

## SEMESTER II

### UCCSD20 – DATA STRUCTURES WITH C++

<b>Year: I</b> <b>Sem: II</b>	<b>Course Code:</b> UCCSD20	<b>Title of the Course:</b> Data Structures with C++	<b>Course Type:</b> Theory	<b>Course Category:</b> Core	<b>H/W</b> 4	<b>Credits</b> 4	<b>Marks</b> 40+60
----------------------------------	--------------------------------	---------------------------------------------------------	-------------------------------	---------------------------------	-----------------	---------------------	-----------------------

#### Course Learning Objectives (CLO)

1. To understand how C++ expands C with object-oriented features.
2. To learn how to implement copy constructors and class member functions.
3. To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
4. To identify problem involving trees and binary search trees.
5. To apply Algorithm for solving problems like sorting, searching, insertion and deletion of data using linked list.

#### Course Outcomes (COs)

1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Understand dynamic memory management techniques using pointers, constructors, destructors, etc.
3. Describe the concept of function overloading, operator overloading, virtual functions.
4. Identify problem involving trees and binary search trees.
5. Analyse graphs and describe the hash function and concepts of collision and its resolution methods.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	M	M	L	H
CO2	M	L	H	L	M	M
CO3	L	L	M	H	L	M
CO4	M	M	L	M	M	M
CO5	H	L	M	M	M	L

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6

<b>CO1</b>	H	M	L	M	M	H
<b>CO2</b>	M	H	M	H	H	L
<b>CO3</b>	H	M	H	L	L	H
<b>CO4</b>	M	H	L	M	H	M
<b>CO5</b>	L	M	H	H	M	M

**(Low -L, Medium -M, High-H)**

**Unit I**

**(Hour 12)**

- 1.1 Principles of OOP – Basic concepts - Benefits – Applications (K2, K4)
- 1.2 Introduction to C++ –Tokens-Keywords – Identifiers – Variables (K1, K2)
- 1.3 Operators – Expressions and Control structures. (K1, K2, K4)
- 1.4 Function Function Prototyping (K4, K5, K6)
- 1.5 Parameter Passing in Function – Values Returned by Functions (K4, K6)
- 1.6 Inline Functions – Function Overloading. (K2, K4, K6)

**Unit II**

**(Hour 12)**

- 2.1 Classes and Objects - Constructors and Destructors - Introduction (K2, K4, K6)
- 2.2 Types of Constructors - Destructors - Operator Overloading (K2, K3, K6)
- 2.3 Inheritance: Introduction – Types - Virtual Base Classes (K3, K4, K5, K6)
- 2.4 Abstract Classes - Constructors in Inheritance (K2, K4)
- 2.5 Virtual functions and Polymorphism (K2, K6)
- 2.6 Pointers to Objects - this Pointer (K2, K6)

**Unit III**

**(Hour 11)**

- 3.1 Virtual functions and Polymorphism: Pointers to Objects - this Pointer(K2, K6)
- 3.2 Pointers to Derived Classes - Virtual Functions- Pure Virtual Functions. (K2, K4)
- 3.3 Mapping Console I/O Operations - File File streams (K2, K5, K6)
- 3.4 File operations - File pointers (K2)
- 3.5 Command Line Arguments (K4, K6)
- 3.6 Exception handling. (K2, K4, K5, K6)

**Unit IV**

**(Hour 13)**

- 4.1 Introduction - Basic Terminology - Data structures - Data structure operation (K2)
- 4.3 Traversing Linear Arrays - Inserting and Deleting – Searching - Linear Search - Binary Search - Multidimensional Arrays – Pointers - Pointer Arrays(K2)
- 4.4 Introduction- Linked list - Traversing a linked list - Searching a linked list (K3)

4.5 Single Linked List - Doubly Linked List – Stacks - Arithmetic Expression- Polish Notation – Recursion - Queues. (K2, K3)

4.6 Trees – Introduction - Binary Trees - Traversing Binary Trees – Preorder - In order - Post order. (K3)

## **Unit V**

**(Hour 12)**

5.1 Graphs - Warshall Algorithm Shortest paths. (K2)

5.2 Adjacency - First Search - Depth First Search. (K3, K4)

5.4 Warshall Algorithm Matrix - Path Matrix - Heap Sort. (K2)

5.3 Traversing on Graphs - Breadth Shortest paths - Linked Representation of Graphs. (K3)

5.5 Hashing- Hash Function - Collision Resolution. (K2)

5.6 Open Addressing: Linear Probing and Modifications – Chaining. (K3)

## **Text Book**

1. Balagurusamy E., “Object Oriented Programming with C++”, Sixth Edition, Tata McGraw Hill Publication, 2014.
2. Seymour Lipschutz, “Data Structure Schaum’s Outline Series”, Revised Edition, McGraw Hill Publication, 2011.

