 3-tier model - n-tier model.

Unit – II: J2EEarchitecture - DOTNET architecture - MVC Architecture - Java Beans –Enterprise Java Beans – Distributed Object models – RMI – XML-JSP.

Unit – III: Advanced ASP, NET – AdRotator, Multiview, Wizard and Image Map Controls – Master Pages – Web Parts - Security in ASP, NET – State Management in ASP, NET – Mobile Application development in ASP. NET- Uses of these controls and features in Website development.

Unit – IV: Advanced ADO. NET – Disconnected Data Access – Grid view, Details View, Form View controls – Crystal Reports – Role of ADO.NET in Distributed Applications.

Unit – V: Web services – Role of Web services in Distributed Computing – WSDL, UDDI, SOAP concepts involved in Web Services – Connected a Web Service to a Data Base – Accessing a Web Service through n ASP.NET application.

TEXT BOOKS:

1. Walther, ASP. NET 3.5, SAMS Publication, 2008.
2. Justin Couch, Daniel H.Steinberg, “J2EE Bible”, Wiley India(P) Ltd, NewDelhi, 2002

REFERENCES:

1. Platt S David, “Introducing Micorsoft .Net”, Prentice Hall of India, New Delhi, 2005.
2. Paul Tremblett, “Instant Enterprise Java y – Beans”, Tata McGraw Hill Publishing Company, New Delhi, 2001

3. Stephanie Bodoff, Dale Green, Eric Jendrock, "The J2EE tutorial", Addison-Wesley, 2002
4. Hitesh Seth, "Microsoft .NET: kick start", Sams Publishing, 2004

Outcomes:

On completion of the course the student will be able to compare the architectures of distributed systems; able to differentiate the technologies associated with presentation and interaction services; have sound knowledge in developing applications with components; know the art of developing ASP.NET pages with web server and HTML controls; familiar with the disconnected data access technology in ADO.NET.

CORE COURSE – VIII (CC)

PROGRAMMING IN PYTHON

Objectives:

To enable the students to understand the concepts of programming in Python. To provide knowledge in core python, concepts like modules and packages, file handling, regular expressions, exception handling, to be able to work with numbers and data and to use them with visualisation tools.

Unit – I: Introduction to Python: Features of Python - How to Run Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Input, Output and Import Functions. Data Types and Operations: Numbers-Strings-List-Tuple-Set-Dictionary. **Flow Control:** Decision Making-Loops-Nested Loops-Types of Loops.

Unit – II: Functions: Function Definition-Function Calling - Function Arguments - Recursive Functions - Function with more than one return value. **Modules and Packages:** Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - dir() function - reload() function - Packages in Python - Date and Time Modules. **File Handling:** Opening a File - Closing a File - Writing to a File - Reading from a File - File Methods - Renaming a File - Deleting a File - Directories in Python.

Unit – III: Object Oriented Programming: Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes - Destructors in Python-Encapsulation - Data Hiding-Inheritance - Method Overriding-Polymorphism. **Exception Handling:** Built-in Exceptions - Handling Exceptions - Exception with Arguments - Raising Exception - User-defined Exceptions. **Regular Expressions:** match() function - search() function - Search and Replace - Regular Expression Modifiers: Option Flags - Regular Expression Patterns - findall() method - compile() method.

Unit – IV: Introduction to NumPy: Basics of NumPy Array – Computation on NumPy Array – Aggregations – Broadcasting – Comparisons, Masks and Boolean Logic – Sorting Arrays – NumPy Structured Array. **Data Manipulation with Pandas:** Introducing Panda Objects – Data Indexing and Selection - Operating Data on Pandas – Handling Missing Data – Hierarchical Indexing – Combining DataSets – Vectorized String Operations – Working with Time Series.

Unit – V: Visualization with Matplotlib: Simple Line Plots – Simple Scatter Plots – Visualizing Errors – Density and Contour Plots – Histograms, Binnings and Density – Customizing Plot Legends – Customising Colorbars – Multiple Subplots – Text and Annotation – Three Dimension Plotting in Matplotlib – Geographic Data with Basemap – Visualization with Seaborn

Text Book(s) :

1. Jeeva Jose and P. SojanLal, “Introduction to Computing and Problem Solving with Python”, Khanna Book Publishing Co. (P) Ltd., 2019, **ISBN:** 9789382609810. **(Units: I, II & III).**
2. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, 1st Edition, O'Reilly Media, 2016. **ISBN:** 9352134915. **(Units: IV & V).**

Book for References :

1. Wesley J. Chun, “Core Python Programming”, Second Edition, Prentice Hall, 2006.
2. Timothy A Budd, “Exploring Python”, Tata McGraw Hill, New Delhi, ISBN:9780071321228.

Outcomes:

Students would have understood the concepts of programming in Python. Gained knowledge in core python, concepts like modules and packages, file handing, regular expressions, exception handling, would be able to work with numbers and data and to use them with visualisation tools.

CORE ELECTIVE – II (CE)

A: PROBABILITY AND STATISTICS

Objectives:

To provide knowledge to understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena and translate real-world problems into probability models and finding a reasonable solution ; to understand and use the properties of discrete and continuous distribution functions and its applications; apply Mathematical expectations, Correlation and Regression for Practical Problems and Identify when and how to use various tests of hypothesis such as t, F, Chi-square; to understand the ideas of variety of Queues and their characteristics and to apply them in applications.

Unit – I: Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Baye’s theorem of probability and Geometric probability. Random variables and their properties, Discrete Random variable, Continuous Random variable, Probability Distribution joint probability distributions their properties, Transformation variables, Mathematical expectations, probability generating functions

Unit – II: Probability Distributions / Discrete distributions: Binomial, Poisson Negative binominal distributions and their properties. (Definition, mean, variance, moment generating function, Additive properties, fitting of the distribution.) **Continuous distributions:** Uniform, Normal, exponential distributions and their properties. Curve fitting using Principle of Least Squares.

Unit – III: Multivariate Analysis: Correlation, correlation coefficient, Rank correlation, Regression Analysis, multiple Regression, Attributes, coefficient of Association, Chi-square test for goodness of fit, test for independence.

Unit – IV: Sample, populations, statistic, parameter, Sampling distribution, standard error, unbiasedness, efficiency, Maximum likelihood estimator, notion & interval estimation Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, power of the test.

Unit – V: Queuing theory: Queue description, characteristics of a queuing model, steady state solutions of M/M/1: a Model, M/M/1; N Model.

Text book(s):

1. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw Hill, New Delhi, 2017.

Reference Books:

1. Yuri Suhov, Mark Kelber, Probability and Statistics by Example, Cambridge University Press, 2014.
2. Kishor S. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley, 2nd Edition, 2008.

Outcomes:

Upon successful completion of this subject, the student will be able to: Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena and translate real-world problems into probability models and finding a reasonable solution; Understand and use the properties of discrete and continuous distribution functions and its applications; apply Mathematical expectations, Correlation and Regression for Practical Problems and Identify when and how to use various tests of hypothesis such as t, F, Chi-square; understood the ideas of variety of Queues and their characteristics and to apply them in applications.

