Computer Science & Engineering (AI & ML)

Semester III (Second Year)

S. No.	Course Code	Course Title	Hours Per Week	Scheme of Examination			Category Code
			L – T – P	INT	EXT	Credits	
1	CM 211	Probability and Statistics	3 – 0 – 0	30	70	3	BS
2	CM 212	Discrete Mathematics	3 – 0 – 0	30	70	3	ES
3	CM 213	Computer Organization	3 – 0 – 0	30	70	3	PC
4	CM 214	Database Management Systems	3 – 0 – 0	30	70	3	PC
5	CM 215	Object Oriented Programming	3 – 0 – 0	30	70	3	PC
6	CM 251	Probability and Statistics Lab	0 – 0 – 3	30	70	1.5	BS
7	CM 252	Database Management System Lab	0 – 0 – 3	30	70	1.5	PC
8	CM 253	Object Oriented Programming Lab	0 – 0 – 3	30	70	1.5	PC
9	CM SL1	Skill Oriented Course - I	1 – 0 – 2	100	-	2	SC
10	CM MC3	Design Thinking & Product Innovation	2 – 0 – 0	100	-	-	MC
		Total	18 – 0 –11	**440**	**560**	**21.5**	

CM 211	Probability and Statistics	L	T	P	C
		3	-	-	3

Course Objectives:

The student who successfully completes this course will have:

1. The ability to understand the basic principles of various probability distributions.
2. The ability to know the sample distributions of the data
3. The basic concepts of testing of hypothesis and their applications for the data.
4. The skill to predict the future behavior based on time series data.

Course Outcomes:

On completion of this course, students will be able to:

CO1. Apply various formulae to analyze and interpret the data.

CO2. Apply the knowledge of distribution theory to both software and hardware design problems

CO3. Apply the basic concepts of testing of hypothesis and derive the conclusions for the data.

CO4. Forecast the behavior of the data by various models in time series.

Course Content:

UNIT – I **14 Periods**

Probability distributions: Random Variables, Binomial distribution, Poisson distribution, and Geometric distribution.

Probability densities: Continuous random variables, Normal distribution, Normal approximation to the Binomial distribution, Uniform distribution, Log-normal distribution, Gamma distribution, Beta distribution, Weibull distribution.

UNIT – II **14 Periods**

Sampling distribution: Population and samples, the sampling distribution of mean (σknown), the sampling distribution of mean (σ unknown), the sampling distribution of variance.

Testing of Hypotheses (Parametric Tests): Inferences Concerning Means: Point estimation, Interval estimation, tests of hypothesis, Null hypothesis and tests of hypothesis, hypothesis concerning one mean, inferences concerning two means

UNIT – III **14 Periods**

Testing of Hypotheses (Parametric Tests) (Contd…):

Inferences Concerning Variances*:* The estimation of variances, hypothesis concerning one variance, hypothesis concerning two variances.

Inferences Concerning Proportions: The estimation of proportions, hypothesis concerning one proportion, hypothesis concerning several proportions, The analysis of r×c tables, Goodness of fit.

UNIT – IV **14 Periods**

Testing of Hypotheses (Non-Parametric Tests): Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Tolerance region.

Basics of Time Series Analysis& Forecasting: Stationary, ARIMA, Models : Identification, Estimation and Forecasting.

Learning Resources:

Text Book:

1. Miller & Freund's Probability and Statistics for Engineers–Richard A. Johnson.

Reference Books:

1. U. Dinesh Kumar, Business Analytics: The science of data-driven decision making.
2. S. M. Ross, Introduction to Probability and Statistics for Engineers and Scientists.
3. P. G. Hoel, S.C. Port and C.J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol.1, 3rd Ed., Wiley.
5. S.C. Gupta and V.K. Kapoor., Fundamentals of Mathematical Statistics, Sultan Chand & Co.

CM 212	Discrete Mathematics	L	T	P	C
		3	-	-	3

Course Objectives:

At the end of the course, the student will

1. Introduce the concepts of mathematical logic.
2. Understand the combinatorial problems using counting principles,
3. Create generating functions and solve recurrence relations.
4. Use Directed & Un-Directed Graphs concepts and its applications.