## **Reference Books**

1. Herbert Schildt, “The complete Reference C++”, 4<sup>th</sup> Edition, Tata McGraw Hill Publication, 2015.
2. Yashawant P. Kanetkar,” Let Us C++”, 2<sup>nd</sup> Edition, BPB Publication, 2003.
3. John R. Hubbard, “Programming with C++”, 2<sup>nd</sup> EditionI, Schaum’s Outlines, Tata McGraw Hill Publication, 2009.
4. Ellis Horowitz, Sartaj Sahni, Susan Andeson Freed, “Fundamentals of Data Structures in C&quot, 2<sup>nd</sup> Edition, Universities Press Pvt Ltd, 2018.
5. YashavantP.Kanetkar,“ Data Structures through C” , 2<sup>nd</sup> Edition, BPB Publications, 2003.
6. Alfred V.Aho, John E.Hopcroft, Jeffrey D.Ullman , “Data Structures and Algorithms”, 1<sup>st</sup> Edition, Pearson Education, 2004.

## **Open Educational Resources (OER)**

- 1.<http://beginnersbook.com/2017/08/cpp-oops-concepts/>
- 2.[http://www.tutorialspoint.com/cplusplus/cpp\\_object\\_oriented.htm](http://www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm)
3. [http://www.youtube.com/watch?v=h4kUiFOb\\_v0](http://www.youtube.com/watch?v=h4kUiFOb_v0)
4. <http://www.ddegjust.ac.in/studymaterial/mca-3/ms-17.pdf>

## SEMESTER II

### UCCSE20- PRACTICAL III: DATA STRUCTURES WITH C++

<b>Year: I</b> <b>SEM: II</b>	<b>Course Code:</b> UCCSE20	<b>Title of the Course:</b> Practical III: Data Structures with C++	<b>Course Type:</b> Practical	<b>Course Category:</b> Core	<b>H/W</b> 2	<b>Credits</b> 2	<b>Marks</b> 40+60
----------------------------------	--------------------------------	------------------------------------------------------------------------	----------------------------------	---------------------------------	-----------------	---------------------	-----------------------

#### Course Learning Objectives (CLO)

1. To build an understanding of basic concepts of object-oriented programming techniques.
2. To develop programming skills in programming language.
3. To write a program to solve various problems.
4. To implement object-oriented techniques using C++ language features.
5. To develop software using object-oriented programming paradigms.

#### Course Outcomes (COs)

1. Identify the appropriate data structure and algorithm for solving the real world problems.
2. Implement stack and queue techniques using arrays and pointers.
3. Implement the data structure algorithm for polynomial addition.
4. To know the concept of singly linked list.
5. To implement the concept of tree traversals using the algorithm.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	M	M	L	H
CO2	L	M	L	M	M	M
CO3	H	L	M	H	M	L
CO4	H	H	H	H	M	H
CO5	H	M	M	M	M	L

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	M	M	L
CO2	M	H	H	M	H	M
CO3	L	M	M	H	H	L
CO4	H	H	H	H	H	H
CO5	M	M	M	L	H	M

(Low -L, Medium -M, High-H)

### Practical Programs (K6)

(Hour 30)

1. Stack using Array in C++.
2. Queue using Array in C++.
3. Stack using pointers in C++.
4. Queue using pointers in C++.
5. Polynomial Addition using Array in C++.
6. Singly Linked List in C++.
7. Depth First Search for Graph in C++.
8. Binary Tree Traversal using Recursion in C++.