CORE ELECTIVE – II (CE)

B: RESOURCE MANAGEMENT TECHNIQUES

Objectives:

To identify real life problems as Linear Programming model and find an optimized solution; To apply the primal dual relationship as producer and consumer relationship in business; to understand the concept of solving transportation problems and assignment problem with business solutions; to use CPM and PERT techniques, to plan, schedule, and control project activities; analyse and choose the best course of action out of several alternative courses for the purpose of achieving objectives by solving game problems.

Unit – I: Linear Programming: Formulations and Graphical solution to L.P. Problem Simplex method-Degeneracy, Unbounded and infeasible solution– Two Phase Method.

Unit – II: Linear Programming (contd): Duality-Primal and Dual Computations – Dual Simplex Method - Transportation problem and its solution-Assignment problem and its solution by Hungarian method.

Unit – III: Project scheduling by PERT / CPM: Phases of project scheduling –Arrow Diagram - Critical Path Method - Probability Considerations in Project Scheduling.

Unit – IV: Queueing Theory: Queueing System - Characteristics of Queueing system - classification of queues - Poisson Queues - M/M/1 and M/M/C Queueing Models.

Unit – V: Inventory Management: Inventory Control - ABC analysis - Economic Lot size Problems - EOQ with uniform Demand and shortages - Limitations of inventories - Buffer stock - Determination of Buffer stocks. Note: Stress to be on solving Numerical Problems only.

Text book:

1. Kanti Swarup, P K Guptha and Man Mohan, “Operations Research”, Sultan Chand & Sons, New Delhi, 2013.

Book(s) for Reference:

1. Hamdy A. Taha, “Operations Research-An Introduction”, Macmillan Publishing Co, 5th Edition, 1987.
2. P.K.Gupta, Man Mohan, “Operations Research and Quantitative Analysis”, Sultan Chand & Sons, New Delhi First Edition, 1987.

Outcomes:

The students would have learnt to identify real life problems as Linear Programming model and find an optimized solution; apply the primal dual relationship as producer and consumer relationship in business; understood the concept of solving transportation problems and assignment problem with business solutions; to use CPM and PERT techniques, to plan, schedule, and control project activities; analyse and choose the best course of action out of several alternative courses for the purpose of achieving objectives by solving game problems.

CORE ELECTIVE – II (CE)

C: THEORY OF COMPUTATION

Objectives:

To understand the concept of machines such as finite automata, pushdown automata, linear bounded automata, and Turing machines; to understand the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages; to understand the relation between these formal languages, grammars, and machines; to understand the complexity or difficulty level of problems. to compare the complexity of problems.

Unit – I: Automata Theory: Set, Relation and Function– Introduction to Formal Proof– Additional Forms of proof – Inductive proofs – Alphabets, Strings and Language – Finite representation of language– Chomsky hierarchy.

Unit – II: Finite Automata And Regular Expressions: Deterministic Finite Automata – Nondeterministic Finite Automata – Finite Automata with Epsilon Transitions – Regular Expression – Finite Automata and Regular Expressions– Equivalence of Regular languages.

Unit – III: Context-Free Grammars And Pushdown Automata: Context-Free Grammars – Parse Trees – Applications of Context-free Grammars – Ambiguity in Grammars and Languages – Definition of Pushdown Automata – The languages of Pushdown Automata – Equivalence of PDA and CFG – Deterministic Pushdown Automata.

Unit – IV: Context-Free Languages And Turing Machine: Definition– Languages that are and are not Context-free – Normal Forms – Pumping Lemma for Context-Free Languages – Closure and Decision Properties of Context Free Languages – Definition of Turing Machines – Computing with Turing Machine – Extensions of Turing Machine – Random Access Turing Machine – Nondeterministic Turing Machine.

Unit – V: Undecidability And Computational Complexity: The Church-Turing Thesis – Universal Turing Machine – The Halting Problem – Unsolvable Problems about Turing Machines – Class P, Class NP – NP-completeness.

Text books:

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2009
2. H.R. Lewis and C.H. Papadimitriou, “Elements of The theory of Computation”, Second Edition, Pearson Education/PHI, 2007

Reference books:

1. J. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2008
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: Principles, Techniques, & Tools", Second Edition, Boston, Addison-Wesley, 2007.

Outcomes:

The students will be able to design Finite Automata machines for given problems; able to analyze a given Finite Automata machine and find out its Language; able to design Pushdown Automata machine for given CF language(s); able to generate the strings/sentences of a given context-free languages using its grammar; able to design Turing machines for given any computational problem.

CORE PRACTICAL – III (CP)
DISTRIBUTED TECHNOLOGIES

Objectives:

To develop RMI/CORBA applications; have skills to develop web applications using Servlet and JDBC; have experience to create presentation services using JSP; to develop secured, robust and scalable distributed applications; to have the knowledge to develop appropriate ASP.NET web applications and understand the disconnected data access technology in ADO.NET.

1. RMI application with a server and more than one client.
2. RMI application with Database Connectivity
3. Webpages using JSP Scriptlet.
4. Webpage using JSP of java beans.
5. Performing XML transformation using XML and XSL coding.
6. Create XML Schema.
7. Creation of a table and insertion of a few records using Disconnected Access.
8. Viewing records using GridView, Details View, Form View Controls.
9. Generation of a crystal report from an existing database.
10. Web page that uses of Ad Rotator Control.

Outcomes:

The learners will have the ability to develop RMI/CORBA applications; have skills to develop web applications using Servlet and JDBC; have experience to create presentation services using JSP; develop secured, robust and scalable distributed applications; have the knowledge to develop appropriate ASP.NET web applications and understand the disconnected data access technology in ADO.NET.

CORE PRACTICAL – IV (CP)
PROGRAMMING IN PYTHON

Objectives:

To introduce the ideas of programming in Python; to provide knowledge in core python, advanced concepts like regular expressions; to handle numerical data and strings and to operate on data sets; to visualize the data.

1. Flow controls, Functions and String Manipulation.
2. Operations on Tuples and Lists.
3. Operations on Sets and Dictionary.
4. Simple OOP – Constructors, Method Overloading, Inheritance.
5. Reading and Writing Files & Regular Expressions.
6. NumPy Arrays, Sorting and Searching on Arrays.
7. String and Date & Time Functions using NumPy.
8. Data Series, Data Frame using Pandas.
9. Combining and Merging Data Sets.
10. Graphs and Charts using Matplotlib.

Outcomes:

The students would have gained the ideas of programming in Python; knowledge in core python, advanced concepts like regular expressions; able to handle numerical data and strings and operate on data sets; capable of visualizing the data.

BRIDGE COURSE – III (BC)

WEB DESIGN

Objectives:

To understand the basic concepts of Internet; identify the features of HTML tags; to design the HTML tables, frames and forms; to design applications with JavaScript Programming; to comprehend the objects in HTML and Java Script.

Unit – I: Networking Concepts: INTERNET - History - Applications-Users – Protocols - Host Machines and Host Names - Internet Architecture and Packet Switching- Client Server Model - Band width and Asynchronous Communication. Connection: Dial-up Access-Direct and Dedicated Connections - shell or TCP/ IP accounts - Domains and Addresses – IP addresses.

