

**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY(A):  
VISAKHAPATNAM**

**DEPARTMENT OF INFORMATION TECHNOLOGY  
PROGRAM STRUCTURE – VR-20**

**II Year**

**I Semester**

<b>S. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	1000202100	Discrete Mathematical Structures	3	1	0	3
2	1005201203	Data Structures	3	0	0	3
3	1005202100	Java Programming	3	0	0	3
4	1005202101	Operating Systems	3	0	0	3
5	1099202100	Managerial Economics & Financial Analysis	3	0	0	3
6	1005201212	Data Structures Lab	0	0	3	1.5
7	1005202110	Java Programming Lab	0	0	3	1.5
8	1005202111	Operating Systems Lab	0	0	3	1.5
9	1012202180	R Programming	0	0	4	2
10	1000202120	Life Skills	2	0	0	0
<b>Total Credits</b>						<b>21.5</b>

# II Year- I Semester

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code</b> 1000202100	<b>DISCRETE MATHEMATICAL STRUCTURES</b>  (Common for CSE, IT and AI&DS)	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

1. To introduce the algorithmic approach to the solution of problems, which is fundamental in discrete mathematics and this approach reinforces the close ties between this discipline and the area of computer science.
2. To introduce basic logical connectives and inference theory.
3. To Familiarize closed form solution of linear recurrence relations by various methods.
4. To perform the operations associated with sets, functions and relations.
5. To bring awareness of basic concepts of graphs and explaining related algorithms.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	<b>Develop</b> reasoning skills using Mathematical Logic concepts.	PO1 PO2 PO3	2 2 3
<b>CO2</b>	<b>Evaluate</b> the solutions for various problems using recurrence relations.	PO1 PO2	1 2
<b>CO3</b>	<b>Construct</b> Hasse diagrams and Understand the concept of Algebraic Structures.	PO1 PO2 PO3	1 2 2
<b>CO4</b>	<b>Apply</b> the concepts of graph theory for a given problem.	PO1 PO2 PO3 PO12	1 2 3 3

**UNIT- I**

**MATHEMATICAL LOGIC**

**[12 HOURS]**

**Propositional Logic:** Connectives- negation, conjunction, disjunction, conditional and bi-conditional, well-formed formulae, tautologies, equivalence of formulae, tautological implications, Disjunctive and Conjunctive normal forms, Rules of inference and examples, Consistency of premises.

**Predicative Logic.:** Statement Functions, Variables and Quantifiers, Free and Bounded variables, Inference theory for predicative logic.

**UNIT- II**

**RECURRENCE RELATIONS**

**[8 HOURS]**

**Recurrence relations:** Recurrence relations, solving homogeneous linear recurrence relations by characteristic roots method, solving non-homogeneous linear recurrence relations.

**UNIT- III**

**SETS, RELATIONS AND ALGEBRAIC STRUCTURES**

**[12 Hours]**

**Sets:** Sets, Operations on Sets, Principles of Inclusion–Exclusion, Pigeonhole Principle and its Application

**Relations:** Definition, representation, types of relations: equivalence relation, equivalence class, partial order, Hasse Diagram and total order relations.

**Functions:** Definition, types of functions: surjective, injective and bijective.

**Algebraic Structures:** Binary operations, Algebraic structures, Group, Abelian Group, Subgroups, Lagrange's theorem on finite groups.

**UNIT- IV**

**GRAPH THEORY**

**[10 HOURS]**

**Graph theory:** Definitions, finite and infinite graphs, incidence and degree, isolated and pendant vertices, isomorphism, sub graphs, connected and disconnected graphs, simple graph, complete graph, bipartite graph, complete bipartite graph, planar graph, Isomorphic Graphs, Euler formula (without proof) and Graph colouring, Walk, path and circuit, Euler graph, Hamiltonian Graph.

**UNIT- V**

**TREES**

**[10 HOURS]**

**Trees:** Some properties of trees, rooted and binary trees, spanning trees, BFS & DFS Algorithms, Minimal spanning trees, Kruskal's algorithm.

**TEXTBOOKS:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
3. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for computer scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

**REFERENCE BOOKS:**

1. S. Santha and E. V. Prasad Mathematical Foundation for Computer Science, Cengage, 2017.
2. Discrete Mathematical Structures, Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, PHI.