Course Outcomes:

At the end of the course, the student will be able to

CO1. Apply formal methods of proof and propositional & First order logic to validate the Propositional statements.

CO2. Apply techniques for counting the occurrences of discrete events including

CO3. permutations, combinations with or without repetitions.

CO4. Solve generating function and recurrence relations.

CO5. Solve the real-world problems using directed and undirected graphs.

Course Content:

UNIT – I **13 Periods**

Foundations: Sets, Relations and Functions, Fundamentals of Logic, Logical Inferences Methods of Proof of an implication, First order Logic & Other methods of proof, Rules of Inference for Quantified propositions, Mathematical Induction.

UNIT – II **10 Periods**

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of combinations and permutations ,enumerating of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Combinations and Permutations with Constrained Repetitions.

UNIT – III **13 Periods**

Recurrence Relations: Generating functions of sequences, Calculating Coefficients of generating Functions, solving recurrence relations by Substitution and generating functions. The methods of characteristic roots, solutions of inhomogeneous recurrence relations.

UNIT – IV **14 Periods**

Relations & Digraphs: Properties & Equivalence relations, Operations on relation, Directed Graphs and Adjacency Matrices, Ordering relations, Lattices and Enumerations.

Graphs: Isomorphism's and Sub graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem.

Learning Resources:

Text Book:

1. Joe L. Mott, Abraham Kandel & Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, PHI 2nd edition.

Reference Books:

1. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach,3rd Edition by, Tata McGraw – Hill.
2. Discrete and Combinational Mathematics- An Applied Introduction-5th Edition– Ralph. P. Grimaldi. Pearson Education
3. Discrete Mathematical Structures with applications to computer science Trembly J. P. & Manohar P., TMH
4. Discrete Mathematics and its Applications, Kenneth H. Rosen, 5th Edition. TMH.

CM 213	Computer Organization	L	T	P	C
		3	-	-	3

Course Objectives:

The objectives of the course are:

1. To introduce the functional units of computer system, architecture and its operations.
2. To discuss the basic processing unit and I/O devices.
3. To impart the knowledge on memory system.
4. To demonstrate the arithmetic operations in a computer system.
5. To instruct the instruction level parallelism

Course Outcomes:

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

CO1. Describe components, architecture of a computer system and its working.

CO2. Analyze instruction execution and control system.

CO3. Develop a pipeline system for the execution of instruction.

CO4. Explain various I/O handling mechanisms and its interfaces.

CO5. Analyze computer arithmetic algorithms.

CO6. Construct various memory systems.

Course Content:

UNIT – I **12 Periods**

Basic structure of computers: Computer types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic, Character Representation, Performance.

Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Stacks, Subroutines, Additional Instructions, Encoding of Machine Instructions.

UNIT – II **14 Periods**

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control.

Pipelining: Basic Concept-The Ideal Case, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource limitations.

UNIT – III **10 Periods**

Basic Input/ Output: Accessing I/O Devices: I/O Device Interface, Program-Controlled I/O; Interrupts: Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling I/O Device Behavior, Processor Control Registers.

Input/output Organization: Bus Structure, Bus Operation: Synchronous Bus, Asynchronous Bus; Arbitration, Interface Circuits; PCI Bus, SCSI Bus.

UNIT – IV **14 Periods**

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Cache Memories, Performance Considerations.

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication-Bit-Pair recoding of Multipliers, Integer Division, Floating-Point Numbers and Operations.

Learning Resources:

Text Book:

1. Computer Organization and Embedded Systems, 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Reference Books:

1. Computer Architecture and Organization, 3rd Edition by John P. Hayes, WCB/McGraw-Hill.
2. Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, Pearson Education.