Unit – II: HTML: Introduction to HTML Tags - Document Layout - Comments - Headings-Paragraphs -Breaks - Texts - Lists - Special Characters.

Unit – III: HTML: Tables - Linking documents - Frames - Form and its elements.

Unit – IV: JavaScript: Introduction to JavaScript - JavaScript in web pages-writing JavaScript with HTML - Basic programming techniques - operators and expressions - conditional checking - loops - functions - user defined functions - dialog boxes.

Unit – V: JavaScript: JavaScript DOM: JSS DOM - understanding objects in HTML - browser objects - web page object hierarchy - Handling events - The form object - built-in objects-user defined objects - cookies - setting a cookie.

Text book(s):

1. Wendy G. Lehnert, “Internet 101 - A Beginners Guide To The Internet And The World Wide Web”, Addison-Wesley, 1999.(Unit-I).
2. Ivan N. Bayross, “Web enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP”, 4th Revised Edition, BPB Publications, New Delhi, 2010.(Units-II, III, IV, V)

Books for Reference :

1. Chuck Musciano& Bill Kennedy, “HTML - The Definitive Guide”, Shroff Publishers & Distributors Pvt. Ltd., Calcutta - 1999.
2. Raj Kamal, “ Internet And Web Technologies”, TMH, New Delhi, SBN: 9780070472969
3. John Pollock, “JavaScript A Beginner’s Guide”, The McGraw-Hill, 2010.

Outcomes:

After completing this course the students will be able to understand the basic concepts of Internet; identify the features of HTML tags; design the HTML tables, frames and forms; design applications with JavaScript Programming; work with the objects in HTML and Java Script.

BRIDGE COURSE – IV (BC)

INTRODUCTION TO INTERNET

Objectives:

To introduce the ideas of working with Internet, knowledge of basic hardware, WWW, basics of Electronic Commerce, communication using Internet, and to have own space in the Internet.

Unit – I: Welcome to the Internet – Internet Safety – Viruses, Spyware, Spam – Advantages of Internet – Web bugs, Cookies – Internet and Kids – Useful websites - Internet – Connecting with WiFi, Laptops and Smart phones - The Types of Internet Connections - What’s in an Account? - Speedy Connections: DSL and Cable – Broadband - A hub, switch, or router - Setting up a router - Wiring your computers into a LAN - Set a password - Making the Wi-Fi connection

Unit – II: What Is the Web?- Linking up Web pages – Web Surfing with Your Browser - The best place to start browsing - Browsing from Your Smartphone - Telling the browser what to display at the start – Storing Passwords - Getting and Installing a Browser - Saving Stuff from the Web - Saving text from a page - Saving an image - Printing pages - Viewing Lots of Web Pages at the Same Time - Downloading pictures, Files and Programs – Bookmarking - Music and Video on the Web – Borrow, Rent, Buy, Subscribe to media – Subscribing to Podcasts – Watching TVs and Movies

Unit – III: Shopping Online - Pros and Cons - The Credit Card - Paying at the Store – Auctions and used stuff – Books, Music , Clothes, Food and Computers - Going to the Bank without Ever Leaving Home - Transferring money between bank accounts - Paying bills online - Taking advantage of other online bank services

Unit – IV: E-Mail - Sending and Receiving E-mail – Keeping your mail safe from viruses, spam and wi-fi snoops - Typing and Talking on the Net – AIMing to Chat via Text - Windows Live Messenger - Yahoo! Messenger - Google Chat - Facebook chat – Chat and phone calls with Skype - Abbreviations and smileys - Adding Voices and Faces

Unit – V: Putting Your Own Stuff on the Net - Setting up your social site - Blogs and Twitter – What is in a Blog? – Writing your own Blog - Twittering about Your Life - Private tweeting - Specifying a topic by using hash marks - Making Twitter lists - Making Your Own Web Site - Setting up your site - Editing a page - Publishing your first Web page - Linking to Other Pages

Text Book:

1. Internet for Dummies, John R. Levine and Margaret Levine Young, WILEY Publishing Inc., 12th Edition, 2010, ISBN: 978-0-470-56095-2,

Reference Books:

1. Absolute Beginner's Guide to Computers and the Internet, Michael Miller, Que Pub, 2001, 480 pages, ISBN-10 : 0789780127, ISBN-13 : 978-0789780126,
2. 2.Computer & Internet Basics Step-by-Step, Etc End the Clutter, Infinity Publishing (PA), 2004, 256 pages, ISBN-10 : 074142178X, ISBN-13 : 978-0741421784,

Outcomes:

The students would have gained knowledge to work with Internet, about basic hardware, WWW, basics of Electronic Commerce, communication using Internet, and would be able to create and use own writing materials in the Internet.

BRIDGE PRACTICAL – II (BP)

WEB DESIGN

Objectives:

To have hands-on experience of displaying formatted text and pages, learn to accept input from user and display using tables and frames; to know how to create forms in web pages to collect data.

1. Text formatting
2. Getting input and performing string manipulation operations
3. Using tables for neatly displaying information about an organization
4. Using frames to categorise and display information in a easy-to-understand format.
5. Using forms to create web pages for applying for a position in an organization
6. Event handling
7. Creating and managing cookies

Outcomes:

After completion the students would be able to display formatted text and pages, accept input from user and display using tables and frames; and know how to create forms in web pages to collect data.

CORE COURSE – IX (CC)

PROGRAMMING SMART DEVICES

Objectives:

To provide ability to develop applications for smart devices using android; Ability to handle operation of the application, configuration files, intents, and activities; Ability to work with UI-component layouts, event handling, and screen orientations; Ability to appreciate android framework and features; Ability to design interfaces like Buttons, Menus, and Dialogs; Ability to design different types of screen layouts in android.

Unit – I: Introduction to Android: History of Android – Versions of Android – Android Architecture – App Architecture – Components – Intents – Manifest – App Package - Activities - Services – Broadcast Receivers – Content Providers – Installing the Android SDK – Installing an Android Platform – Creating an Android Virtual Device – Starting the AVD – Introducing UC – Creating UC – Installing and Running UC – Preparing UC for Publishing – Migrating to Eclipse – Developing UC with Eclipse.

Unit – II: User Interface: Customizing the Window – Creating and Displaying Views – Monitoring Click Actions – Resolution Independent Assets – Locking Activity Orientation – Dynamic Orientation Locking – Manually Handling Rotation - Creating Pop-up Menu Actions – Customizing Options Menu – Customizing Back Button – Emulating the Home Button – Monitoring Text View Changes – Scrolling Text View Ticker – Animating a View – Creating Drawables as Backgrounds – Creating Custom State Drawables – Applying Masks to Images – Creating Dialogs that Persist – Implementing Situation Specific Layouts – Customizing Keyboard Actions – Dismissing Soft Keyboard – Customizing Adapter View Empty Views – Customizing List View Rows – Making List View Section Headers – Creating Compound Controls.

Unit – III: Interacting with Device Hardware and Media: Interacting Device Location – Mapping Locations – Annotating Maps – Capturing Images and Videos – Making a Custom Camera Overlay – Recording Audio – Adding Speech Recognition – Playing Back Audio/Video – Creating a Tilt Monitor – Monitoring Compass Orientation.