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## **Program Structure and Detailed Syllabus (VR 20)**

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3. Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
4. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rdEdition, Tata McGraw.

**Program Structure and Detailed Syllabus (VR 20)**

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code : 1005201203</b>	<b>Data Structures</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

1. Basics of data structures including their fundamentals building blocks: arrays and linked list.
2. To solve problems using linear data structures such as linear lists, stacks, queues.
3. To solve problems using searching and sorting techniques.
4. To be familiar with non-linear data structures such as trees.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Apply the C language Concepts: Pointers, Structures, Unions and recursion to solve the problems	PO1 PO2 PO3 PO11	2 2 3 1
<b>CO2</b>	Implement Standard Data Structures like Stack, Queue, List, Trees and Graphs	PO1 PO2 PO3 PO11	2 2 3 2
<b>CO3</b>	Choose appropriate data structure while building new application	PO1 PO2 PO3 PO5	2 2 3 3
<b>CO4</b>	Explain the need for data structuring techniques	PO1 PO2	3 3

**UNIT- I****ARRAYS AND LINKED LISTS**

The Abstract Data Type (ADT), Dynamic allocation of Arrays, Representation of multidimensional Arrays. Single Linked List, Polynomials, Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Sparse Matrices, Sparse Matrix Representation, Doubly Linked Lists. **[8 Hours]**

**UNIT-II**

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**STACKS AND QUEUES**

The Stack, Stacks using Dynamic Arrays, Recursion, Linked Stacks, The Queue, Linked Queues, Circular Queues using Dynamic Arrays, De-queue. Application of stacks and queues, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix, Towers Of Hanoi Problem. **[8 Hours]**

**UNIT-III**

**SEARCHING AND SORTING**

Searching: Linear Search, Binary Search.

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort **[8 Hours]**

**UNIT-IV**

**TREES:**

Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Trees, Binary Tree Representations, Binary Tree Traversals: Inorder Traversal, Preorder Traversal, Postorder Traversal, Binary Search Trees: Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree

**[10 Hours]**

**UNIT-V**

**GRAPHS:**

The Graph Abstract Data Type, Introduction, Definition, Graph Representation, Elementary Graph Operation- Depth First Search, Breadth First Search, Connected Components, Spanning Trees, Biconnected Components, Minimum Cost Spanning Trees- Kruskal's Algorithm, Prim's Algorithm, Shortest Paths and Transitive Closure, Single Source/All Destination, All-Pairs Shortest Path. **[10 Hours]**

**Text Books:**

1. Fundamentals of Data Structures in C, Ellis Horowitz, S.Sahni, Andrews Freed, University Press (India). Second Edition.
2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.

**Reference Books:**

1. Classic Data Structures, Debasis Samanta, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition

**E-Books:**

1. <https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf>
2. <https://vardhaman.org/wp-content/uploads/2018/12/Data%20Structures.pdf>
3. <https://www.ncertbooks.guru/data-structures/>

**NPTEL/MOOC:**<https://nptel.ac.in/courses/106/102/106102064/>

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<b>Course Code :</b> 1005202100	<b>Java Programming</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

1. Implementing program for user interface and application development using core java principles.
2. Comprehension of java programming constructs, control structures in java.
3. Implementing object-oriented constructs such as various class hierarchies, interfaces and exception handling.
4. Understanding of thread concepts and I/O in java.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Use the Java programming language for various programming technologies.	PO1 PO2 PO12	3 3 3
<b>CO2</b>	Develop software in the Java programming language.	PO1 PO2 PO12	3 3 3
<b>CO3</b>	Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.	PO1 PO2 PO3 PO12	3 3 3 3
<b>CO4</b>	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.	PO1 PO2 PO3 PO12	3 3 3 3

**UNIT- I**

**INTRODUCTION TO OOPS**

Introduction to object-oriented programming -principles of object-oriented languages - procedural languages Vs. OOPs -applications of OOPs -java features - JVM -program structures -Variables -primitive data types –identifiers -naming conventions –keywords –literals – operators –binary -unary and ternary –expression -precedence rules and associativity -primitive



type conversion and casting, flow of control.

**[6 Hours]**

## UNIT-II

### **PROGRAMMING CONSTRUCTS**

Arrays-one dimensional and multidimensional -command line arguments. Introducing classes –class fundamentals –methods -objects -constructors –this keyword –garbage collection- Nested Classes – Polymorphism.