### SEMESTER- III

#### UCCSG20 - JAVA PROGRAMMING

Year: II	Course Code:	Title of the Course:	Course Type:	Course Category:	H/W	Credits	Marks
Sem: III	UCCSG20	Java Programming	Theory	Core	4	4	40+60

### Course Learning Objectives (CLO)

1. To give the knowledge of the structure and model of the Java programming language.
2. Use the Java programming language for various programming technology.
3. To develop software in the Java programming.
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirement.
5. To decide whether the Java programming language provides the required solutions.

### Course Outcomes (COs)

The Learners will be able to

1. Able to understand the use of OOPs concepts.

2. Able to solve real world problems using OOP techniques and to understand the use of polymorphism and Inheritance.
3. Able to understand the use of Packages and Interface in Java.
4. Able to develop and understand exception handling, multithreaded applications with synchronization.
5. Able to design GUI based applications and develop AWT and applets for web applications.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	M	M	M	H
CO2	L	M	L	M	M	M
CO3	M	L	L	M	L	M
CO4	L	L	M	H	M	L
CO5	H	M	M	M	L	L

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6
CO1	H	H	M	M	M	M
CO2	H	H	M	L	M	M
CO3	L	L	H	H	H	H
CO4	H	H	H	L	H	H
CO5	L	L	H	M	H	H

(Low -L, Medium -M, High-H)

## Unit I

(Hour 12)

- 1.1 Introduction to Java (K2)
- 1.2 Features of Java (K4)
- 1.3 Lexical issues (K2, K5)
- 1.4 Data types – Variables (K2)
- 1.5 Operators - Type conversion and casting (K2, K3, K4)
- 1.6 Control Statements (K2, K4)

**Unit II****(Hour 12)**

- 2.1 Arrays – Strings (K2, K4)
- 2.2 Classes and Objects – Constructors (K2, K3, K4)
- 2.3 Overloading method – Access Control - Static and Fixed method (K2, K4)
- 2.4 Inner Class - String class (K2, K3, K4)
- 2.5 Inheritance (K2, K3)
- 2.6 Overriding Method - Using Super Class. (K2, K3, K6)

**Unit III****(Hour 12)**

- 3.1 Input/Output: Exploring Java I/O: The Java I/O classes and Interfaces (K2, K3, K5)
- 3.2 File (K2, K4, K6)
- 3.3 The Stream Classes (K2, K4)
- 3.4 Packages - Access Protection (K2, K3, K4)
- 3.5 Importing Packages (K2, K4)
- 3.6 Interfaces. (K2, K4, K5)

**Unit IV****(Hour 12)**

- 4.1 Exception Handling: try, catch (K2, K4)
- 4.2 Throw and Throws (K2, K4)
- 4.3 Finally (K2, K4)
- 4.4 Thread (K2, K3, K6)
- 4.5 Multithreading: Creating a Thread. (K2, K3, K6)
- 4.6 Executing threads (K5)

**Unit V****(Hour 12)**

- 5.1 The Java Applet and Interface (K2)
- 5.2 HTML Interface (K2)
- 5.3 getDocumentBase() and getCodeBase() (K4)
- 5.4 Event Handling (K4, K6)
- 5.5 Working with Windows (K4)
- 5.6 AWT Classes. (K5, K6)

**Text Book**

1. Herbert Schildt (2018). The Complete Reference: Java 2, Tata McGraw Hill Publication, 10<sup>th</sup> Edition.

**Reference Books**

1. C. Muthu, “Programming with Java”, 2<sup>nd</sup> Edition, Tata McGraw Hill Publishing, 2015.
2. E.Balagurusamy, “Programming with Java: A Primer”, 4<sup>th</sup> Edition, Tata McGraw Hill

Publication, 2015.

### Open Educational Resources (OER)

1. <http://www.tutorialspoint.com/java/index.htm>
2. <http://www.geeksforgeeks.org/java-programming-basics/>
3. <http://www.youtube.com/watch?v=eIrMbAQSU34>

## SEMESTER III

### UCCSH20 – PRACTICAL -V: PROGRAMMING IN JAVA

<b>Year: II</b> <b>Sem:III</b>	<b>Course Code:</b> UCCSH20	<b>Title of the Course:</b> Practical - V: programming in Java	<b>Course Type:</b> Practical	<b>Course Category:</b> Core	<b>H/W</b> 2	<b>Credits</b> 2	<b>Marks</b> 100
-----------------------------------	--------------------------------	----------------------------------------------------------------------	----------------------------------	---------------------------------	-----------------	---------------------	---------------------

### Course Learning Objectives (CLO)

1. To introduce the object-oriented programming concepts.
2. To understand object-oriented programming concepts and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes.
4. To introduce the concept of exception handling and multi-threading.
5. To introduce the design of graphical user interface using applets and AWT controls.