Unit – IV: Persisting Data : Making a Preference Screen – Persisting Simple Data – Reading and Writing Files – Using Files as Resources - Managing a Database – Querying a Database – Backing Up Data – Sharing your Database – Sharing your other Data.

Unit – V: Interacting with the Systems: Notifying from the Background – Creating Timed and Periodic Tasks – Scheduling a Periodic Task – Creating Sticky Operations – Running Persistent Background Operations – Launching Other Applications – Launching System Application – other Applications –

Interacting with Contacts – Picking Device Media – Saving to the Media Store -
Working with Libraries : Creating Java Library JARs – Using Java Library JARs
– Creating Android Library Projects – Using Android Library Projects – Charting
– Practical Push Messaging.

Text book:

1. Dave Smith and Jeff Friesen, – “Android Recipes: A Problem – Solution Approach”, Rakmo Press Pvt., Ltd, New Delhi, 2011.

Book(s) for Reference:

1. Wallace Jackson, “Android Apps for Absolute Beginners”, Apress, 4th edition, 2017.
2. Marko Gargenta, “Learning Android”, O’Reilly Media, Inc., 2011.
3. <http://developer.android.com/Android Developer’s Guides>.

Outcomes:

The students would have the knowledge and ability to develop applications for smart devices using android; Ability to handle operation of the application, configuration files, intents, and activities; Ability to work with UI-component layouts, event handling, and screen orientations; Ability to appreciate android framework and features; Ability to design interfaces like Buttons, Menus, and Dialogs; Ability to design different types of screen layouts in android.

CORE COURSE – X (CC)

COMPILER DESIGN

Objectives:

To introduce the various phases of a compiler; To know the various parsing techniques; To impart the code optimization techniques; To know the structure and various phases of compiler; To implement lexical analyser; To know the basic parsing techniques; To develop skills in generating intermediate code.

Unit – I: Compilers: Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens.

Unit – II: Role of the parser, Writing Grammars – Context – Free Grammars – Top Down parsing – Recursive Descent parsing – Predictive parsing – Bottom –up parsing – Shift Reduce Parsing – Operator Precedence Parsing – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser.

Unit – III: Intermediate Languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – procedure calls.

Unit – IV: Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next use Information – A simple Code generator – DAG representation of Basic Blocks – Peephole optimization.

Unit – V:Introduction – Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – Runtime Environments – Source Language issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

Text Book:

1. Alfred Aho, Ravi Sethi, Jeffrey D. Ullman, “Compilers – Principles, Techniques and Tools”, Pearson Education Asia, 2003

Reference Books:

1. TorbenÆgidius Mogensen, “Introduction to Compiler Design”, Springer, 2011.
2. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001
3. Kenneth C. Loudon, “Compiler Construction: Principles and Practices”, Thompson Learning, 2003

Outcomes:

The students would be familiar with the various phases of a compiler; know the various parsing techniques; know the code optimization techniques; know the structure and various phases of compiler; able to implement lexical analyser; know the basic parsing techniques; develop skills in generating intermediate code.

CORE COURSE – XI (CC)
PRINCIPLES OF DATA SCIENCE

Objectives:

To offer basic concepts and variety of data; Mathematical and Statistical ideas to manipulate data; to communicate the results using various forms of visualisation and predict using basic Data Mining techniques.

Unit – I: Basic Terminology: The data science Venn diagram - :Python practices – Domain knowledge – Case studies – Types of Data: Flavors of data – Structured versus Unstructured data – Quantitative versus qualitative data. The four levels of data: The Nominal, ordinal, interval and ratio levels. The five steps of Data Science – Exploring the data

Unit - II: Basic Mathematics: basic symbols and terminology – Graphs, Logarithms, Exponents, Set theory – Linear Algebra – Probability: Definitions – Bayesian versus Frequentist – Compound events – Conditional probability – Rules of probability – Collectively exhaustive events – Bayes theorem – Applications of Bayes theorem – Random variables

Unit – III: Basic Statistics: Obtaining data – Sampling data – Measures of centre - measures of variation – measures of relative standing – Point estimates – Sampling distributions – Confidence intervals – Hypothesis tests

Unit – IV: Communicating Data: Effective and ineffective visualizations – Scatter plots – Line graphs – Bar Charts – Histograms – Box plots. Correlation versus causation – Simpson’s paradox – verbal communication. Machine Learning: Supervised and Unsupervised learning – Linear regression – Probability, odds and logodds – Dummy variables.

Unit - V: Prediction: Naïve-Bayes classification – Decision trees – Unsupervised learning – K-means clustering – choosing an optimal number for K and cluster validation – feature extraction and Principal Component Analysis – Bias variance tradeoff – K folds cross-validation – Grid searching – Ensembling techniques – Neural networks.

Text Book:

1. Sinan Ozdemir, “:Principles of Data Science”, Packt Publishing, First Edition, Birmingham- Mumbai, ISBN: 978-1-78588-791-8, 2016.

Books for reference:

1. Joel Grus, “Data Science from Scratch”, O’Reilly Publishers, First Edition, 2015.
2. Vijay Kotu & Bala Deshpande, “Data Science Concepts and Practice”, Morgan Kaufmann publishers, Second Edition, 2019.

Outcomes:

The students would have grasped the basic concepts and variety of data; Mathematical and Statistical ideas to manipulate data; learnt to communicate the results using various forms of visualisation and be able to predict using basic Data Mining techniques.

CORE COURSE – XII (CC)

ORGANISATIONAL BEHAVIOUR

Objectives:

To familiarize the students to understand the basic concepts of organizational structure and its behaviour; to understand the Human Behaviour and Perception; Develop the Attitudes, Formation factors and attitude changes; Equip the students in building the Perceptual Interpretation and Motivation; Have the group decision making and analysis; Acquire knowledge and capability to develop communication skills; Equip their Leadership skills through various activities; Have the knowledge about organizational structure and projects.

Unit – I: Nature of Organization: Features – types – goals. Nature Of Organizational Behavior: Nature of OB – Role of OB – Foundations of OB.

Unit – II: Nature Of Human Behavior: Nature and causes of individual differences – models of man. **Perception:** concept – process – perceptual selectivity and distortion – Developing perceptual skills. **Attitudes:** Concept – Theories – Formation factors – measurements – Attitude change.

Unit – III: Personality: Concept – theories – determinants of personality- Personality and behaviour. **Motivation:** Definition – Motivation & Behavior – Theories – approaches – incentives. **Interpersonal Behavior:** Transactional analysis – Ego states – life scripts – life positions – transactions – stroking – Psychological games – Benefits of TA.

Unit – IV: Group Dynamics: Concepts & features of group – types of groups – group behaviour – group decision making – committee – task group – inter group behaviour. **Leadership:** Definitions – types – importance theories – styles. **Communication:** Basics of communication – Communication network – Factors affecting communication – Business writing – Office management – Presentation strategies.