**[8 Hours]**

## UNIT-III

### **INHERITANCE, INTERFACE AND EXCEPTIONS**

Types of inheritance-Super and Final -Interface-Abstract Classes- Interface vs Abstract classes -Packages-Creating Packages -access protection - Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions.

**[8 Hours]**

## UNIT-IV

### **MULTITHREADING AND I/O**

Threads -Thread Life Cycle-Thread priority –multithreading –Synchronization -suspending and resuming threads -communication between threads. Java I/O streaming –filter and pipe streams.

**Hours]**

**[8**

## UNIT-V

### **COLLECTION FRAMEWORKS**

Collection Framework in Java –Introduction to Java Collections, Overview of Java Collection frame work, Generics, commonly used Collection classes–Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calendar and Properties.

**[10 Hours]**

#### **Text Books:**

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

#### **Reference Books:**

1. Head First Java, Author – Kathy Sierra & Bert Bates, Latest Edition – 2nd Edition, Publisher – Shroff/O’Reilly
2. Effective Java, Author – Joshua Bloch, Latest Edition – 3rd Edition, Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016 by R. Nageswara Rao

#### **E-Books:**

<https://docs.oracle.com/en/java/>

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**NPTEL/MOOC:**

<https://nptel.ac.in/courses/106/105/106105191/>

[https://onlinecourses.nptel.ac.in/noc20\\_cs85/preview](https://onlinecourses.nptel.ac.in/noc20_cs85/preview)

**Program Structure and Detailed Syllabus (VR 20)**

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<b>Course Code :</b> 1005202101	<b>Operating Systems</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

1. Study the basic concepts and functions of operating systems.
2. Understand the structure and functions of OS.
3. Learn about Processes, Threads and Scheduling algorithms.
4. Understand the principles of concurrency and Deadlocks.
5. Learn various memory management schemes.
6. Study I/O management and File systems.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Summarize various concepts of Operating Systems	PO1 PO2	1 2
<b>CO2</b>	Implement and Apply Process Scheduling Algorithms	PO1 PO2 PO4	1 2 2
<b>CO3</b>	Illustrate concepts of Paging, Segmentation and Apply Concurrency, Deadlock Mechanisms in real world	PO1 PO2 PO3	2 2 3
<b>CO4</b>	Analyze the concepts of file systems in operating systems	PO1 PO3 PO12	1 2 3

**UNIT- I**

**INTRODUCTION TO OPERATING SYSTEM CONCEPT**

Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types. **[8 Hours]**

**UNIT-II**

**PROCESS MANAGEMENT**

Process concept, The process, Process State Diagram ,Process control block, Process

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## **Program Structure and Detailed Syllabus (VR 20)**

Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Inter process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms. **[8 Hours]**

### **UNIT-III**

#### **MEMORY MANAGEMENT**

Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation.

#### **VIRTUAL MEMORY MANAGEMENT**

Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing **[10 Hours]**

### **UNIT-IV**

#### **CONCURRENCY**

Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples.

**[8 Hours]**

### **UNIT-V**

#### **FILE SYSTEM INTERFACE**

The concept of a file, Access Methods, Directory structure, File system mounting, files sharing, protection. File System implementation- File system structure, allocation methods, free-space management Mass-storage structure overview of Mass-storage structure, Disk scheduling, Device drivers. Introduction to Dockers. **[10 Hours]**

#### **Text Books:**

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

#### **Reference Books:**

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education”, 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhare, Second Edition, TataMc Graw-Hill Education, 2007.

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## Program Structure and Detailed Syllabus (VR 20)

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code</b> 1099202100	<b>Managerial Economics &amp; Financial Analysis</b> <b>(MEFA)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Overview:** The present course is designed in such a way that it gives an overview of concepts of Economics. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Financial Analysis gives clear idea about concepts, conventions and accounting procedures along with introducing students to fundamentals financial statements. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning.

### Course Objectives:

1. Understand the concepts of managerial economics and the market dynamics namely Demand, Elasticity of demand and pricing in different market structures.
2. Acquire the knowledge about production theories and cost analysis besides dealing with the production and factors of production.
3. Analyze the different market structures and understand various pricing methods which are adopted in attracting the customers under different markets.
4. To provide the basic knowledge on financial accounting
5. To understanding Capital budgeting decisions.