### Course Outcomes (COs)

The Learners will be able to

1. Explain about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods and I/O Streams.
3. Demonstrate the concepts of Packages and Interface.
4. Evaluate the Java programs to implement error handling techniques using exception handling.
5. Design GUI based applications and develop applets for web applications.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	M	M	M	H
CO2	L	M	L	M	M	M
CO3	M	H	L	H	L	H
CO4	L	L	M	H	M	L



CO5	H	H	M	M	L	L
-----	---	---	---	---	---	---

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6
CO1	H	M	H	H	M	M
CO2	L	H	M	M	H	H
CO3	M	H	H	M	H	H
CO4	M	M	H	H	M	M
CO5	L	M	M	H	M	M

(Low -L, Medium -M, High-H)

### Practical Programs

(Hour 30)

1. Implementing String manipulation using character Array. (K1, K3, K5)
2. Implementing Input and Output Stream. (K1, K3, K5)
3. Implementing Packages and Interface. (K3, K5)
4. Implementing Exception handling. (K3, K5)
5. Implementing Real time application using multithread. (K3, K5)
6. Implementing Applet using Graphics class. (K3, K5)
7. Implementing AWT controls. (K3, K5)
8. Implementing Colors and fonts. (K3, K5)
9. To create any applications using Applets and AWT. (K5)

## SEMESTER V

### UCCSO20 - DATA COMMUNICATION AND NETWORKING

Year: III	Course Code:	Title of the Course:	Course Type:	Course Category:	H/W	Credits	Marks
Sem: V	UCCSO20	Data Communication and Networking	Theory	Core	5	4	40+60

### Course Learning Objectives (CLO)

1. To discuss and explain about basics of data communication and networking concepts.
2. To introduce analysis and design of computer and communication networks.

3. Understand the network layered architecture and the protocol stack.
4. Design the basic configuration of routers and switches.
5. Resource sharing in the computer network to provide high Reliability.

### Course Outcomes (COs)

The Learners will be able to

1. To gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
2. Explain the types of Transmission Media with Real-Time Applications.
3. Apply Time and Frequency concept of analysis.
4. Manage Network functions for an Organization.
5. Analyze various Routing Algorithms and Protocols.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	M	M	M	H
CO2	M	H	M	M	H	L
CO3	M	L	L	L	M	M
CO4	M	H	M	M	M	M
CO5	H	M	L	H	L	L

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6
CO1	H	M	L	H	H	L
CO2	H	H	H	L	L	M
CO3	M	H	H	M	M	L
CO4	H	M	L	M	M	H
CO5	H	L	L	M	H	L

(Low -L, Medium -M, High-H)

### Course Syllabus

#### Unit I

(Hour14)

- 1.1 Data Communication Data Networking and the Internet - Data Communications and Networking for Today's Enterprise. (K1, K2)
- 1.2 Communications Model - Data Communications Networks. (K1, K2)
- 1.3 The Internet Protocol Architecture - TCP/IP and Internet Based Applications the Need for a Protocol Architecture - The TCP/IP Protocol Architecture. (K1, K2)
- 1.4 The OSI Model Standardization within Protocol Architecture - Traditional Internet Based

Applications. (K1, K2)

1.5 Multimedia Data Transmission - Concepts and Terminology. (K1, K2)

1.6 Analog and Digital Data Transmission -Transmission Impairments - Channel Capacity.  
(K1, K2)

## **Unit II**

**(Hour16)**

2.1 Transmission Media - Guided Transmission Media. (K2, K3)

2.2 Wireless Transmission - Wireless Propagation. (K2, K3)

2.3 Line of Sight Transmission - Signal Encoding Techniques. (K2, K3)

2.4 Digital Data Digital Signals - Digital Data Analog Signals – Analog Data Digital Signals –  
Analog Data Analog Signals. (K2, K3)

1.5 Digital Data Communication Techniques - Asynchronous and Synchronous Transmission. (  
K2, K3)

2.6 Types of Errors - Error Detection - Error Correction - Line Configurations. (K2, K3)

## **Unit III**

**(Hour14)**

3.1 Data Link Control Protocols - Flow Control Error Control. (K3, K4, K5)

3.2 High Level Data Link Control (HDLC) - Multiplexing. (K3, K4, K5)

3.3 Frequency Division Multiplexing - Synchronous Time Division Multiplexing.  
(K3, K4, K5)

3.4 Statistical Time Division Multiplexing - Asymmetric Digital Subscriber Line – xDSL.  
(K3, K4, K5)

3.5 Spread Spectrum - The Concept of Spread Spectrum - Frequency Hopping. (K3, K4, K5)

3.6 Spread Spectrum - Direct Sequence Spread Spectrum – Code Division Multiple Access.  
(K3, K4, K5)

## **Unit IV**

**(Hour16)**

4.1 Circuit Switching and Packet Switching - Switched Communications Networks. (K5, K6)

4.2 Circuit Switching Networks - Circuit Switching Concepts. (K5, K6)

4.3 Soft switch Architecture - Packet Switching Principles - X.25 - Frame Relay. (K5, K6)

4.4 Asynchronous Transfer Mode - Protocol Architecture. (K5, K6)

4.5 ATM Logical Connections - ATM Cells. (K5, K6)

4.6 Transmission of ATM Cells - ATM Service Categories. (K5, K6)

## **Unit V**

**(Hour15)**

5.1 Routing in Switched Networks - Routing in Packet Switching Networks. (K4, K5, K6)

5.2 Example Routing in ARPANET. (K4, K5, K6)

5.3 Least Cost Algorithms - Congestion Control in Data Networks. (K4, K5, K6)

5.4 Effects of Congestion - Congestion Control – Traffic Management. (K4, K5, K6)

5.5 Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.  
(K4, K5, K6)

## 5.6 ATM Traffic Management-ATMGFR Traffic Management. (K4, K5, K6)

### Text Book

1. William Stallings, “Data and Computer Communications”, 8<sup>th</sup> Edition, Pearson Education, Inc., 2016.

### Reference Books

1. Andrews S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice Hall of India Private Limited, 2011
2. Leon Garcia and Widjaja, “Communication Networks, Fundamental Concepts and Key Architecture”, 2<sup>nd</sup> Edition, Tata McGraw Hill, 2001.
3. Behrouz A. Forouzan, “Data Communications and Networking”, 4<sup>th</sup> Edition, Tata McGraw Hill, 2017.

### Open Educational Resources (OER)

1. <http://www.amazon.in/Computer-Communications-William-Stallings-Books/dp/0133506487>.
2. <http://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf>
3. <https://www.youtube.com/watch?v=-HIJ4psu5aU>

## SEMESTER VI

### UECSF20 - ELECTIVE III B: COMPUTER GRAPHICS

Year: III	Course Code:	Title of the Course:	Course Type:	Course Category:	H/W	Credits	Marks
Sem: VI	UECSF20	Elective III B: Computer Graphics	Theory	Elective	5	5	40+60

### Course Learning Objectives (CLO)

1. Understand two dimensional graphics and their transformations.
2. Gain knowledge about graphics hardware devices and software used.
3. Understand three dimensional graphics and their transformations and to become familiar with clipping techniques.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.

### Course Outcomes (COs)

The Learners will be able to

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Apply clipping methods and its transformation to graphics display device.
5. Use suitable projections and visible surface detection techniques for display of 3D scene on 2D screen.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	H	M	L	M	L
CO2	M	M	M	L	M	L
CO3	L	L	M	M	M	L
CO4	H	M	M	M	L	M
CO5	L	M	L	H	L	L

(Low -L, Medium -M, High-H)

CO	PO					
	1	2	3	4	5	6
CO1	M	H	M	L	M	M
CO2	H	H	L	L	L	L
CO3	M	H	H	L	L	H
CO4	M	H	H	H	M	H
CO5	M	H	M	H	M	M

(Low -L, Medium -M, High-H)

## Course Syllabus

### Unit I

(14 Hours)