Unit – V: Organization Theory: Classical organizational theory – neoclassical organization theory. **Designing Of Organizational Structure:** need – planning and process – **Departmentation:** Span of management – delegation of authorities – centralization & decentralization. **Forms Of Organizational Structures:** line and staff – functional – divisional – project – matrix – free form.

Book for study :

1. Prasad L.M., “Organisational Behavior”, Sultan Chand and Sons, New Delhi, 2014.

Books for Reference :

1. S. S. Khanka, "Organisational Behavior", S. Chand Ltd., New Delhi
2. K. Aswathappa, "Organisational Behavior", Himalaya Publishing House, New Delhi

Outcomes:

The students would have understand the basic concepts of organizational structure and its behaviour; understood the Human Behaviour and Perception; Developed the Attitudes, Formation factors and attitude changes; Equiped the students in building the Perceptual Interpretation and Motivation; Have the ability of contributing in group decision making and analysis; Acquired knowledge and capability to develop communication skills; Equiped their Leadership skills through various activities; Have the knowledge about organizational structure and projects.

CORE ELECTIVE – III (CE)

A: BIG DATA ANALYTICS

Objectives:

To provide students to acquire the knowledge on the basics of Big Data and its role in various Industries; understand the various techniques of Big Data Analytics; learn the cutting edge tools and technologies to analyze Big Data; ability to appreciate the Big Data Storage concepts and Data Visualization techniques; to get insights into social media and mobile analytics

Unit – I: Introduction: Concepts and Terminology – Big Data Characteristics- Different Types of Data-case study Background- Business goals and Obstacles- Business Motivations and Drivers for Big Data Adoption-Marketplace Dynamic-Business Architecture- Business process Management- Information and Communication Technology-Data Analytics and Data Science-Digitization.

Unit – II: Big data Adoption and Planning Considerations: Organization Prerequisites- Data Procurement - Privacy- Security- Provenance-Limited Real time Support- Distinct Performance Challenges – Distinct Governance Requirements- Distinct Methodology- Clouds- Big Data Analytics-Data Identification- Data Acquisition and Filtering-Data Extraction- Data validation and cleansing-Data Aggregation and Representation- Data Analysis-Data Visualization-Utilization of Analysis Results.

Unit – III: Enterprise Technologies and Big Data Business Intelligence: Online Transaction and Processing (OLTP)-Online Analytical Processing (OLAP)- Extract Transform Load (ETL)-Data Warehouses-Data Marts-Traditional BI-Big Data BI-Big Data Storage Concepts- Clusters- File System and Distributed Systems- No SQL-Sharding-Replication-ACID.

Unit – IV: Big Data Processing Concepts: Introduction -Parallel Data Processing-Distributed Data Processing- Hadoop-Processing Workloads-Cluster- Processing in Batch Mode-Map-Combine-Partition- Shuffle and Sort— Processing in Real Time Mode- Speed Consistency Volume (SCV)-Event Stream Processing- Complex Event Processing- Realtime Big data Processing and SCV-Realtime Big Data Processing and Map Reduce.

Unit – V : Big Data Storage Technology: On-Disk Storage Devices-NoSQL Database- In-Memory Storage Device- Big Data Analytics Techniques- Quantitative Analysis- Qualitative Analysis- Data Mining- Statistical Analysis- A/B Testing-Correlation-Regression- Machin Learning- Semantic Analysis- Visual Analysis-Heat Maps-Time Series Plots-Network Graphs-Spatial Data Mapping.

Book for Study :

1. Paul Buhler, Wajid Khattak and Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Prentice Hall Publications, January 2016.
Unit 1: Chapter 1 and Chapter 2
Unit 2: Chapter 3
Unit 3: Chapter 4 and Chapter 5
Unit 4: Chapter 6
Unit 5: Chapter 7 and Chapter 8

Books for Reference :

1. Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, “Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics”, Published by Apress Media, 2013.
2. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, 2012.

Outcomes:

On successful completion of the course, the students will be able to acquire the knowledge on the basics of Big Data and its role in various Industries; understand the various techniques of Big Data Analytics; learn the cutting edge tools and technologies to analyze Big Data; ability to appreciate the Big Data Storage concepts and Data Visualization techniques; get insights into social media and mobile analytics.

CORE ELECTIVE – III (CE)

B: COMPUTER NETWORK AND SECURITY

Objectives:

To provide students with the fundamental knowledge in computer network communication; make them understand the OSI reference model; learn the technical factors of each layer in OSI reference model; understand the fundamentals of network security; learn the encryption and digital signature techniques.

Unit – I: Introduction – Uses of Computer Network – Network Hardware – Network Software – Reference Models – Example Network.

Unit - II: Introduction –OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms.

Unit – III: Symmetric Ciphers – Classical Encryption Techniques – Block Ciphers and the Data Encryption Standard – Advanced Encryption standard

Unit – IV: Public key Encryption and Hash Functions – Public key cryptography and RSA key Management – Message Authentication and Hash Function

Unit – V: Network Security Applications – Authentication Applications – Electronic Mail Security – IP Security – Web Security. System Security – Intruders – Malicious Software – Firewalls

Text book :

1. Andrew S. Tanenbaum, **“Computer Networks”**, PHI, New Delhi, (EEE), Fourth Edition, 2011.
2. William Stallings, **“Cryptography and Network Security”**, Pearson Publications, Sixth Edition, 2014

Books for Reference:

1. Larry L. Peterson and Bruce S. Davie, **“Computer Networks – A Systems Approach”**, Morgan Kaufmann Publishers, Third Edition
2. Charlie Kaufman, Radia Perlman, Mike Speciner, **“Network Security – Private Communication in a Public World”**, Eastern Economy Edition, PHI, Second Edition
3. William Stallings, **“Network Security Essentials – Applications and Standards”**, Pearson Education – 2007.

Outcomes:

Students completing this course will be able to obtain the fundamental knowledge in computer network communication; understand the OSI reference model; learn the technical factors of each layer in OSI reference model; understand the fundamentals of network security; learn the encryption and digital signature techniques.

CORE ELECTIVE – III (CE)

C: CLOUD COMPUTING

Objectives:

To provide concepts of cloud Architecture and its services; classify different services providers and their services and tools; demonstrate various web based applications for collaborating everyone in the cloud computing; assess various industrial platforms for the developments in terms of security and related facilities.