### Course Outcomes:

Cos	Course outcome	Po s mapping	Strength of mapping
CO1	Analyze the Demand, Price and Cost.	PO3, PO8, PO11, PO12	3
CO2	Identify the Nature of different markets	PO5, PO8, PO11, PO12	2
CO3	Understand Various Business Forms	PO5, PO8, PO11, PO12	3
CO4	Evaluate investment project proposals	PO3, PO11, PO12	3

### **Unit-I**

**Introduction to Managerial Economics and demand Analysis:** Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand, Demand schedule, Demand curve - Law of Demand and its Exceptions- Elasticity of Demand & Its types - Demand forecasting and Methods of forecasting.

### **Unit-II**

**Production and Cost Analysis:** Concept of Production function- Cobb-Douglas Production function – Leontief production function, Production Function with One variable Input, Two Variable Inputs and Concept of Returns to scale -economies of scale, Different cost concepts – Cost –Volume-Profit (CVP) analysis (simple problems)

### **Unit-III**

**Part-I: Introduction to Market Structures and pricing methods:** Perfect Competition, Monopoly, Monopolistic competition and Oligopoly- Features – Price and Output Determination, Significance of Pricing and various methods of pricing with contemporary examples

**Part-II: Introduction to Business:** Features, Merits and Demerits - Sole Trader, Partnership, Joint Stock Company – Public Enterprises – Business Cycles: Meaning and Features – Phases of Business Cycle.

### **Unit-IV**

**Introduction to Financial Accounting:** Systems of Book-keeping, Golden rules of Accounting, Accounting Principles, Accounting Cycle- Journal, Ledger, Trail Balance, Preparation of Trading-Account, P&L Account and Balance Sheet (Simple Problems)

### **Unit-V**

**Capital and Capital Budgeting Decisions:** Introduction to Capital, Classification of Capital, Time value of money. Types of Capital Budgeting Decisions: Traditional Methods (Payback period, Accounting rate of return) and Modern methods (Net Present Value method, Internal Rate of Return Method and Profitability Index Method) (Simple Problems)

#### **Text Books:**

1. M.Kasi Reddy & Saraswathi, “Managerial Economics and Financial Analysis”, PHI Publications, New Delhi, 10th Revised Edition, 2012.
2. Varshney & Maheswari, “Managerial Economics”, Sulthan Chand Publishers, 1st Revised Edition, 2009.
3. S.N. Maheshwari & S.K. Maheshwari, “Financial Accounting”, Vikas Publication House Pvt.Ltd, 4th Edition, 2012.

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**Reference Books:**

1. D.N. Dwivedi, “Managerial Economics”, Vikas Publication House Pvt.Ltd, 2nd Edition, 2012.
- 2.R.Narayana Swamy, “Financial Accounting- A managerial Perspective”, Pearson publications, 1st Indian Reprint Edition, 2012.
- 3.J.V.Prabhakar Rao & P.V.Rao, “Managerial Economics & Financial Analysis”, Maruthi Publishers, 1st Revised Editon, 2011

**NPTEL/SWAYAMMOOCS:**

- 1.[https://onlinecourses.swayam2.ac.in/imb19\\_mg08/preview](https://onlinecourses.swayam2.ac.in/imb19_mg08/preview)
- 2.<https://www.coursera.org/learn/strategic-management>

**Program Structure and Detailed Syllabus (VR 20)**

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<b>Course Code</b> 1005201212	<b>Data Structures Lab</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**COURSE OBJECTIVES:**

- To develop skills to design and analyze simple linear and non-linear data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given real-world problem
- To gain knowledge in practical applications of data structures

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Implement the programs on arrays and linked lists	PO1 PO2 PO3 PO11	2 3 3 2
<b>CO2</b>	Implement Standard Data Structures like Stacks and Queue	PO1 PO2 PO3 PO11	2 3 3 3
<b>CO3</b>	Analyze the time and space efficiency of the data structure be capable to identify the appropriate data structure for given problem	PO1 PO2 PO3	2 3 3
<b>CO4</b>	Have practical knowledge on the application of data structures	PO1 PO2 PO3	2 3 3