- 1.1 Overview of graphics System Video Display Device. (K1)
- 1.2 Refresh Cathode-Ray tubes. (K1)
- 1.3 Raster - Scan Displays. (K1, K3)
- 1.4 Random - Scan Displays. (K1, K3)
- 1.5 Color CRT Monitors -Direct view Storage tubes Flat - Panel Displays. (K1, K3)
- 1.6 Three - Dimensional Viewing Devices - Stereoscopic and Virtual - Reality Systems. (K1, K2)

**Unit II****(16 Hours)**

- 2.1 Raster - Scan Systems Video Controller. (K1, K3)
- 2.2 Random Scan Systems Video Controller. (K1, K3)
- 2.3 Random-Scan Systems. (K1, K3)
- 2.4 Input device - Keyboard Mouse - Trackball and Space ball-Joysticks - Data Glove – Digitizers - Image Scanners - Touch Panels - Light pens. Voice Systems – Hard – Copy Devices. (K1)
- 2.5 Line Drawing Algorithms DDA Algorithms. (K1, K3, K5)
- 2.6 Circle generating Algorithm Properties of Ellipses. (K1, K3, K5)

**Unit III****(14 Hours)**

- 3.1 Two Dimensional Geometric Transformation: Basic Transformations – Translation. (K1, K2, K3)
- 3.2 Rotation. (K1, K2, K3)
- 3.3 Scaling. (K1, K2, K3)
- 3.4 Matrix Representations and Homogeneous Coordinates. (K1, K3)
- 3.5 Other Transformations Reflections. (K1, K2, K3)
- 3.6 Two Dimensional Viewing. (K1)

**Unit IV****(16 Hours)**

- 4.1 Three Dimensional Concept Three Dimensional Display method. (K1)
- 4.2 Parallel projection - Depth cueing visible line and surface. (K1, K3)
- 4.3 Three Dimensional Geometric and modeling Transformation Translation - Rotation – Scaling. (K1, K2, K3)
- 4.4 Composite Transformations. (K1, K3)
- 4.5 Three Dimensional Viewing: Viewing pipeline - Viewing Coordinates. (K1, K3)
- 4.6 Projections - Parallel Projections - Perspective Projections. (K2, K3)

**Unit V****(15 Hours)**

- 5.1 Windows to view point coordinate Transformations. (K1, K2)
- 5.2 Clipping Operations - Point Clipping - Line Clipping - Curve Clipping - Text Clipping - Exterior Clipping. (K1, K3)
- 5.3 Visible Surface Detection Method Classification Visible Surface Detection Algorithms. (K1, K2)
- 5.4 Back Face Detection. (K1, K2)
- 5.5 Depth - Buffer Method - A-Buffer Method. (K1, K2)
- 5.6 Scan line method. (K1, K3)

**Text Books**

1. Donald Hearn, M. Pauline Baker, “Computer Graphics”, 2<sup>nd</sup> Edition, Prentice Hall of India Publication, 2011.
2. Donald Hearn, M. Pauline Baker Warren Carithers, “Computer Graphics with Open GL”, 4<sup>th</sup> Edition, Pearson Publication, 2014.

### **Reference Books**

1. Apurva A. Desai - “Computer Graphics”, 1<sup>st</sup> Edition, Prentice Hall of India Publication, 2008.
1. ISRD Group - “Computer Graphics”, 2<sup>nd</sup> Edition, McGraw Hill Book Company, 2008.

### **Open Educational Resources (OER)**

1. <http://archive.org/details/DonaldHearnM.PaulineBakerComputerGraphicsBookFi.org/page/n7/mode/2up>
2. [http://www.academia.edu/5750589/Computer\\_Graphics\\_C\\_Version\\_by\\_Donald\\_Hearn\\_and\\_M\\_Pauline\\_Baker\\_II\\_Edition](http://www.academia.edu/5750589/Computer_Graphics_C_Version_by_Donald_Hearn_and_M_Pauline_Baker_II_Edition)
3. [http://www.youtube.com/watch?v=xIFc0HFh\\_Wg](http://www.youtube.com/watch?v=xIFc0HFh_Wg)
4. [http://www.youtube.com/watch?v=sHsmE\\_5HPDY](http://www.youtube.com/watch?v=sHsmE_5HPDY)
5. <http://www.youtube.com/watch?v=jQvRA-GiwwA>