Unit – I: Fundamentals of Cloud Computing: Grid Computing – Utility Computing – Need for Cloud Computing – Defining Cloud Computing – Stakeholders in Cloud Computing – Cloud versus Grid – Applications of Cloud Computing – Limitations of Cloud Computing – Ultimately need for Cloud Computing - Essential Needs of Enterprises and how they turn out as unique Features of Cloud Computing – Scalability - Scalability and On-Demand Provisioning - Self-Service based Access - Resource Pooling and Multi-Tenancy - Rapid Elasticity - Measured Service and Pay-as-Per-use Pricing Model – Architecture of Cloud – Deployment Models – Service Class Models – Infrastructure as a Service – Platform as a Service – Software as a Service

Unit – II: Technological Foundations of Cloud Computing: Basic Foundations of Cloud Computing - Technological Drivers of Cloud Computing - Multicore Technology and Parallel Programming Models – Virtualization - Server Virtualization - Types of Hypervisors - Types of Server Virtualization - Storage Virtualization - Network Virtualization - Memory Virtualization - Desktop Virtualization - Data Virtualization - Application Virtualization - Service Oriented Architecture (SOA) and Cloud Computing - Grid and Utility Computing technologies - Web 2.0 for cloud computing – MicroServices Architecture (MSA), DevOps and Agile- Software Defined Networking and Software Defined Security

Unit – III: Cloud Networking: Overview Of Enterprise Networks and Internetworking - Network Design Requirements and Design Goals - Standard Network Models - Flat Networking Model - Hierarchical Networking Model - Modern Network Requirement & Need For Suitable Network Model - Leaf-Spine Architecture - Need For Programmable/Automatic Network Configuration - Different Methods Of Configuring Network Devices - Manual and Conventional Method for Configuring Network Devices - Early Methods for Automatic Configuration of Network Devices - Software Defined Network (SDN) - Features of SDN - How does SDN Controller help SDN Applications to Manage a Network easily? - SDN Controller and SDN Switches - Functional Modules of SDN Controller - Software Defined Wide Area Network (SDWAN) - Network Functions Virtualization (NFV)

Unit – IV: Cloud Storage: Taxonomy of Storage - Direct Attached Storage (DAS) - Network Attached Storage (NAS) Architecture of NAS - File Sharing Concept in NAS - Storage Area Network (SAN) - Why Do We Need SAN? - Concept of SAN - FC SAN - Architecture of FC SAN - Fibre Channel topologies - How FC SAN Works – An Overview - Data Access Methods in SAN. IP SAN - Architecture of IP SAN - Storage Protocols for IP SAN - Internet Small Computer System Interface (iSCSI) - Fibre Channel over TCP/IP(FCIP) Protocol - Internet Fibre Channel Protocol (IFCP) - Converged Enhanced Ethernet (CEE) - Fibre Channel over Ethernet SAN (FCoE SAN) - Cloud Storage - Cloud and Cloud Storage? - Storages inside the Cloud - Architecture of Cloud Storage - Architecture of Cloud Storage- Storage Optimization Techniques - Software Defined Storage (SDS)

Unit – V: Cloud Security: Basic Security Requirements - Traditional Enterprise Security Model - Aspects/Factors which influence Security in Cloud - Security Threats In Cloud Computing - General Types Of Threats - Data Related Security Threats - Application Related Security Issues - Server And Network Related Threats - Vulnerabilities In Cloud APIs - Insider Threats - Threats Due To Virtualization - Virtualization threats and Related Security aspects in IaaS Cloud - Virtualization threats and Related Security aspects in PaaS Cloud

Text Book:

1. Chellammal Surianarayanan, Pethuru Raj Chelliah, Essentials of Cloud Computing: A Holistic Perspective, Springer, First Edition, 2019.

Books for Reference:

1. K.Chandrasekharan, Essentials of Cloud Computing, CRC press, 2014.

Outcomes:

The students would have gained the understanding of the concepts of cloud Architecture and its services; able to classify different services providers and their services and tools; able to demonstrate various web based applications for collaborating everyone in the cloud computing; assess various industrial platforms for the developments.

CORE PRACTICAL – V (CP)
PROGRAMMING SMART DEVICES

Objectives:

To offer hands-on training in designing and developing Android applications to use and demonstrate the facilities available in the Android development environment.

Android

1. Different Layout design including nested layout for a single biodata.
2. Arithmetic Operation for two numbers
3. Business Calculator
4. Animation: Bouncing of a ball
5. Intent
6. Database SQLite: Student Biodata
7. Fragments – Tablet Programming
8. Media Player

Outcomes:

The students would have familiarised themselves in the usage and application development of small applications as listed above.

CORE PRACTICAL – VI (CP)

R –PROGRAMMING

Objectives:

To offer hands-on training the R-environment to use the facilities to handle variety of data and to display the results in the form of charts and graphs.

1. Built in functions
2. Data Frames and Matrices
3. Accessing Data and Indexing
4. Diagrammatic representation of data
 - a) Plotting data
 - b) Bar chart and its varieties
 - c) Bar plot
 - d) Pie chart
 - e) Stem-and –Leaf plot
5. Frequency distribution
6. Graphical representation of data
 - a) Rod-spike graph
 - b) Histogram
 - c) Frequency polygon
7. Measures of central tendency functions
8. Simple R programs

Outcomes:

The students would have become familiar with the development of programs in R environment to accept input in many forms, process them and display the results in charts or graphs and also in applying statistical techniques.

BRIDGE COURSE – V (BC)

OPEN SOURCE TECHNOLOGIES

Objectives:

To make the students appreciate the Open Source Technologies and to use them effectively as an alternate to proprietary software that are available for all types of application from scripting languages, databases and web servers and to become aware of the open source tools and processors, and policies of governments.

Unit – I: Introduction: The need of open Sources, advantages of Open sources application, Open Source Development Model Licences and Patents, FOSS, BSD, Free Software Movement, commercial software vs. Open Source software Commercial aspects of Open Source movement - Certification courses issues - global and Indian. Copyrights and copy lefts, Application of Open Sources. Problems with traditional commercial software

Unit – II: Open source scripting Language. Introduction: What is PHP? - Basic Syntax of PHP – programming in web environment - Common PHP Script Elements - Using Variables - Constants – Data types - Operators ; Statements – Working With Arrays -Using Functions – OOP - String Manipulation and Regular Expression , **File and Directory Handling** , **Working With Forms**, Introduction to advanced PHP concepts

Unit – III: Open source database management System: MySQL: Introduction – Setting up an account - Starting, Terminating and writing your own MySQL Programs - Record Selection Technology - Working with Strings - Date and Time – Sorting Query Results module - Generating Summary - Working with Metadata – Using Sequences – MySQL and Web **PHP and SQL database:** PHP and LDAP ; PHP Connectivity ; Sending and receiving emails , **PHP Database Connectivity:** Retrieving data from MySQL - Manipulating data in MySQL using PHP

Unit – IV: WEB SERVER : Apache Web server – Working with web server – Configuring and using apache web server, WAMP server, Lighttpd, Fnord, Nginx, Savant, tornado.

Unit – V: Open Source Software tools and Processors: Introduction – Eclipse IDE Platform – Compilers – Model driven architecture tools – Selenium ID – Features and uses Government Policy toward Open Source (E- Governance) – Wikipedia as an open Source Project Case Studies: Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.

Text Books:

1. Rem Card, Eric Dumas and Frank Mevel , The Linux Kernel Book Wiley Publications sons, 2003.
2. Steve Suchring, MySQL Bible John Wiley sons, 2002.
3. Rasmus Lerdorf and Levin Tatroe, Programming PHP O'Reilly Publications, 2002.

Books for Reference:

1. Information Resources Management Association (An Imprint of IGI Global), USA, "Open Source Technology: Concepts, Methodologies, Tools and Applications," 2015.

Outcomes:

The students would be familiar with the Open Source Technologies and to use them effectively as an alternate to proprietary software that are available for all types of application from scripting languages, databases and web servers and to become aware of the open source tools and processors, and policies of governments.