CM 214	Database Management Systems	L	T	P	C
		3	-	-	3

Course Objectives:

At the end of the course the students will understand

1. Fundamental concepts and architectures of database system
2. Features and design of conceptual and relational data models
3. Formal relational Languages and SQL to query, update, and manage a database
4. The concepts and protocols related to transaction processing, concurrency control and recovery

Course Outcomes:

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

CO1. Discuss the fundamental concepts and architecture of database systems.
CO2. Query the database using relational algebra and SQL.
CO3. Explain the concepts of relational data model and design database using Normalization process.
CO4. Develop conceptual database schema for a given specification.
CO5. Describe the role of transaction processing, concurrency control and recovery in a multi User database system.

Course Content:

UNIT – I **11 Periods**

Introduction: Database system Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators
Introduction to the Relational Model: Structure of RDBMS, Database Schema, Keys, Relational Query Languages, Relational Operations

UNIT – II **15 Periods**

Formal Relational Query Languages - The Relational Algebra and Relational Calculus.
SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transaction, Integrity Constraints, SQL Data Types and Schemas, Authorization

UNIT – III **12 Periods**

Database Design and the E-R Model - Overview of the Design Process, The Entity- Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity- Relationship Diagrams, Reduction to Relational Schemas.
Relational Database Design - Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database-Design

Process.

UNIT – IV **12 Periods**

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes, Snapshot Isolation

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management.

Learning Resources:

Text Book:

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition, McGraw Hill Publishers

Reference Books:

1. Fundamentals of Database Systems, Ramez Elmasri and Navate Pearson Education, 6th edition.
2. An Introduction to Database Systems, C.J. Date, A.Kannan, S. Swamynathan, Pearson Education,8th edition.
3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

CM 215	Object Oriented Programming	L	T	P	C
		3	-	-	3

Course Objectives:

The learning objectives of this course are:

1. To make the students understand Java fundamental concepts
2. To elucidate the fundamentals of object-oriented programming in Java
3. To create awareness on exception handling and multithreading
4. To familiarize students with the concepts of Event Handling, Generics and Collections

Course Outcomes:

By the end of the course, the students will be able to

CO1. Comprehend the concepts of OOP and fundamentals of Java Programming.
CO2. Develop reusable and efficient programs using Inheritance & Polymorphism.
CO3. Demonstrate the importance of packages and interfaces.
CO4. Use the concept of exception handling to create error free codes and avoid abnormal program terminations.
CO5. Design multi-tasking applications using Multithreading.
CO6. Develop Event Driven applications and generic programs

Course Content:

UNIT – I **11 Periods**

Introduction: The history and evolution of Java, Java Buzz words, object-oriented programming, Data Types, Variables and Arrays, Operators, Control Statements.

Classes and Objects: Concepts, methods, constructors, types of constructors, constructor overloading, usage of static, access control, this keyword, garbage collection, finalize()method, overloading, parameter passing mechanisms, final keyword, nested classes and inner classes.

Utility Classes: Date, Calendar, Scanner, Random

UNIT – II **15 Periods**

Inheritance: Basic concepts, access specifiers, usage of super key word, method overriding, using final with Inheritance, abstract classes, dynamic method dispatch, Object class.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.

Strings: Exploring the String class, String buffer class, Command-line arguments.

UNIT – III **12 Periods**

Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, multiple catch clauses, nested try, Built-in exceptions, creating own exception sub classes.

Multithreading: The Java Thread model, thread life cycle, Thread class, Runnable interface,

creating multiple threads, Synchronization, Inter Thread Communication, Deadlock.

Applets: Concepts of Applets, life cycle of an applet, creating applets

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.

UNIT – IV **12 Periods**

AWT: AWT Components, , File Dialog boxes, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar.

GUI with Swing– Swings introduction, JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons. Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Generics: Basics of Generic Methods, Generic Classes.

Collections: Collection Interfaces, Collection Classes**,** Accessing a Collection via an Iterator.

Learning Resources:

Text Book:

1. Java The Complete Reference - Herbert Schildt 11th Edition, Mc Graw Hill Education.

Reference Books:

1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
3. Cay.S. Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals 7th Edition, Pearson Education.
4. H.M.Dietel and P.J.Dietel, Java How to Program, Sixth Edition, Pearson Education/PHI.
5. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.
6. Cay Horstmann, John Wiley and Sons, Big Java 2nd Edition, Pearson Education.