**LIST OF EXPERIMENTS**

<b>S. No.</b>	<b>Name of the experiment</b>	<b>Skill</b>
1.	<b>Exercise – 1</b> a) Write a program to implement dynamic arrays b) Write a program to implement sparse matrices using arrays	Arrays



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2	<p><b>Exercise – 2</b> Write a program to implement a Single Linked List and its operations.</p>	Single Linked List
3.	<p><b>Exercise – 3</b> Write a program to implement a Doubly Linked List and its operations.</p>	Doubly Linked List
4.	<p><b>Exercise – 4</b> Write a program to implement the following using arrays and linked list a) Stack b) Queue</p>	Linear Data Structures
5.	<p><b>Exercise – 5</b> Write a program to do the following a) Infix to postfix conversion. b) Evaluation of postfix expression.</p>	Applications of Stack
6.	<p><b>Exercise – 6</b> Write a program to implement: a) Linear Search b) Binary Search</p>	Searching Strategies
7.	<p><b>Exercise – 7</b> Develop a Program to find number of comparisons and swapping for a given list of numbers a) Bubble Sort b) Selection Sort</p>	In-Place Sorting techniques
8.	<p><b>Exercise – 8</b> Write a program for the following a) Merge Sort b) Quick Sort</p>	Divide and Conquer
9.	<p><b>Exercise – 9</b> a) Write a program that use non-recursive functions to traverse the given binary tree in i. Pre-order ii. In-order iii. Post-order. b) Implementation of Binary Search trees.</p>	Trees
10.	<p><b>Exercise – 10</b> Write a program for the following modules a) To implement Prim’s algorithm to generate a min-cost spanning tree.</p>	Graphs

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	b) To implement Kruskal's algorithm to generate a min-cost spanning tree. c) To implement Dijkstra's algorithm to find shortest path in the graph. d) Implement Depth First Search	
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### Text Books:

1. Fundamentals of Data structures in C, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press, Pvt. Ltd.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition

### Reference Books:

1. Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition.

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<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code : 1005202110</b>	<b>Java Programming Lab</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**COURSE OBJECTIVES:**

1. Implementing program for user interface and application development using core java principles.
2. Comprehension of java programming constructs, control structures in java.
3. Implementing object-oriented constructs such as various class hierarchies, interfaces and exception handling.
4. Understanding of thread concepts and I/O in java
5. To understand computer programming and application software, package/ suites.

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Use the Java programming language for various programming technologies.	PO1 PO2 PO12	3 3 3
<b>CO2</b>	Develop software in the Java programming language.	PO1 PO2 PO12	3 3 3
<b>CO3</b>	Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.	PO1 PO2 PO3 PO12	3 3 3 3
<b>CO4</b>	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.	PO1 PO2 PO3 PO12	3 3 3 3

**LIST OF EXPERIMENTS**

S. No.	Name of the experiment	Skill
1.	<p><b>Exercise – 1 (Basics)</b></p> <p>a) Write a JAVA program to display default value of all primitive data type of JAVA</p> <p>b) Write a java program that display the roots of a quadratic equation <math>ax^2+bx=0</math>. Calculate the discriminate D and basing on value of D, describe the nature of root.</p> <p>c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.</p> <p>d) Write a case study on public static void main (250 words)</p>	Basic Programming
2.	<p><b>Exercise – 2</b></p> <p>a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.</p> <p>b) Write a JAVA program to sort for an element in a given list of elements using bubble sort.</p> <p>c) Write a JAVA program to sort for an element in a given list of elements using merge sort.</p> <p>d) Write a JAVA program using String Buffer to delete, remove character.</p>	Sorting
3.	<p><b>Exercise – 3</b></p> <p>a) Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.</p> <p>b) Write a JAVA program to implement constructor</p>	Constructor
4.	<p><b>Exercises –4</b></p> <p>a) Write a JAVA program to implement constructor overloading.</p> <p>b) Write a JAVA program implements method overloading.</p>	Constructor Overloading