BRIDGE COURSE – VI (BC)

INTERNET PROGRAMMING

Objectives:

To introduce .Net framework, HTML, development of Applets; to learn applet – servlet communication and JSP.

Unit – I: Introduction to ASP.NET: Architecture of .NET Framework – Life cycle of ASP.NET – Standard controls – Validation controls – Rich web controls – Data controls – Navigation controls.

Unit – II: HTML tags: History of HTML – Structure of HTML – Basic Tags of HTML - List – Linking Document – Frames – Graphics to HTML Documents.

UNIT – III: The Servlet Life Cycle: The Servlet Alternative – Servlet Reloading. Retrieving Information: Initialization Parameters – The Server – The Client – The Request.

UNIT – IV: Applet-Servlet Communication: Communication Options - Daytime Server - Chat Server. Inter servlet Communication: Servlet Manipulation - Servlet Reuse - Servlet Collaboration.

UNIT – V: Introducing Java Server Pages: What Is Java Server Pages? – Why Use JSP? – The Web Programming Environment: Evolution of the Web Application – The Shift from Client-Side to Server-Side Solutions.

TEXT BOOKS:

1. Kogent (2010), ASP.NET 4.0 Black Book – Platinum Edition, DreamtechPress, New Delhi. (Unit – I)
2. Ivan Bayross, Web Enable Commercial Application Development using HTML, DHTML, Javascript, PERL CGI, BPB Publications, 2000. (Unit – II)
3. Java™ Servlet Programming by Jason Hunter with William Crawford, O'Reilly Publishers, (Units – III, IV).
4. Phil Hanna, “JSP: The Complete Reference”, McGraw-Hill, 2001. (Unit – V)

REFERENCE BOOKS:

1. Mathew Mac Donald (2010), ASP.NET Complete Reference , Tata McGraw Hill publishing Company Ltd., New Delhi.
2. Thomas A. Powell, HTML and XHTML: The Complete Reference, Tata McGraw Hill, 4th Edition 2003.
3. Herbert Schildt, “JAVA 2 Complete References”, TMH publications, 4th Edition, 2001.

Outcomes:

The students would have become familiar with the .Net framework, HTML, development of Applets; to learn applet – servlet communication and JSP.

BRIDGE PRACTICAL – III (BP)

PHP AND MYSQL

Objectives:

To offer hands-on training to students in the use of PHP and MySQL to develop small application programs with the facilities available with both the software, such as, use of controls and functions, passing mechanisms, handling arrays, tokenising, file system functions, use of sessions and cookies and database usage.

1. Develop a PHP program using controls and functions
2. Develop a PHP program and check message passing mechanism between pages.
3. Develop a PHP program using String function and Arrays.
4. Develop a PHP program using parsing functions (use Tokenizing)
5. Develop a PHP program and check Regular Expression, HTML functions, Hashing functions.
6. Develop a PHP program and check File System functions, Network functions, Date and time functions.
7. Develop a PHP program using session
8. Develop a PHP program using cookie
9. Develop a PHP program to display student information using MySQL table.
10. Develop a college application form using MySQL table.

Outcomes:

The students would be familiar in the use of PHP and MySQL to develop small application programs with the facilities available with both the software, such as, use of controls and functions, passing mechanisms, handling arrays, tokenising, file system functions, use of sessions and cookies and database usage.

CORE COURSE – XIII (CC)
INTERNET OF THINGS

Objectives:

To introduce IoT and its flavors; to realise the IoT ecosystem and topologies; to learn how to integrate IoT with the environment; communicate from and to machines and some aspects of security of IoT.

Unit – I: Introduction To Internet Of Things: Introduction - Physical design of IoT – Logical design of IoT – IoT Enabling Technologies – IoT levels & Deployment technologies. DEMYSTIFYING THE IoT PARADIGM: The Emerging IoT flavors-The Industrial Internet of Things – Consumer Internet of Things - Social Internet of things - Semantics for The Interoperable IoT- Cognitive IoT.

Unit – II: Realization Of Iot Ecosystem Using Wireless Technologies: Introduction- Architecture for IoT Using Mobile Devices- Mobile Technologies for Supporting IoT Ecosystem- Mobile Use Cases for IoT – Low Power Wide Area Networking Topologies – Sigfox- Weightless – Nwave/Ingenu- Lora.

Unit – III: Infrastructure And Service Discovery Protocols For The Iot Ecosystem: Introduction- Layered Architecture for IoT – Protocol Architecture of IoT – Infrastructure Protocols-Device or Service Discovery for IoT – Protocols for IoT service Discovery. INTEGRATION TECHNOLOGIES AND TOOLS FOR IOT ENVIRONMENTS: Sensor and actuator networks.

Unit - IV: Iot And M2m: Introduction – M2M – Difference Between IoT and M2M – SDN and NFV for IoT. DEVELOPING IOT: IoT Design Methodology.

Unit - V: Security Management Of An Iot Ecosystem: Introduction Security Requirements of an IOT Infrastructure-Authentication, Authorization And Audit Trail (AAA) Framework-Defense In Depth-Security Concerns of Cloud Platforms-Security Threats of Big Data –Security Threats In Smart phones-Security Solutions For Mobile Devices-Security Concerns In IoT Components-Security Measures for IoT Platforms/Devices.

Text books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things, A Hands-On Approach”, Universities Press (INDIA) Private Limited, 1st Edition, 2015.
2. Pethuru Raj and Anupama C. Raman, “The Internet of Things Enabling Technologies, Platforms, and Use Cases”, Taylor & Francis, CRC Press, 1st Edition, 2017.

Book for Reference:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014

Outcomes:

The students would have become familiar with IoT and its flavors; realised the IoT ecosystem and topologies; learnt how to integrate IoT with the environment; communicate from and to machines and some aspects of security of IoT.

CORE ELECTIVE – IV (CE)

A: SOFTWARE PROJECT MANAGEMENT

Objectives:

To introduce the basic concepts of SPM, project evaluation, planning, monitoring and controlling a software project; to teach team management and to introduce ISO standards.

Unit – I: Introduction to Software Project Management: What is a Project? – Software Projects versus Other Types of Project – Activities Covered by Software Project Management -Stakeholders - Project Success and Failure - What is Management? - Management Control. An overview of Project Planning: Introduction to stepwise Project Planning - Select the Project – Identify Project Scope and Objectives – Identity of Project Infrastructure -Analyze Project Characteristics - Identify Project Projects and Activities – Estimate Effort for each Activity - Identify Activity Risks - Allocate Resource – Review/Publicize plan - Execute Plan/Lower levels of Planning.

Unit – II: Project Evaluation: Evaluation of Individual Projects -Risk Evaluation - Strategic Programme Management – Selection of an Appropriate Project Approach: Introduction – Choosing Methodologies and Technologies – Software Processes and Process Models –Choice of Process models – The Waterfall model - Software Prototyping - Other ways of Categories Prototypes – Incremental Delivery – Selecting the Most Appropriate Process Model. Software Effort Estimation : Basis for software Estimating - Software Effort Estimation Techniques – Bottom-up Estimating – The Top-down Approach and Parametric Models - Albrecht Function Point Analysis – COCOMO II : A Parametric Productivity Model.

Unit – III: Activity Planning: Objectives - Project Schedules - Sequencing and Scheduling Activities -Network Planning Models - Formulating a Network Model – The Forward Pass – The Backward Pass – Identifying the Critical Path - Identifying Critical Activities –ActivityOn-Arrow Networks. Risk Management : Risk – Categories of Risk - Risk Identification – Risk Assessment – Risk Planning – Risk Management - Applying the PERT Technique Resource Allocation : The Nature of the Resources - Identifying Resource Requirements –Scheduling Resources – Creating Critical Paths - The Scheduling Sequence.

Unit – IV: Monitoring and Control: Creating the Framework – Collecting the Data –Visualizing Progress - Cost monitoring Earned Value Analysis – Prioritizing Monitoring - Change control. Managing Contracts: Types of Contract - Stages in Contract Placement – Typical Terms of Contract – Contract Management -Acceptance Managing People in Software Environments: Understanding the Behaviour - Organizational Behaviour: A

Background - Selecting the Right Person for the Job – Instruction in the Best methods – Motivation - The Oldham - Hackman Job Characteristic Model.

Unit – V: Working in Teams: Becoming a Team – Decision Making – Organization and Team Structures - Leadership – Coordination dependencies - Software Quality The importance of Software Quality - Defining Software Quality - ISO 9126 - Product versus Process Quality Management - Quality Management systems - Software Reliability -Quality Plans - Prince2 – An overview - Project Management Tools.

Text Book:

Bob Hughes, Mike Cotterell, Rajib Mall –Software Project Management, Fifth Edition, McGraw Hill Education Pvt. Ltd, 2014.

Unit-I : chapters –1, 3, Unit-II: chapters –2, 4, 5, Unit-III: chapters –6, 7, 8, Unit-IV: chapters –9, 10, 11, Unit-V:Chapters –12, 13

Books for Reference:

1. Walker Royce, Software Project Management, Pearson Education, 2012.
2. Joel Henry, Software Project Management, Pearson Education, 2009.

Outcomes:

The students would have become familiar with the basic concepts of SPM, project evaluation, planning, monitoring and controlling a software project, team management and ISO standards.

CORE ELECTIVE – IV (CE)

B: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Objectives:

To introduce to the students the following aspects of AI and ML; simple linear regression, multiple regression, logistic regression, Bayesian networks and Genetic algorithms.

Unit – I: Simple Linear Regression: Introduction to Simple Linear Regression- The Least-Squares Estimates- Dangers of Extrapolation- The Coefficient of Determination, r -Standard Error of the Estimate s - Correlation Coefficient r -ANOVA Table for Simple Linear Regression- Outliers, High Leverage Points, and Influential Observations-Population Regression Equation- Verifying the Regression Assumptions- Inference in Regression- t -Test for the Relationship Between x and y -Confidence Interval for the Slope of the Regression Line - Confidence Interval for the Correlation Coefficient ρ - Confidence Interval for the Mean Value of y Given x - Prediction Interval for a Randomly Chosen Value of y Given x - Transformations to Achieve Linearity- Box-Cox Transformations.

Unit – II: Multiple Regression And Model Building: Introduction to Multiple Regression - The Population Multiple Regression Equation - Inference in Multiple Regression- Regression with Categorical Predictors, Using Indicator Variables - Adjusting R^2 : Penalizing Models for Including Predictors that are not Useful - Sequential Sums of Squares- Multicollinearity - Variable Selection Methods - An Application of Variable Selection Methods - Using the Principal Components as Predictors in Multiple Regression.

Unit - III: Logistic Regression: Simple Example of Logistic Regression- Maximum Likelihood Estimation- Interpreting Logistic Regression Output-Odds Ratio and Relative Risk-Interpreting Logistic Regression for a Dichotomous Predictor-Interpreting Logistic Regression for a Polychotomous Predictor- Interpreting Logistic Regression for a Continuous Predictor- Assumption of Linearity-Zero-Cell Problem- Multiple Logistic Regression- Introducing Higher Order Terms to Handle Nonlinearity - Validating the Logistic Regression Model-

Unit – IV: Naive Bayes And Bayesian Networks: Bayesian Approach- Maximum a Posteriori (Map) Classification- Posterior Odds Ratio- Balancing the Data- Naïve Bayes Classification- Interpreting the Log Posterior Odds Ratio- Zero-Cell Problem - Numeric Predictors for Naïve Bayes Classification.

Unit - V: Genetic Algorithms: Introduction to Genetic Algorithms-Basic Framework of a Genetic Algorithm- Simple Example of a Genetic Algorithm at Work - Modifications and Enhancements: Selection-Modifications and Enhancements: Crossover- Genetic Algorithms for Real-Valued Variables- Using Genetic Algorithms to Train a Neural Network -

Text Book:

1. Daniel T. Larose , Chantal D. Larose, Data mining and Predictive analytics, Second Ed., Wiley Publication, 2015. **Chapters:** 8, 9, 13,14,27.

Books for Reference:

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling, 3rd Edition, April 15, 2019,
2. Jason Bell, Machine Learning: Hands-On for Developers and Technical Professionals, Wiley Publication, 2015.

Outcomes:

The learners would have become familiar with the following concepts; AI and ML; simple linear regression, multiple regression, logistic regression, Bayesian networks and Genetic algorithms.

CORE ELECTIVE – IV (CE)

C: SOFT COMPUTING

Objectives:

To introduce the students the following areas of knowledge that is important for research in Computer Science. Fuzzy set theory, Optimisation, Artificial neural networks, neuro-fuzzy modelling and computational intelligence.

Unit – I: Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set – Theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models –Input Space Partitioning and Fuzzy Modeling.

Unit – II: Optimization: Derivative based Optimization – Descent Methods – The Method of Steepest Descent– Classical Newton’s Method – Step Size Determination – Derivative Free Optimization – Genetic Algorithms – Simulated Annealing – Random Search –Downhill Simplex Search.

Unit – III: Neural Networks: Supervised Learning Neural Networks – Perceptrons – Adaline Backpropagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self –Organizing Networks – Learning Vector Quantization – Hebbian Learning.

Unit – IV: Neuro Fuzzy Modeling: Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Unit – V: Application Of Computational Intelligence: Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Text book:

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

Books for Reference:

1. Timothy J. Ross, “Fuzzy Logic with Engineering Application, “McGraw Hill, 1977.
2. Davis E. Goldberg, “Genetic Algorithms Search, Optimization and MachineLearning”, Addison Wesley, 1989.
3. S. Rajasekaran and G.A.V. Pai, “Neural Networks, Fuzzy Logic and GeneticAlgorithms”, PHI, 2003. Emereo Pty Limited, July 2008.
4. Ahmar, Abbas, “Grid Computing - A Practical Guide to technology and Applications”, Charles River media, 2003.

Outcomes:

The students would have gathered knowledge in the following areas; Fuzzy set theory, Optimisation, Artificial neural networks, neuro-fuzzy modelling and computational intelligence.