CM 251	Probability & Statistics Lab	L	T	P	C
		-	-	3	1.5

Course Objectives:

The student who successfully completes this course will have:

1. The knowledge to use R for statistical programming, computation, modelling and graphics.
2. The skill to write functions and use R in an efficient way.
3. The ability to fit some basic types of statistical models using R.
4. The idea to expand the knowledge of R on their own.

Course Outcomes:

On completion of this course, students will be able to:

CO1. Write the programs in R to solve the statistical problems.

CO2. Apply various built in functions in R to solve the computational and modelling problems.

CO3. Interpret the statistical data by various functions of graphical representation.

CO4. Understand- reading, writing, working and manipulating the data in various data frames.

Lab – Course Content:

Pre – Requisites: CM-154–Fundamentals of Computer Science Lab.

Lab – Course Plan & Delivery:

LIST OF EXPERIMENTS	PERIODS
1. Graphical representation of data a)Bar plot b)Frequency polygon	3
2. Graphical representation of data a) Histogram b)Pie chart c) Scatter plot	3
3.Measures of central tendency a)Mean b)Median c)Mode	3
4. Measures of central tendency a)Geometric Mean b)HarmonicMean	3
5. Measures of dispersion a)ange b)Quartiledeviation	3
6. Measures of dispersion a) Mean deviation b)Standard deviation	3
7. Goodness of fit a) Binomial b)Poisson	3
8. Goodness of fit a) Normal b)Contingency table	3
9. Parametric tests a) t-test for one-mean b) t-test for two means	3

10. Parametric tests a) paired t-test b) F-test	**3**
11. Non-parametric tests a) Sign test b) Wilcoxon-Signed rank test	**3**
12. Non-parametric tests a) Mann-Whitney test b)Kolmogorov-Smirnov test	**3**
13. Time series a) Trend line b)Non-linear trend line	**3**
14. Time series a) Moving averages b)ARIMA	**3**

Learning Resources:

TextBooks:

1. Hands-on Programming with R, Garrett Grolemund, O'Reilly.
2. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, Addison-Wesley.

CM 252	Database Management Systems Lab	L	T	P	C
		-	-	3	1.5

Course Objectives:

At the end of the course the students will understand

1. Syntax and usage of DDL, DML, DCL, and TCL statements, asserting database integrity constraints during database creation.
2. Semantics of SQL for implementing the user queries on a relational database.
3. Block structured PL / SQL programming concepts.

Course Outcomes:

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

CO1. Define, manipulate and control data using Structured Query Language (SQL).

CO2. Identify various database integrity constraints during database creation.

CO3. Construct SQL statements for satisfying end user queries by utilizing functions, set operations, joins, and subqueries.

CO4. Develop various applications using various PL/SQL data object like Database cursors, Functions, Stored Procedures, Packages, and Triggers.

Week 1	Practice DDL and DML statements for creating a sample database without integrity constraints.
Week 2	Practice DDL and DML statements for refining a sample database including integrity constraints.
Week 3-6	Query the sample database using simple select statements retrieving: 1.Small-large number of attributes 2.Distinct output values 3.By Renaming attributes 4.Computed attributes 5.By using Simple-complex conditions (AND, OR, NOT) 6.By using Partial Matching operators (LIKE, %, _, *,?) 7.Sorted records 8.By checking for Nulls
Week 7	Query the sample database using built-in single row functions
Week 8	Implement PL/SQL named and unnamed blocks
Week 9	Implement PL/SQL Implicit and Explicit Cursors
Week 10	Implement PL/SQL pre-defined and user defined exceptions
Week 11	Implement PL/SQL stored procedures, functions and packages
Week 12	Implement PL/SQL database triggers

CM 253	Object Oriented Programming Lab	L	T	P	C
		-	-	3	1.5

Course Objectives:

1. To introduce java compiler, interpreter.
2. To make the students learn an object oriented way of solving problems using java.
3. To make the students write programs using multithreading concepts and exception handling.
4. To make the students understand the usage of Event handling, generics, collections

Course Outcomes:

By the end of this course the students will be able to

CO1. Write simple java programs using java fundamentals and basic OOP concepts.

CO2. Design programs using inheritance and polymorphism.

CO3. Demonstrate inter process communication using multithreading.

CO4. Demonstrate the user defined exceptions by exception handling keywords (try, catch, throw, throws and finally).

CO5. Develop Event driven applications and Generic programs

List of Experiments:

The programming concepts to be implemented in the Lab are

Week 1:	Fundamentals of classes and objects
Week 2:	static keyword, this keyword, variable length arguments
Week 3:	inner classes, constructor overloading
Week 4:	Types of inheritances
Week 5:	Method overloading, Method Overriding, usage of final and super
Week 6:	Abstract classes, interfaces, Dynamic method dispatch.
Week 7:	String class and its methods
Week 8:	Packages
Week 9:	Exception Handling Techniques
Week 10:	Multithreading concepts
Week 11:	Applets and event handling
Week 12:	Awt components and delegation event model
Week 13:	MVC architecture in Swing
Week 14:	Generics and collections

CM SL1 (a)	Skill Oriented Course - Web Design & Development	L	T	P	C
		1	-	2	2

Course objectives:

At the end of the course the students will understand

1. Basic technologies to develop web documents.
2. Cascading Style Sheets in web page designing.
3. Interactive web pages using java script.
4. Dynamic HTML Pages and Event handling mechanism.

Course Outcomes:

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

CO1. Analyze a web page and identify its elements and attributes.

CO2. Create web pages using XHTML and Cascading Styles sheets.

CO3. Build dynamic web pages and interactive web pages using java script.

CO4. Create web pages using event handling models.

Course Content

UNIT – I **11 hours**

Fundamentals – Brief Introduction to the Internet, The Word Wide Web, Web Browsers, Web Servers, URL, Multipurpose Internet Mail Extensions, Hypertext Transfer Protocol, Security The Web Programmers Toolbox.

Introduction to HTML5 Part 1: Introduction, Editing HTML5, First HTML5 example, Headings, Linking, Images, Special Characters and Horizontal Rules, Lists, Tables and Forms. Internal Linking and meta elements.

Introduction to HTML5 Part 2: Introduction, New HTML5 Form input types, Input and Data List elements and autocomplete Attribute, Page Structure Elements.

UNIT – II **11 hours**

Cascading Style Sheets Part 1: Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Elements Dimensions, Box Model and Text Flow, Media Types and Media Queries, Drop Down Menu and User Style Sheets.

Cascading Style Sheets Part 2: Introduction, Text Shadows, rounded corners, Color, Box Shadows, Linear Gradients, Radial Gradients, Multiple Background Images, Image borders, Animation: Selectors, Transitions and Transformations, Downloading Web fonts, Flexible Box Layout Module, Multicolumn Layout and Media Queries

UNIT – III **10 hours**

JavaScript: Introduction to Scripting, Control Statements I, Control statements II, Functions, Arrays, Objects.

UNIT – IV **10 hours**

Document Object Model (DOM) Objects and Collections: Introduction, DOM Nodes and Trees, Traversing and Modifying a DOM tree, DOM Collections and dynamic styles.

Java Script Event Handling: Introduction, Reviewing the load Event, Event mouse move and the event object, Rollovers with mouse over and mouse out, Form processing with focus and blur, More form processing with submit and reset, Event Bubbling.

Learning Resources:

Text Book:

1. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 5/e,Pearson Education.

Reference Books:

1. Web Technology – Uttam K. Roy, Oxford University Press, 2010 Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson

Web References:

1. www.deitel.com
2. www.w3schools.com
3. www.tutorialspot.com

CM SL1 (b)	Skill Oriented Course - Programming with C++	L	T	P	C
		1	-	2	2

Course Objectives:

At the end of the course the students will understand

1. Introduce to the student the fundamentals of C++ language.
2. To make the students understand the principles of data abstraction, inheritance and polymorphism
3. To create awareness about generic programming and exception handling
4. To make the students familiar with IO streams, STL.

Course Outcomes:

After the completion of the course, students will be able to

CO1. Differentiate POP and OOP and then use C++ fundamentals and various function modifiers to create and manipulate classes and objects.

CO2. Make use of the advantages of Compile time polymorphism and also develop Reusable programs by applying inheritance.

CO3. Use runtime polymorphism, generic programming and exception handling techniques for developing efficient programs.

CO4. Demonstrate C++ streams, Name Spaces and STL.

Course Content:

UNIT – I **12 Periods**

An Overview of C++: The Origins of C++, What is Object Oriented Programming, some C++ fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Function Overloading, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program

Classes and Objects: Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment, arrays of objects.

UNIT – II **12 Periods**

Function Overloading, Copy Constructors and Default Arguments: Function Overloading, Overloading Constructor Functions, Copy Constructors, Finding the Address of an Overloaded Function, Overload Anachronism, Default Arguments, Function Overloading and Ambiguity.

Operator Overloading: Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator

Inheritance: Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

UNIT – III **12 Periods**

Virtual Functions & Polymorphism: Virtual Functions, The Virtual Attribute is inherited, Virtual Functions Are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.
Templates: Generic Functions, Applying Generic Functions, Generic Classes, Typename and export Keywords, Power of Templates.
Exception Handling: Fundamentals, Derived-Class Exceptions, Options, Terminate() and unexpected(), uncaught_exception(), exception and bad_exception Classes, Applying Exception Handling.

UNIT – IV **12 Periods**

The C++ I/O System Basics: Old Vs. Modern C++ I/O, Streams, Stream Classes, Formatted I/O, Overloading << and >>, Creating Manipulators.
C++ File I/O: File Classes, Opening and Closing a File, Text Files, Unformatted Binary I/O,get(), Getline() functions, Detecting EOF ,Random Access
Namespaces, Conversion Functions and other Advanced Topics: Namespaces, Thestd Namespace, Creating Conversion Functions, const Member Functions and mutable, Volatile Member Functions, Explicit Constructors, Differences between C and C++.
Introducing Standard Template Library: An Overview of STL

Learning Resources:

Text Book:

1. The Complete Reference - C++ - Herbert Schieldt, 4/e, Tata McGraw Hill.

Reference Books:

1. Bjarne Stroustrup, “The C++ Programming Language”, Special Edition,
2. Pearson Education.
3. C++ - How to Program – Dietel&Dietel
4. Programming in C++ - Barkakati
5. Mastering C++ by Venugopal

CM MC3	Design Thinking & Product Innovation	L	T	P	C
		2	-	-	-

Course Objectives:

At the end of the course the students will understand

1. Identify the design thinking principles and practices in today's industry.
2. Learn the Planning of research activities to gather and empathize from a user's viewpoint.
3. Study the Ideate techniques to help arrive at the best solution and evaluation.

Course Outcomes:

After the completion of the course, students will be able to

CO1. Interpret the concepts of Design thinking to real-world activities.

CO2. Investigate a problem to determine its root cause in terms of Design Thinking perspective.

CO3. Apply group thinking methods and experiment with different solutions to a given problem.

CO4. Develop innovative thinking and creative problem solving abilities.

Course Content:

UNIT I **12 Periods**

Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking.

UNIT II **12 Periods**

Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.

UNIT III **12 Periods**

Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.

UNIT IV **12 Periods**

Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization, Creative Culture, Strategy & Organization Design Thinking approaches.

Learning Resources:

Text Book(S):

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress. [UNIT - I]
2. "Change by design", Tim Brown, Harper Collins, 2009 [UNIT - I]
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil Service Commission, Bhutan. [UNIT – II & III]
4. IdrisMootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). [UNIT -IV]

Reference Book(s):

1. “Design Thinking Business Innovation”, Rio de Janeiro – 2012 1st edition, MJV press.
2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

Web Reference:

1. IDEO: Design Thinking for Educators toolkit https://designthinkingforeducators.com/.
2. https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking
3. https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/ (wallet Project)