## Program Structure and Detailed Syllabus (VR 20)

5.	<p><b>Exercise -5</b></p> <p>a) Write a JAVA program to implement Single Inheritance</p> <p>b) Write a JAVA program to implement multi-level Inheritance</p> <p>c) Write a java program for abstract class to find areas of different shapes</p>	Inheritance
6.	<p><b>Exercise -6</b></p> <p>a) Write a JAVA program give example for “super” keyword.</p> <p>b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?</p>	Programming using “super” Keyword
7.	<p><b>Exercise -7</b></p> <p>a) Write a JAVA program that describes exception handling mechanism</p> <p>b) Write a JAVA program Illustrating Multiple catch clauses</p>	Exception Handling
8.	<p><b>Exercise -8</b></p> <p>a) Write a JAVA program that implements Runtime polymorphism</p> <p>b) Write a Case study on run time polymorphism, inheritance that implements in above problem</p>	Runtime Polymorphism
9.	<p><b>Exercise -9</b></p> <p>a) Write a JAVA program for creation of Illustrating throw</p> <p>b) Write a JAVA program for creation of Illustrating finally</p> <p>c) Write a JAVA program for creation of Java Built-in Exceptions</p> <p>d) Write a JAVA program for creation of User Defined Exception.</p> <p>e) Write a Program to implement set and set Operations.</p>	Exceptions
10.	<p><b>Exercise -10</b></p> <p>a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable)</p> <p>b) Write a program illustrating is Alive and join</p> <p>c) Write a Program illustrating Daemon Threads.</p>	Threads

## Program Structure and Detailed Syllabus (VR 20)

11.	<b>Exercise -11</b> a) Write a JAVA program for Producer Consumer Problem b) Write a case study on thread Synchronization after solving the above producer consumer problem	Synchronization
12.	<b>Exercise -12</b> a) Write a JAVA program illustrates class path b) Write a case study on including in class path in your os environment of your package. c) Write a JAVA program that import and use the defined your package in the previous Problem	Package
13.	<b>Exercise -13</b> a) What is the difference between List and Set? Implement a Program to show the differences. b) What is the difference between HashSet and TreeSet? Implement a Program to show the differences. c) What is the difference between Set and Map? Implement a Program to show the differences.	Set and Map

### Text Books:

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

### Reference Books:

1. Head First Java, Author – Kathy Sierra & Bert Bates, Latest Edition – 2nd Edition, Publisher – Shroff/O'Reilly
2. Effective Java, Author – Joshua Bloch, Latest Edition – 3rd Edition, Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016 by R. Nageswara Rao

**Program Structure and Detailed Syllabus (VR 20)**

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code :</b> 1005202111	<b>Operating Systems Lab</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**COURSE OBJECTIVES:**

1. To provide an understanding of the design aspects of operating system.
2. To provide practical knowledge on the different concepts of operating systems.
3. To familiarize students with the Linux environment.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Stimulate CPU scheduling algorithms in operating system.	PO1 PO2 PO12	3 3 3
<b>CO2</b>	Evaluate memory management techniques in operating system.	PO1 PO2 PO12	3 3 3
<b>CO3</b>	Implement page replacement algorithms in operating system	PO1 PO2 PO3 PO12	3 3 3 3
<b>CO4</b>	Implement file allocation strategies used in operating system.	PO1 PO2 PO3 PO12	3 3 3 3

**LIST OF EXPERIMENTS**

<b>S. No.</b>	<b>Name of the experiment</b>	<b>Skill</b>
1.	<b>Exercise -1</b> Study of Unix/Linux general purpose utility command list man,who,cap, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more,	Unix/Linux Commands

## Program Structure and Detailed Syllabus (VR 20)

	date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.	
2.	<b>Exercise – 2</b> Simulate the following CPU scheduling algorithms Round Robin a) SJF b) FCFS c) Priority	CPU Scheduling
3.	<b>Exercise – 3</b> Simulate MVT and MFT	Multi Programming
4.	<b>Exercise – 4</b> Simulate Bankers Algorithm for Dead Lock Avoidance	Dead Lock Avoidance
5.	<b>Exercises –5</b> Simulate Bankers Algorithm for Dead Lock Prevention	Dead Lock Prevention
6.	<b>Exercise -6</b> Simulate all page replacement algorithms. FIFO a) LRU b) LFU	Page Replacement
7.	<b>Exercise -7</b> Simulate all File allocation strategies Sequenced a) Indexed b) Linked	File Allocation
8.	<b>Exercise -8</b> C program to emulate the UNIX ls -l command.	ls -l command
9.	<b>Exercise -9</b> C program that illustrates how to execute two commands concurrently with a command pipe.	Command Pipe
10.	<b>Exercise -10</b> C program that illustrates two processes communicating using shared memory	Shared Memory



**Text Books:**

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

**Reference Books:**

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education”, 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhare, Second Edition, TataMc Graw-Hill Education, 2007.

**Program Structure and Detailed Syllabus (VR 20)**

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code :</b> 1012202180	<b>R-Programming</b> <b>(Skill Oriented Course)</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Course Description:**

R is rapidly becoming the leading language in data science and statistics. Today, R is the tool of choice for data science professionals in every industry and field. This Statistics with R programming course will help you master the Programming with R in five Sections. It covers the basic syntax, making you ready to undertake your own first data analysis using R. Starting from variables and basic operations, you will eventually learn how to handle data structures such as vectors, matrices, data frames and lists. In the final section, you will dive deeper into the graphical capabilities of R, and create your own stunning data visualizations and data perform various analysis of Regression models in Linear and Non-Linear.

**Course outcomes:**

<b>CO'S</b>	<b>Course outcome</b>	<b>Skill</b>	<b>PO</b>
CO1	Understand the R workspace and Programming with R	Understand	PO1, PO2
CO2	Access online resources for R and import new function packages into the R workspace	Understand	PO1, PO2, PO3
CO3	Apply math functions to calculate probability and statistical distributions and knowledge on Graphics in data visualization.	Understand	PO2, PO3, PO5
CO4	Understand and use linear, non-linear regression models, and classification techniques for data analysis	Understand/ Apply	PO3, PO4, PO6, PO12

## LIST OF EXPERIMENTS

i. Study of data analysis using MS-Excel (Prerequisite)

1. Study of basic Syntaxes in R

2. Implementation of vector data objects operations

3. Implementation of matrix, array and factors and perform va in R

4. Implementation and use of data frames in R

5. Create Sample (Dummy) Data in R and perform data manipulation with R

6. Study and implementation of various control structures in R

7. Data Manipulation with dplyr package

8. Data Manipulation with data.table package

9. Study and implementation of Data Visualization with ggplot2

10. Study and implementation data transpose operations in R

### Text Books:

1. The Art of R Programming, Norman Matloff, Cengage Learning

2. R for Everyone, Lander, Pearson

### Reference Books:

1. R Cookbook, Paul Teetor, O'Reilly.

2. R in Action, Rob Kabacoff, Manning

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**Program Structure and Detailed Syllabus (VR 20)**

<b>II Year – I Semester</b>	<b>B. Tech (IT) – VR20</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Course Code</b> 1000202120	<b>LIFE SKILLS</b> <b>(Audit Course)</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**COURSE OBJECTIVE:**

The students will be able to build self-confidence, encourage critical thinking, foster independence and help people to communicate more effectively.

**COURSE OUTCOMES:**

<b>CO's</b>	<b>At the end of the course, the student will have the ability to:</b>	<b>POs Mapped</b>	<b>Strength of mapping</b>
<b>CO1</b>	Build Self Confidence and Interpersonal and Intrapersonal relationships.	PO12 PO10 PO9	3 3 3
<b>CO2</b>	Practice Emotional Competency while communicating with others	PO12 PO10 PO9	3 3 3
<b>CO3</b>	Gain Intellectual Competency by practicing ethics and morals	PO12 PO10 PO8	3 3 3

**UNIT1: LIFE SKILLS:** Positive Attitude and Positive Work Ethics, Time Management, Goal Setting: Short term, Long Term. (Activity has to be conducted)

**UNIT2: EMOTIONAL INTELLIGENCE:** Self Awareness through Johari Window and SWOT analysis (Activity has to be conducted)

**UNIT3: PROBLEM SOLVING SKILLS:** Critical Thinking and Brain Storming, Creative Thinking, Conflict Management. (Activity has to be conducted)

**UNIT4: PUBLIC SPEAKING:** Body Language, presentation skills, impromptu presentation, interviewing others. (Activity has to be conducted)

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**UNIT 5: NPTEL Course/ Coursera /Any relevant Certificate Course has to be done**

**Assessment:** In order to clear internal assessment, the student has to submit Project Report and give Presentation on all the activities he/she has done during the course. The student has to do a certificate course also. (Presentation, Project Report and Certificate in total will be the criteria for the assessment)

**References:**

- Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; Oxford Publishers.
- Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
- Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
- Shalini Verma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company
- John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc.