

Curriculum Design
Sri G.V.G Visalakshi College for Women (Autonomous)
 Affiliated to Bharathiar University
B.Sc. Computer Science
 Scheme of Examination - CBCS and OBE Pattern
 (For the students admitted from the academic year 2021-2022 onwards)

Sem	Course Code	Course Title	Ins. Hrs/Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	121TA1/ 121MY1 /121HD1/121FR1	Part I -Language I	6	3	50	50	100	3
	121EN1	Part II - English I	6	3	50	50	100	3
		Part III						
	121S01	Core I - Programming with C++	6	3	50	50	100	5
	121SP1	Core Practical I - Programming with C++ Lab	4	3	50	50	100	2
	121AS1/ 121AK1 / 121AF1	Allied I -Basic Mathematics and Statistics	6	3	50	50	100	4
	121VEG	Part IV - Value Education- Human Values and Gender Equity	2	2	50	-	50	1
II	221TA2/ 221MY2 / 221HD2 / 221FR2	Part I- Language II	6	3	50	50	100	3
	221EN2	Part II- English II	6	3	50	50	100	3
		Part III						
	221S02	Core II - Data Structures using Python	5	3	50	50	100	5
	221SP2	Core Practical II - Data Structures Lab	5	3	50	50	100	3
	221AS2/ 221AG2 / 221AK2 / 221AF2	Allied II - Discrete Mathematics	6	3	50	50	100	4
	221EVS	Part IV - Environmental Studies	2	2	50	-	50	1
	Part III							
	321S03	Core III -Digital Principles and Computer Organization	5	3	50	50	100	4

III	321S04/ 321G04/ 321K04	Core IV - Operating System	5	3	50	50	100	5
	321S05	Core V - Database Management System	4	3	50	50	100	4
	321SP3	Core Practical III - DBMS and Operating System Lab	5	3	50	50	100	3
	321AS3/ 321AG3 / 321AK3	Allied III - Operations Research	6	3	50	50	100	4
	321INDT	Part IV - Non Major Elective - Multimedia Tools	2	2	50	-	50	2
	321SS1	Part IV - Skill Enhancement Course I: Professional English for Computer Science	3	3	100	-	100	2
	321NG A	Part IV- General Awareness - Information Security	Self Study	2	50	-	50	Grade
IV		Part III						
	421S06/ 421G06	Core VI - Computer Networks	5	3	50	50	100	5
	421S07	Core VII - Java Programming	4	3	50	50	100	4
	421S08/ 421G08/ 421N12	Core VIII-Software Engineering / Core XII - Mobile Commerce	5	3	50	50	100	5
	421SP4	Core Practical IV - Computer Networks Lab	5	3	50	50	100	3
	421AS4/ 421AK4 / 421AW 4	Allied IV - Principles of Accountancy	6	3	50	50	100	4
	421SS2	Part IV - Skill Enhancement Course II: Software Testing Lab	3	3	100	-	100	2
	421NG A	Part IV - General Awareness	2	2	50	-	50	2
421SA1/ 421SA2	Advanced Learners Course I - Introduction to Modeling and Simulation / Online Courses	Self Study	3	-	100	100	4*	
		Part III						
	521S09	Core IX - Compiler Design	6	3	50	50	100	5
	521S10/ 521G10	Core X - Data Mining	5	3	50	50	100	5
	521S11	Core XI - Cloud Computing	5	3	50	50	100	5

V	521SP5	Core Practical V - PHP and Data Mining Lab	5	3	50	50	100	4
	521SE1/ 521GE1/ 521KE1 521SE2/ 521GE2/ 521KE2 521SE3/ 521GE3/ 521KE3	Elective I - Introduction to IoT / Introduction to Data Science/ Trends in Computing	6	3	50	50	100	5
	521SS3	Part IV - Skill Enhancement Course III: Mobile Application Development	3	3	100	-	100	2
	521NGO / 521NGA	Part IV - General Awareness - Online MOOC/Swayam Courses/ Life Skills	Self Stud y	2	50	-	50	Grade
VI		Part III						
	621S12	Core XII - Web Technology	5	3	50	50	100	5
	621S13	Core XIII - Computer Graphics	5	3	50	50	100	5
	621SP6	Core Practical VI - Web Technology Lab	5	3	50	50	100	4
	621SE4/ 621GE4/ 621KE4 621SE5/ 621GE5/ 621KE5 621SE6/ 621GE6/ 621KE6	Elective II - Big Data Analytics / Mobile Computing / Bioinformatics	6	3	50	50	100	5
	621SPV	Project & Viva Voce	6	3	50	50	100	5
	621SS4	Part IV - Skill Enhancement Course IV: Node.js	3	3	100	-	100	2
	621EX1/ 621EX2/ 621EX3/ 621EX4/ 621EX5	Part V- Extension activity NCC/ NSS/ YRC/ RRC/ Games	-	-	50	-	50	2
	621NG A	Part IV - General Awareness - Professional Ethics	Self Stud y	2	50	-	50	Grade
	621SA3	Advanced Learners Course II - Augmented Reality	Self Stud y	3	-	100	100	4*
Total							3800	140

*Starred credits are treated as additional credits (Optional)

Employability Courses

B.Sc Computer Science

Semester I

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core I - Programming with C++	Course Code : 121S01
Semester : I	No. of Credits : 5
No. of hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Principles of Object-Oriented Programming	(16 hrs)
Basic Concepts of Object- Oriented Programming - Benefits of OOP - Object-Oriented Languages - Applications of OOP. Beginning with C++: What is C++? - A simple C++ Program - Structure of C++ Program. Tokens, Expressions and Control Structures: Tokens - Keywords - Identifiers and Constants - Basic Data Types - Operators in C++ - Control Structures. Functions in C++. [Chapters: 1,2,3,4]	

Unit II: Classes and Objects:	(15 hrs)
Introduction - Specifying a Class - Defining Member Functions -Making an outside Function Inline - Nesting Of Member Functions - Array within a Class - Memory Allocation for Objects - Static Data Members - Static Member Functions - Arrays Of Objects - Friendly Functions. Constructors and Destructors: Introduction - Constructors - Parameterized Constructors - Multiple Constructors in a class - Dynamic Initialization of Objects – Copy Constructors - Destructors. [Chapters: 5,6]	

Unit III: Operator Overloading and Type Conversions:	(15 hrs)
Introduction - Defining Operator Overloading - Overloading Unary Operators - Overloading Binary Operators - Rules for Overloading Operators – Type Conversions. Inheritance: Extending Classes: Introduction - Defining Derived Classes - Single Inheritance - Multilevel Inheritance - Multiple Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Virtual base classes. [Chapters: 7,8]	

Unit IV: Pointers, Virtual Functions and Polymorphism:	(15 hrs)
Introduction - Pointers - Pointers to Objects - this Pointer - Pointers to Derived Classes - Virtual Functions. Managing Console I/O Operations: C++ Streams - C++ Stream Classes. Working with Files: Introduction - Classes for File Stream Operations - Opening and Closing a File - Detecting End-of-File - Error Handling during File operations. [Chapters: 9,10,11]	

Unit V: Templates:	(14 hrs)
Introduction - Class Templates - Class Templates with Multiple Parameters - Function Templates - Function Templates with Multiple Parameters. Exception Handling: Introduction - Basics of Exception Handling - Exception Handling Mechanism -Throwing Mechanism - Catching	

Mechanism - Specifying Exceptions. **Manipulating Strings:** Introduction - Creating (String) Objects - Manipulating String Objects.
[Chapters: 12,13,15]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7, 8,9,10,11,12,13,15)	Object Oriented Programming with C++	E Balagurusamy	McGraw Hill Education (India) Private Limited, New Delhi, Sixth Edition, Third Reprint 2014.

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	The C++ Programming Language	Bjarne Stroustrup	Addison-Wesley, Fourth Edition, 2013.
2.	Beginning C++20: From Novice to Professional	Ivor Horton , Peter Van Weert	apress, Sixth Edition, 2020

E-Resources : (Web resources & E-books)

1. <https://www.programiz.com/cpp-programming>
2. https://www.w3schools.com/cpp/cpp_intro.asp

**B.Sc Computer Science
Semester II**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core II - Data Structures using Python	Course Code : 221S02
Semester : II	No. of Credits : 5
No. of Hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Python Objects, Types, and Expressions:	(14 hrs)
Understanding data structures and algorithms - Python for data-The Python environment-Variables and expressions - Overview of data types and objects - Lists - Functions as first class objects - Classes and object programming. Data Encapsulation and Properties. Python Data Types and Structures: Operations and expressions - Built-in data types - Modules for data structures and algorithms. [Chapters: 1, 2]	

Unit II: Principles of Algorithm Design:	(12 hrs)
Algorithm design paradigms - Recursion and backtracking - Runtime analysis. Lists and Pointer Structures: Arrays - Pointer structures - Nodes - Finding endpoints - Singly linked lists - Deleting nodes - Doubly linked lists - Circular lists. Stacks and Queues: Stacks - Queues. [Chapters: 3, 4, 5]	

Unit III: Trees: (13 hrs)

Terminology - Tree nodes - Binary trees - Inserting nodes - Deleting nodes - Searching the tree - Tree traversal. **Hashing and Symbol Tables:** Hashing - Hash table. **Graphs and Other Algorithms:** Graphs - Directed and undirected graphs - Weighted graph - Graph representation - Graph traversal - Other useful graph methods - Priority queues and heaps - Selection algorithms.
[Chapters: 6, 7, 8]

Unit IV: Searching: (13 hrs)

Linear Search - Binary search - Interpolation search. **Sorting:** Sorting algorithms - Insertion sort - Selection sort - Quick sort - Heap sort. **Selection Algorithms:** Selection by sorting - Randomized selection - Deterministic selection.
[Chapters: 9, 10, 11]

Unit V: Design Techniques and Strategies: (13 hrs)

Classification of algorithms - Classification by implementation - Classification by complexity - Classification by design. **Technical implementation:** Dynamic programming - The Fibonacci series - Divide and conquer - Greedy algorithms. **Implementations, Applications, and Tools:** Data preprocessing - Machine learning - Data visualization
[Chapters: 12, 13]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7,8,9, 10,11,12,13)	Python Data Structures and Algorithms	Benjamin Baka	Packt Publishing Ltd. Edition, 2017.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Data Structures and Algorithms Using Python	RanceD.Necaise	Wiley Publication, 2016.
2.	Data Structures and Algorithms with Python	Dr. Kent D. Lee, Steve Hubbard	Springer International Publishing, 2015

E-Resources: (Web resources & E-books)

- <http://home.usc.edu.cn/~huang83/ds/Data%20Structures%20and%20Algorithms%20Using%20Python.pdf>
- https://www.tutorialspoint.com/python_data_structure/python_data_structure_introduction.htm

B.Sc Computer Science Semester I

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Core Practical I - Programming with C++ Lab	Course Code : 121SP1
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Semester : I	No. of Credits : 2
No. of hours : 60	P:D : 52:8
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical, D: Demo)

Syllabus

List of Programs:

(52 hrs)

1. Write a C++ program to find the sum of individual digits of a positive integer.
2. Write a C++ program to generate the first n terms of the sequence.
3. Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C++ program to find both the largest and smallest number in a list of integers.
5. Write a C++ program to sort a list of numbers in ascending order.
6. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading
7. Write a C++ program to illustrate the multilevel inheritance.
8. Write a C++ program to Demonstrate Friend Function and Friend Class.
9. Write a C++ program to Generate Fibonacci Series use Constructor to Initialize the Data Members.
10. Write a C++ program to demonstrate default constructors and copy constructors.
11. Write a C++ Program to implement the following operation using class:
 - a) Matrix Addition and b) Matrix Multiplication
12. Write a C++ program to Implement a Class STUDENT having Following Members:

Member	Description
Data members	
sname	Name of the student
Marks array	Marks of the student
total	Total marks obtained
tmax	Total maximum marks

Member functions	
Member	Description
assign()	Assign Initial Values
compute()	to Compute Total, Average
display()	to Display the Data.

B.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core II - Data Structures using Python	Course Code : 221S02
Semester : II	No. of Credits : 5
No. of Hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Python Objects, Types, and Expressions: (14 hrs)

Understanding data structures and algorithms - Python for data-The Python environment-Variables and expressions - Overview of data types and objects - Lists - Functions as first class objects - Classes and object programming. Data Encapsulation and Properties. **Python Data Types and Structures:** Operations and expressions - Built-in data types - Modules for data structures and algorithms.

[Chapters: 1, 2]

Unit II: Principles of Algorithm Design: (12 hrs)

Algorithm design paradigms - Recursion and backtracking - Runtime analysis. **Lists and Pointer Structures:** Arrays - Pointer structures - Nodes - Finding endpoints - Singly linked lists - Deleting nodes - Doubly linked lists - Circular lists. **Stacks and Queues:** Stacks - Queues.

[Chapters: 3, 4, 5]

Unit III: Trees: (13 hrs)

Terminology - Tree nodes - Binary trees - Inserting nodes - Deleting nodes - Searching the tree - Tree traversal. **Hashing and Symbol Tables:** Hashing - Hash table. **Graphs and Other Algorithms:** Graphs - Directed and undirected graphs - Weighted graph - Graph representation - Graph traversal - Other useful graph methods - Priority queues and heaps - Selection algorithms.

[Chapters: 6, 7, 8]

Unit IV: Searching: (13 hrs)

Linear Search - Binary search - Interpolation search. **Sorting:** Sorting algorithms - Insertion sort - Selection sort - Quick sort - Heap sort. **Selection Algorithms:** Selection by sorting - Randomized selection - Deterministic selection.

[Chapters: 9, 10, 11]

Unit V: Design Techniques and Strategies: (13 hrs)

Classification of algorithms - Classification by implementation - Classification by complexity - Classification by design. **Technical implementation:** Dynamic programming - The Fibonacci series - Divide and conquer - Greedy algorithms. **Implementations, Applications, and Tools:** Data preprocessing - Machine learning - Data visualization

[Chapters: 12, 13]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7,8,9, 10,11,12,13)	Python Data Structures and Algorithms	Benjamin Baka	Packt Publishing Ltd. Edition, 2017.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Data Structures and Algorithms Using Python	RanceD.Necaise	Wiley Publication,2016.
2.	Data Structures and Algorithms with Python	Dr. Kent D. Lee, Steve Hubbard	Springer International Publishing, 2015

E-Resources: (Web resources & E-books)

1. <http://home.ustc.edu.cn/~huang83/ds/Data%20Structures%20and%20Algorithms%20Using%20Python.pdf>
2. https://www.tutorialspoint.com/python_data_structure/python_data_structure_introduction.htm

B.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core Practical II - Data Structures Lab	Course Code : 221SP2
Semester : II	No. of Credits : 3
No. of Hours : 75	P:D : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical, D: Demo)

Syllabus:

List of Programs:	(65 hrs)
<ol style="list-style-type: none">1. Write python program for checking whether the given number is an even number or not.2. Write python program for the following operations on single linked list. (a) creation (b) insertion (c) deletion (d) traversal3. Write a python program to insert items into a list in sorted order.4. Write a python program to create a queue and display all the members and size of the queue.5. Write a program to perform different arithmetic operations on numbers python.6. Write python program to implement the following graph traversal algorithms: (a) Depth first search (b) Breadth first search.7. Write a python program to implement file operations.8. Write a python program to find factorial of a number using recursion.9. Write a python program to display the examination schedule.10. Write a python program to calculate the length of a string.11. Write a python program for creating dynamic and interactive web pages using forms.12. Write a recursive python program to test if a string is a palindrome or not.13. Write a python program to find the maximum from a list of numbers.14. Write a python program to perform selection sort.15. Write a python program to multiply matrices.	

E-Resources: (Web resources & E-books)

1. <https://www.programiz.com/python-programming/examples>
2. <http://www.msec.ac.in/files/vlab/Python%20lab%20manual.pdf>

B.Sc Computer Science Semester III

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Core III -Digital Principles and Computer Organization	Course Code: 321S03
Semester : III	No. of Credits : 4
No. of hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Binary Systems:	(13 hrs)
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Digital Computers and Digital Systems - Binary Numbers - Number Base Conversions - Octal and Hexadecimal Numbers -Complements -Binary codes. **Boolean Algebra and Logic Gates:** Boolean Functions - Canonical and Standard Forms - Other Logic Operations - Digital Logic Gates.
[Chapters: 1,2]

Unit II: Simplification of Boolean Functions: (13 hrs)

The Map Method -Two- and Three- Variable Maps -Four Variable Maps -Five and Six Variable Maps -Product of Sums Simplification - NAND and NOR implementation -other two level Implementation. Combinational Logic: Adders - Subtractors. Combinational Logic with MSI and LSI: Decoders -Multiplexers.
[Chapters: 3,4,5]

Unit III: Sequential Logic: (13 hrs)

Introduction - Flip Flops - Triggering of Flip Flops - Analysis of Clocked Sequential Circuits. **Registers, Counters and the Memory Unit:** Introduction - Registers - Shift Registers - Ripple Counters - Synchronous Counters -The Memory Unit.
[Chapters:6,7]

Unit IV: Register Transfer Logic: (13 hrs)

Arithmetic, Logic, and Shift Micro operations-Control Conditional statements -Fixed Point Binary Data -Arithmetic shifts -Decimal Data -Floating point data -Instruction Codes. **Processor Logic Design :** Introduction -Processor Organization -Arithmetic Logic unit - Design of Arithmetic Logic unit- Status Register -Design of Shifter.
[Chapters: 8,9].

Unit V: Computer Design: (13 hrs)

Introduction -System Configuration -Computer instructions -Timing and Control. **Microcomputer System Design:** Microprocessor Organization - Instructions and Addressing Modes - Stack, Subroutines, and Interrupt - Memory Organization - Direct Memory Access.
[Chapters: 11,12]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7,8, 9,11,12)	Digital Logic and Computer Design.	M.Morris Mano	Pearson Education Incorporation, Second Impression 2017.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Digital Fundamentals	Thomas L. Floyd	Pearson Education, Eleventh Edition 2014
2.	Fundamentals of Computers	V.Rajaraman, NeeharikaAdabala	Sixth Edition, PHI Learning Private Limited, January 2015.

E-Resources: (Web resources & E-books)

1. <https://web.sonoma.edu/users/f/farahman/sonoma/courses/es310/lectures/chapter1.pdf>
2. <https://books.google.co.in/books?id=rGjkbQAAQBAJ&printsec=frontcover&dq=digital+fundamentals+2012+edition+free+ebook&hl=en&sa=X&ved=0ahUKEwivmrbcjvneAhXJY08KHfwCCCUQ6AEIWDAl#v=onepage&q&f=true>

B.Sc. Computer Science Semester III

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Core Practical III - DBMS and Operating System Lab	Course Code : 321SP3
Semester : III	No. of Credits: 3
No. of Hours : 75	P:D : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical hours, D: Demo)

Syllabus:

List of Programs:	(65 hrs)
DBMS Programming:	
<ol style="list-style-type: none"> 1. Create a table and perform alter, modify and drop column commands. 2. Create a table and perform DML commands. 3. Write SQL queries to perform transaction commands. 4. Write SQL queries for group functions using student database. 5. Develop queries by using character and date functions. 6. Create the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table using PL/SQL. 7. Create a PL/SQL Program for Armstrong Number. 	
Operating System Programming:	
<ol style="list-style-type: none"> 1. Write a shell script using the following file commands: rm, cp, cat, mv, cmp, wc, split, diff, locate, clear. 2. Write a shell script to show the following system configuration: <ol style="list-style-type: none"> a. Current shell, home directory, Operating System type, current Path setting, current working directory. b. Currently logged user and his log name. c. Show currently logged number of users, show all available shells. 3. Write a shell script to show the CPU information like processor type, speed and memory information. 4. Write a shell Script using pipes, Redirection and tee commands. 5. Write a shell script for following commands. Ionice, Ip, Ifconfig, Isusb, netcat, kmod, kill. 6. Write a program <ol style="list-style-type: none"> a. To perform arithmetic operations using basic shell commands b. To find the sum of the individual digits of a given number. 7. Write a shell script to print the multiplication table of the given argument using for loop. 8. Write a shell script <ol style="list-style-type: none"> a. To displaying current date, user name, file listing and directories by getting user choice. b. To implement the filter commands. 	

B.Sc Computer Science Semester IV

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core VII - Java Programming	Course Code : 421S07
Semester : IV	No. of Credits : 4
No. of hours : 60	C:T : 52:8
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Overview of Programming Languages:	(10 hrs)
<p>Introduction: The Origins of Programming Languages - Abstractions in Programming Languages - Computational Paradigms - Language Definition - Language Translation - The Future of Programming Languages. Object-Oriented Programming: Software Reuse and Independence - Java - C++ - Design Issues in Object-Oriented Languages - Implementation Issues in Object-Oriented Languages. Basic Semantics: Attributes, Binding, and Semantic Functions - Declarations, Blocks, and Scope - The Symbol Table - Name Resolution and Overloading - Allocation, Lifetimes, and the Environment - Variables and Constants - Aliases, Dangling References, and Garbage. Operators and Expressions: Arithmetic Operators - Relational Operators - Logical Operators - Assignment Operators - Increment and Decrement Operators - Conditional Operator - Bitwise Operators - Special Operators - Arithmetic Expressions - Evolution of Expressions - Precedence of Arithmetic Operators - Type Conversions in Expressions - Operator Precedence and Associativity - Mathematical Functions. [Book: 1 Chapters: 1,5,7] [Book 2: Chapters: 4,5]</p>	
Unit II: Decision Making and Branching:	(10 hrs)
<p>Simple If Statement - The If...Else Statement -Nesting of If...Else Statements - The Else If Ladder - The Switch Statement - The ? : Operator. Decision Making and Looping: While Statement - Do Statement - For Statement - Jumps in Loops - Labeled Loops. Classes, Objects and Methods: Defining a Class - Fields Declaration - Methods Declaration - Creating Objects - Accessing Class Members - Constructors - Method Overloading - Static Members - Nesting of Methods - Inheritance - Overriding Methods - Final Variables and Methods - Final Classes - Finalizer Methods - Abstract Methods and Classes - Methods with Varargs - Visibility Control. [Book 2: Chapters: 6,7,8]</p>	
Unit III: Arrays, Strings and Vectors:	(10 hrs)
<p>One Dimensional Arrays - Creating an Array - Two-Dimensional Arrays - Strings - Vectors - Wrapper Classes - Enumerated Types - Annotations. Interfaces: Multiple Inheritance - Packages: Putting Classes Together. [Book 2: Chapters: 9,10,11]</p>	
Unit IV: Multithreaded Programming:	(11 hrs)
<p>Creating Threads - Extending the Thread Class - Stopping and Blocking a Thread - Life Cycle of a Thread - Using Thread Methods - Thread Exceptions - Thread Priority - Synchronization - Implementing the 'Runnable' Interface - Inter-Thread Communications. Managing Errors and Exceptions - Applet Programming: Building Applet Code - Applet Life Cycle - Creating and Designing Applet using Web page - Applet Tag - Adding and Running the Applet using HTML file - More about Applet Tag - Passing Parameters to Applets - Event Handling. [Chapters: 12,13,14]</p>	

Unit V: Graphics Programming:	(11 hrs)
Managing Input/Output Files in Java: Concept of Streams - Stream Classes - Byte and Character Stream Classes - Using Streams - Other Useful I/O Classes - Using the File Class - I/O Exceptions - Creation of Files Reading/Writing Characters and Bytes - Handling Primitive Data Types - Concatenating and Buffering Files - Random Access Files - Interactive Input and Output - Other Stream Classes. Java Collections: Overview of Interfaces, Classes and Algorithms. Networking: Networking Basics - The Networking Classes and Interfaces - InetAddress- Factory Methods - Instance Methods - Inet4Address and Inet6Address. [Book 2: Chapters: 15,16,17] [Book 3: Chapter: 22]	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I (Chapters 1,5,7)	Programming Languages - Principles and Practice:	Kenneth C. Louden, Kenneth A. Lambert	Third Edition, CengageLearning Publications, Course Technology , Channel Center Street, Boston, MA 02210 USA 2011.
I -V (Chapters 4,5,6,7,8,9,10,11, 12,13,14,15,16,17)	Programming with Java, A Primer	E.Balagurusamy	Fifth Edition, McGraw Hill Education (India) Private Limited, Ninth reprint 2016
V (Chapter 22)	Java: The Complete Reference, Ninth Edition	Herbert Schildt	Ninth Edition, McGraw Hill Education (Publisher). All rights reserved. Printed in the United States of America. 2014

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	JAVA Programming	Hari Mohan Pandey	Pearson Edition, New Delhi, 2012.
2.	Java A Beginner's Guide Create, Compile and Run Java Programs	Herbert Schildt	Eighth Edition, Nov 2020

E-Resources: (Web resources & E-books)

- <http://iiti.ac.in/people/~tanimad/JavaTheCompleteReference.pdf>
- <http://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf>

B.Sc Computer Science Semester IV

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Core Practical IV - Computer Networks Lab	Course Code : 421SP4
Semester : IV	No. of Credits : 3
No. of hours : 75	P:D: : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical, D: Demo)

Syllabus:

List of Programs:	(65 hrs)
<ol style="list-style-type: none">1. Write a C Program for Simple RSA Algorithm to Encrypt and Decrypt the data.2. Write a C Program for Error Detection using Hamming Code.3. Write a C Program to implement Link State Routing Algorithm.4. Write a C++ Program for Distance Vector Algorithm to find suitable path for transmission.5. Write a C++ Program for Congestion Control using Leaky Bucket Algorithm.6. Write a Socket Program for TRACE ROUTE in Java.7. Write a Program in Java to implement IP Address Configuration.8. Write a Program in Java to implement STOP & WAIT Protocol.9. Write a Program in Java to implement Sliding Window Protocol.10. Write a Program in Java to demonstrate the usage of NSlookup command.11. Write a Program in Java to implement the Carrier Sense Multiple Access with Collision Detection.12. Write a Program in Java to implement Selective Repeat Protocol.	

B.Sc Computer Science Semester V

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Core Practical V - PHP and Data Mining Lab	Course Code : 521SP5
Semester : V	No. of Credits : 4
No. of Hours : 75	P:D : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical hours, D: Demo)

Syllabus:

List of Programs:
(65 hrs)
PHP: <ol style="list-style-type: none">1. Create a program in PHP to demonstrate the message passing between forms.2. Write a program for Registration form in PHP and perform validation.3. Create a login form in PHP for users using Cookies and Sessions in PHP.4. Design a program in PHP to get student details and display the submitted data in another page.5. Create a program to implement string operations in PHP.6. Design a webpage for calculating BMI using Functions in PHP.7. Create a program in PHP to store and read an image using MqSQL database.8. Create a program in PHP to generate grocery bill using MySQL database.
Data Mining: <ol style="list-style-type: none">1. Design a program to prepare a sample data set in Excel and perform preprocessing.2. Design a program to illustrate Apriori Algorithm with sample dataset.3. Create a program to implement K-means Clustering with sample dataset.4. Create a program with sample dataset to perform Naïve Bayes Classification.5. Create a program to illustrate Support Vector Machines using sample dataset.6. Design a program to perform K-nearest neighbor algorithm using sample dataset.7. Design a program to perform visualization for a data set and change the views.

B.Sc Computer Science Semester IV

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Advanced Learners Course I - Introduction to Modeling and Simulation	Course Code: 421SA1
Semester : IV	No. of Credits : 4*
No. of hours : -	C:T : -
CIA Max. Marks: -	ESE Max. Marks: 100

(C: Contact hours, T: Tutorials)

*Self Study

Syllabus:

Unit I: Introduction

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation. **General Principles:** Concepts in Discrete-Event Simulation - The Event Scheduling/Time Advance Algorithm - World Views - Manual Simulation Using Event Scheduling .List Processing: Basic Properties and Operations performed on lists- Using Arrays for List Processing - Using Dynamic Allocation and Linked Lists - Advanced Techniques [Chapter: 1,3]

Unit II: Mathematical and Statistical Models

Simulation Software: History of Simulation Software , Selection of Simulation Software, An Example Simulation, Simulation in Java, Simulation in GPSS, Simulation in SSF, simulation Software, Experimentation and Statistical-Analysis Tools **Queuing Models:** Characteristics of Queuing Systems, Queuing Notation, Long-Run Measures of Performance of Queuing Systems [Chapter:5,6]

Unit III: Networking Programming:

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers: Linear Congruential Method - Combined Linear Congruential Generators - **Random-Number Streams Tests for Random Numbers:** Frequency Tests - Tests for Autocorrelation. **Inverse - Transform Technique :** Exponential Distribution - Uniform Distribution - Weibull Distribution - Triangular Distribution - Empirical Continuous Distributions - Continuous Distributions without a Closed-Form Inverse - Discrete Distributions. **Acceptance-Rejection Technique:** Poisson Distribution - Nonstationary Poisson Process - Gamma Distribution [Chapter: 7,8]

Unit IV: Analysis of Simulation Data

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. **Verification and Validation of Simulation Models:** Model Building, Verification, and Validation, Verification of Simulation Models, **Calibration and Validation of Models:** Face Validity - Validation of Model Assumptions - Validating Input-Output Transformations -Input-Output Validation: Using Historical Input Data - **Input-Output Validation:** Using a Turing Test

[Book 1: Chapter: 9,10]

Unit V: Applications:

Simulation of Computer Systems: Introduction - Simulation Tools - Process Orientation - Event Orientation. **Model Input:** Modulated Poisson Process - Virtual-Memory Referencing, High-Level Computer-System Simulation, CPU Simulation, Memory Simulation. **Simulation of Computer Networks:** Introduction Traffic Modeling - Media Access Control - Token-Passing Protocols - Ethernet, Data Link Layer - TCP, **Model Construction:** Construction - Example

[Chapters: 14,15]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V (Chapters 1,3,5,6,7,8, 9,10,14,15)	Discrete-Event System Simulation	Jerry Banks, John S. Carson II, Barry L Nelson and David M. Nicol	Fifth Edition, Pearson, 2010

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Event Simulation: A First Course,	Lawrence M. Leemis, Stephen K. Park	Pearson Education, 2006.
2.	Simulation Modeling and Analysis	Averill M. Law:	4 th Edition, Tata McGraw-Hill, 2007

E-Resources : (Web resources & E-books)

1. <https://www.cs.nmt.edu/~jholten/ModelingAndSimulation/syllabus.html>
<https://nptel.ac.in/courses/112/107/112107220/>

B.Sc Computer Science

Semester V

(For the students admitted from the academic year 2021 - 2022onwards)

Course : Part III - Core XI - Cloud Computing	Course Code : 521S11
Semester : V	No. of Credits : 5
No. of hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Fundamental Cloud Computing:

(12 hrs)

Understanding Cloud Computing: Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges. **Fundamental Concepts and Models:** Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models.
[Chapters: 3, 4]

Unit II: Cloud-Enabling Technology: (12 hrs)

Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology. Fundamental Cloud Security: Basic Terms and Concepts - Threat Agents - Cloud Security Threats - Additional Considerations.
[Chapters: 5, 6]

Unit III: Cloud Computing Mechanisms: (13 hrs)

Cloud Infrastructure Mechanisms: Logical Network Perimeter - Virtual Server - Cloud Storage Device - Cloud Usage Monitor - Resource Replication - Ready-Made Environment. **Specialized Cloud Mechanisms:** Automated Scaling Listener - Load Balancer - SLA Monitor - Pay-Per-Use Monitor - Audit Monitor - Failover System - Hypervisor - Resource Cluster - Multi-Device Broker - State Management Database. **Cloud Management Mechanisms:** Remote Administration System - Resource Management System - SLA Management System - Billing Management System. Cloud Security Mechanisms: Encryption - Hashing - Digital Signature - Public Key Infrastructure (PKI) - Identity and Access Management (IAM) - Single Sign-On (SSO) - Cloud-Based Security Groups - Hardened Virtual Server Images.
[Chapters: 7, 8, 9, 10]

Unit IV: Cloud Computing Architecture: (14 hrs)

Fundamental Cloud Architectures: Workload Distribution Architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture - Service Load Balancing Architecture - Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture. **Advanced Cloud Architectures:** Hypervisor Clustering Architecture - Load Balanced Virtual Server Instances Architecture - Non-Disruptive Service Relocation Architecture - Zero Downtime Architecture - Cloud Balancing Architecture - Resource Reservation Architecture - Dynamic Failure Detection and Recovery Architecture - Bare-Metal Provisioning Architecture - Rapid Provisioning Architecture - Storage Workload Management Architecture.
[Chapters: 11, 12]

Unit V: Specialized Cloud Architectures: (14 hrs)

Direct I/O Access Architecture - Direct LUN Access Architecture - Dynamic Data Normalization Architecture - Elastic Network Capacity Architecture - Cross-Storage Device Vertical Tiering Architecture - Intra-Storage Device Vertical Data Tiering Architecture - Load Balanced Virtual Switches Architecture - Multipath Resource Access Architecture - Persistent Virtual Network Configuration Architecture - Redundant Physical Connection for Virtual Servers Architecture - Storage Maintenance Window Architecture. **Working With Clouds: Cloud Delivery Model Considerations: Cloud Delivery Models:** The Cloud Provider Perspective - **Cloud Delivery Models: The Cloud Consumer Perspective.** **Cost Metrics and Pricing Models:** Business Cost Metrics - Cloud Usage Cost Metrics - Cost Management Considerations. **Service Quality Metrics and SLAs:** Service Quality Metrics - SLA Guidelines.
[Chapters: 13, 14, 15, 16]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
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I - V (Chapters 3,4,5,6,7,8, 9,10,11,12, 13,14,15,16)	Cloud Computing Concepts, Technology & Architecture	Thomas Erl, Zaigham Mahmood and Ricardo Puttini	Pearson India Education Services Pvt Ltd Publication, Fifth Impression, 2017.
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Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Fundamentals of Cloud Computing	A. Kannammal	Cengage Learning India Pvt. Ltd, 2015
2.	Cloud Computing Unleashing Next Gen Infrastructure to Application	Dr. Kumar Saurabh	Third Edition, Wiley India Pvt. Ltd, 2014.

E-Resources: (Web resources & E-books)

- [https://s3.amazonaws.com/arena_attachments/911381 / 0ea8a9793158a95d9b91911e49240a43.pdf](https://s3.amazonaws.com/arena_attachments/911381/0ea8a9793158a95d9b91911e49240a43.pdf)
- <https://ramslaw.files.wordpress.com/2016/07/0124114547cloud.pdf>

B.Sc Computer Science Semester VI

(For the students admitted from the academic year 2021-2022 onwards)

Course: Advanced Learners Course II - Augmented Reality	Course Code : 621SA3
Semester : VI	No. of Credits : 4*
No. of hours : -	C:T : -
CIA Max. Marks: -	ESE Max. Marks: 100

(C: Contact hours, T: Tutorial)

*Self Study

Syllabus:

Unit I: Introduction
Introduction to Augmented Reality: History of AR - Augmented Reality -Some Scenarios- The Future of AR - Applications of AR. Calibration and Registration: Transformation- Coordinate System- Projection - Image Formation in Pinhole Camera - Camera Calibration - Camera Calibration setup for AR - Camera Calibration Techniques- Camera Calibration tools.
Unit II: Computer Vision for AR
Computer Vision for AR: Image Processing - Computer vision - Definition and Scope- Object Detection and Tracking- Spatial Mapping - 3D Reconstruction of Outdoor tracking- OCR and text Recognition for AR. 3D Graphics in AR: Basic of 3D Computer Graphics - 3D Modeling Software- Available Graphics Libraries.
Unit III: Designing AR System
Designing AR System: Design Principles of AR- Designing Interactions for AR - Prototyping AR Projects - Software Architecture and Design Patterns for AR- Designing AR Interface.
Unit IV: Developing AR System

Developing AR System: Non- programming Frameworks - AR Programming Framework: ALVAR - Artisan - AR Tool kit - AR Toolkit Plus- Other Commercial AR Framework - AR Developing using other Platforms - Developing Web-Based AR- AR Related Markup Languages . AR Hardware: Classification of Visual Displays - Developing AR Hardware/Devices.

Unit V: Mobile AR

Introduction to Mobile AR-: Types of Mobile Apps - AR Browser for Smart Phones- Point of Interest (POIs) in Mobile AR- AR Application for Android- AR Games for Android- AR Application for Ios - AR Games for Ios. Combining Other Technologies with AR: Color Recognition- Gesture Recognition- Motion Capture and Tracking - Face Detection- Maps and Geo-spatial Visualization- Integrating Cloud Computing with AR-Brainwave Interaction with AR- Internet of things.

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V	“Augmented Reality - Theory, Design and Development”	Chetankumar G Shetty	Published by McGraw Hill Education (India)Pvt.ltd

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing	<u>Erin Pangilinan</u> , <u>Steve Lukas</u> & <u>Vasanth Mohan</u>	Published by O’Reilly Media, Inc., 1005 April 2019: First Edition
2.	Virtual Reality and Augmented Reality Myths and Realities	Bruno Arnaldi , Pascal Guitton, Guillaume Moreau	First published 2018 in Great Britain and the United States by ISTE Ltd and John Wiley & Sons, Inc.

E-Resources: (Web resources & E-books)

1. <http://digilib.stmik-banjarbaru.ac.id/data.bc/12.%20Enterprise%20Architecture/12.%20Enterprise%20Architecture/2013%20Understanding%20Augmented%20Reality.pdf>
2. https://www.queppelin.com/wp-content/uploads/2019/05/Augment_your_business_with_AR_VR_by_Queppelin.pdf.

Entrepreneurship Courses

B.Sc Computer Science Semester III

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part IV - Non Major Elective - Multimedia Tools	Course Code : 321NDT
Semester : III	No. of Credits : 2
No. of Hours : 30	P:D : 27:3
CIA Max. Marks: 50	ESE Max. Marks: -

(P: Practical, D: Demo)

Syllabus:

List of Programs:	(27 hrs)
Gimp Tool: <ol style="list-style-type: none">1. Design a 3D Text.2. Create a program to use the Light and Shadow Filter.3. Create a program to render (Cut Out) An Image.4. Design an Invitation. Scribus Tool: <ol style="list-style-type: none">5. Create a program to manipulate the text and Image.6. Create a program to wrap text around an image.7. Design the brochure for College Advertisement. Inkscape Tool: <ol style="list-style-type: none">8. Create a program to crop an image.9. Create a program to remove the background from an image.10. Design a program to add shadow for an image.	

B.Sc Computer Science Semester V

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part IV- Skill Enhancement Course III - Mobile Application Development	Course Code : 521SS3
Semester : V	No. of Credits : 2
No. of Hours : 45	P:D : 38:7
CIA Max. Marks: 100	ESE Max. Marks: -

(P: Practical hours, D: Demo)

Syllabus:

List of Programs:
(38 hrs)
<ol style="list-style-type: none">1. Develop a simple mobile application that changes Font Color and Size of a Text.2. Create a simple mobile application with login form.3. Write a mobile application that draws basic graphical primitives on the screen.4. Create a simple program to change the image displayed on the screen.5. Create a simple mobile application program to start and stop a service.6. Write a mobile application program to demonstrate count down Timer application.7. Write a mobile application program to demonstrate the sound and video views.

8. Write a mobile application that creates an alert upon receiving a message.
9. Design a mobile application program to create a simple menu.
10. Develop a simple mobile calculator application.

B.Sc Computer Science/Information Technology/BCA Semester VI

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Elective II - Big Data Analytics	Course Code : 621SE4/621GE4/621KE4
Semester : VI	No. of Credits : 5
No. of hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Big Data Analytics Concepts - Setting up of Big Data Stack	(15 hrs)
Introduction to Big Data: What is Analytics? - What is Big Data? - Characteristics of Big Data - Domain Specific examples for Big Data - Analytics flow for Big Data - Big Data Stack - Case study: Weather Data Analytics.Hortonworks Data Platform(HDP) - Cloudera CDH Stack - Amazon Elastic Mapreduce(EMR) - Azure HDInsight. [Chapter: 1,2]	

Unit II: Big Data Patterns	(15 hrs)
Analytics and Architecture Components & Design Styles - Map Reduce Patterns - NoSQL. [Chapter: 3,4]	

Unit III: Big Data Analytics Implementation	(15 hrs)
Data Acquisition - Publish - Subscribe Messaging Frameworks - Big Data Collection Systems - Messaging Queues -Custom Connectors. [Chapter: 5]	

Unit IV: Big Data Storage- Batch Analysis-Real Time Analysis	(15 hrs)
HDFS - Hadoop and Map Reduce - Hadoop and Map Reduce Examples - Pig - Case Study: Batch Analysis of News Articles-Stream Processing - In-Memory Processing. Interactive Querying: Hive -Amazon Redshift - Google BigQuery. [Chapter:6,7,8,9]	

Unit V: Advanced Topics: Analytics Algorithms - Data Visualization	(15 hrs)
Frameworks -Clustering - Case Study: Song Recommendation System - Classification and Regression.Frameworks& Libraries - Visualization Examples. [Chapter: 11, 12]	

Book for Study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7,8,9,11,12)	Big Data Science &Analytics: A Hands-on Approach	ArshdeepBahga & Vijay Madishetti	Published by ArshdeepBahga & Vijay Madishetti, Copyright - 2017.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	BIG DATA, Black Book	DT Editorial Services	Dreamtech Press, 2016.
2.	Big Data Analytics	Seema Acharya, Subhasini Chellappan	Wiley 2015.

E-Resources: (Web resources & E-books)

- https://www.google.co.in/books/edition/Handbook_of_Research_on_Big_Data_Storage/vQ9MDwAAQBAJ?hl=en&gbpv=1&dq=Big+data+Analytics+E+resources&printsec=frontcover
- https://www.tutorialspoint.com/big_data_analytics/index.htm

B.Sc Computer Science /Information Technology/ BCA

Semester VI

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Elective II - Mobile Computing	Course Code: 621SE5/621GE5/621KE5
Semester : VI	No. of Credits : 5
No. of hours : 90	C:T:S : 75:10:5
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial, S: Seminar)

Syllabus:

Unit I: (15 hrs)

Basics of Communication Technologies: Mobile Handsets, Wireless Communications, and Server Applications - Cell Phone System. Types of Telecommunication Networks - Computer Networks - Traditional LAN - LAN Architecture - Components of a Wireless Communication System - Architecture of a Mobile Telecommunication System - Wireless Local Area Networks (WLANs) - Bluetooth Technology - Introduction to Mobile Computing and Wireless Networking.

(Chapters: 1, 2)

Unit II: (16 hrs)

MAC Protocols: Properties Required of MAC Protocols - Wireless MAC Protocols: Some Issues - A Taxonomy of MAC Protocols - Fixed Assignment Schemes - Random Assignment Schemes - Reservation-based Schemes - The 802.11 MAC Standard - MAC Protocols for ad-Hoc Networks - Cognitive Radio ad-hoc Network - Mobile Transport Layer.

(Chapters: 3, 5)

Unit III: (15 hrs)

Mobile Internet Protocol: Mobile IP - Packet Delivery - Overview of Mobile IP - Desirable Features of Mobile IP - Key Mechanism Used in Mobile IP - Route Optimization - Dynamic Host Configuration Protocol (DHCP) - Mobile Ad Hoc Networks.

(Chapters: 4, 7)

Unit IV: (14 hrs)

Wireless Sensor Networks: WSN vs MANET-Applications - Architecture of the Sensor Node - Challenges in the Design of an Effective WSN - Characteristics of Sensor Networks -

WSN Routing Protocols - Target Coverage - Clustered Wireless Sensor Networks - Operating Systems for Mobile Computing.
(Chapters: 8, 9)

Unit V: (15 hrs)
Mobile Databases - Mobile Application Development and Protocols: Mobile Devices as Web Clients - WAP - J2ME - Android Application Development - Mobile Commerce: Applications of M-Commerce - Business-to-Business (B2B) Applications - Structure of Mobile Commerce - Pros and Cons of M-Commerce - Mobile Payment Systems - Security Issues.
(Chapters: 6, 10, 11)

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V (Chapters: 1,2,3,4,5,6,7,8,9,10,11)	Fundamentals of Mobile computing	Prasant Kumar Pattnaik and Rajib Mall	PHI learning Private Ltd. Second Edition

Books for Reference:

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Mobile Computing - Technology, Applications and Service Creation	Asoke K Talukder, Hasan Ahmed and Roopa R Yavagal	Tata Mcgraw Hill Second Edition, Ninth Reprint 2016

E-Resources: (Web resources & E-books)

1. <https://searchmobilecomputing.techtarget.com>
2. Fundamentals of Mobile Computing 2nd Edition, kindle edition by Prasant Kumar Pattnaik, Rajib Mall.

B.Sc Computer Science /Information Technology/ BCA

Semester VI

(For the students admitted during the academic year 2021 - 2022 onwards)

Course: Part III - Elective II - Bioinformatics	Course Code: 621SE6/621GE6/621KE6
Semester : VI	No. of Credits : 5
No. of hours : 90	C: T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: (15 hrs)
Introduction- What is Bioinformatics? - Goals - Scope - Applications - Limitations - New themes.
Introduction to Biological Databases - Types of Databases - Biological Databases - Pitfalls of Biological Databases - Information Retrieval from Biological Databases.

Unit II: (15 hrs)
Database Similarity Searching: Unique Requirements of Database Searching- Heuristic Database Searching - Basic Local Alignment Search Tool (BLAST) - FASTA - Comparison of

FASTA and BLAST - Database Searching with the Smith-Waterman Method. **Multiple Sequence Alignment:** Scoring Function - Exhaustive Algorithm - Heuristic Algorithm - Practical Issues.

Unit III: (15 hrs)
Protein Structure Basics: Secondary Structures - Tertiary Structures - Determination of Protein Three-Dimensional Structure - Protein Structure Database. **Protein Secondary Structure Prediction** - Secondary Structure Prediction for Globular Proteins - Secondary Structure Prediction for Transmembrane Proteins. **Protein Tertiary Structure Prediction** - Methods - Homology Modeling - Threading and Fold Recognition - Ab Initio Protein Structural Prediction.

Unit IV: (15 hrs)
Genomic Mapping and Mapping Databases: Genomic Map Elements - Types of Maps - Complexities and Pitfalls of Mapping - Data Repositories.
Information Retrieval from Biological Databases: Integrated Information Retrieval: The Entrez System Sequence Database Beyond NCBI - Medical Databases.

Unit V: (15 hrs)
Predictive Methods using DNA Sequences: GRAIL - FGENEH/FGENES – MZEF - GENSCAN - PROCRUSTERS - How do well the methods work? **Expressed Sequence Tags (ESTs):** What is an EST? - EST Clustering - ESTs and Gene Discovery - The Human Gene Map - Gene Prediction in Genomic Map - Assessing Levels of Gene Expression Using ESTs.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - III	Essential Bioinformatics.	JIN XIONG Texas A&M University	Cambridge University Press 2012.
IV - V	Bioinformatics - A Practical guide to the Analysis of Genes and Protein.	Andreas D.Baxevanis, B.F. Francis Ouellette	A John Wiley & Sons, inc., Publications 2 nd Edition.

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	Bioinformatics Basics. Applications in Biological Science and Medicine by	Hooman H. Rashidi and Lukas K.Buehler	CAC Press 2019.
2.	Bioinformatics	David Mount	CSH Publications,2000.
3.	Introduction to Bioinformatics	Attwood T.K and Parry-Smith	Addison Wesley Longman, 1999

E-Resources: (Web resources & E-books)

1. http://www.aun.edu.eg/molecular_biology/Procedure%20Bioinformatics22.23-4-2015/Xiong%20-%20Essential%20Bioinformatics%20send%20by%20Amira.pdf
2. https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/Algorithms%20n%20Strings%2C%20Trees%2C%20and%20Sequences%20%5BGusfield%201997-05-28%5D.pdf
3. http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/410_04_Baxevanis_Bioinformatics_-a-practical-guide-to-the-analysis-of-genes-and-proteins-Wiley.pdf

Skill Development Courses

B.Sc Computer Science/Information Technology/BCA

Semester III

(For the students admitted from the academic year 2021 - 2022 onwards)

Course System : Part III - Core IV - Operating	Course Code : 321S04/ 321G04/321K04
Semester : III	No. of Credits : 5
No. of Hours :75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: System Structures: (14hrs)
Introduction: What Operating Systems do?- Computer-System Organization- Operating-System Structure-Operating-System Operations-Virtualization-Kernel Data Structure-Computing Environments-Open-Source Operating systems. System Structures: Operating-System Services-User and Operating system interface-System call-System services-Linkers and Loaders-Operating System Structure-Building and Booting an Operating System-OS Debugging [Book1: Chapters: 1,2]
Unit II: Process Concept: (13hrs)
Process Concept: Process Concept-Process Scheduling - Operations on Processes - Inter-Process Communication - Examples of IPC Systems - Communication in Client-Server Systems. Process Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multiple-Processor Scheduling - Real-Time CPU Scheduling. [Book1: Chapters: 3,5]
Unit III: Synchronization: (13hrs)
Synchronization: The Critical-Section Problem - Peterson's Solution - Synchronization Hardware - Mutex Locks - Semaphores-Monitors - Classic Problems of Synchronization - Synchronization within the kernel- Deadlocks: System-Model-Deadlock in Multithread Application-Deadlock Characterization-Methods for Handling Deadlocks-Deadlock Prevention-Deadlock Avoidance-Deadlock Detection-Recovery From Deadlock. [Book1: Chapters :6, 7,8]
Unit IV: Memory-Management Strategies: (13hrs)
Memory-Management: Background-Contiguous Memory Allocation-Paging-Structure of the Page Table-Swapping-Virtual Memory: Demand Paging -Copy on write - Page Replacement - Allocation of Frames - Thrashing-Memory Compression-Allocating Kernel Memory-Mass Storage Structure-HDD Scheduling-NVM Scheduling-Error Detection and correction-Storage Device Management. [Book1: Chapters: 9,10,11]
Unit V: File System: (12hrs)
File System: File Concept - Access Methods - Directory Structure -FileSystem Implementation: File System Structure-File system operation-Directory Implementation-File System-File system Mounting-Partitions and Mounting-File Sharing-Virtual file system-Remote File System-Security: Security Problem-Program threats -Starting the Shell - Using the Shell Prompt - Interacting with the bash Manual - Navigating the Filesystem - Listing Files and Directories -

Handling Files - Managing Directories - Viewing File Contents. **More bash Shell Commands:** Monitoring Programs - Monitoring Disk Space - Working with Data Files.
 [Book1: Chapters: 13,14,15,16,17],[Book2: Chapters: 3, 4]

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,5,6,7, 8,9,10,11,12, 13,14,15,16,17)	Operating System Concepts	Abraham Silberschatz, Peter B.Galvin, Greg Gagne	John Wiley & Sons, Ninth Edition, Reprint 2018.
V (Chapters 3,4)	Linux Command Line and Shell Scripting Bible	Richard Blum and Christine Bresnahan	John Wiley & Sons, Reprint 2016

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Operating System	H.M. Deitel	Third Edition, Pearson Education incorporation.
2.	Operating Systems: Design and Implementation	Andrew S.Tanenbaum, Albert S.Woodhull	Pearson Prentice Hall. 2009.
3.	The Linux Command Line	William Shotts	Fifth Internet Edition, 2019.

E-Resources: (Web resources &E-books)

1. <https://www.cl.cam.ac.uk/teaching/1011/OpSystems/os1a-slides.pdf>
2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf

**B.Sc Computer Science
Semester III**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core V - Database Management System	Course Code : 321S05
Semester : III	No. of Credits : 4
No. of Hours : 60	C:T : 52:8
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Database Concepts:	(10 hrs)
A Relational Approach: Database: An Introduction - Relationships -Database Management System (DBMS) - The Relational Database Model - Integrity Rules -Theoretical Relational Languages. Database Design: Data Modeling and Normalization: Data Modeling - Dependency - Database Design - Normal Forms - Dependency Diagrams -Denormalization - Another Example of Normalization. Oracle9i: An Overview: Oracle9i: An Introduction - The SQL*Plus Environment - Structured Query Language (SQL) - Logging in to SQL*Plus - SQL*Plus Commands - Oracle Errors and Online Help. [Chapters:1,2,3]	

Unit II: Oracle Tables: Data Definition Language (DDL):	(10 hrs)
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Naming Rules and Conventions - Data Types - Constraints - Creating an Oracle Table - Displaying Table Information - Altering an Existing Table - Dropping a Table - Renaming a Table - Truncating a Table - Oracle's Various Table Types - Spooling - Error Codes. **Working with Tables: Data Management And Retrieval:** Data Manipulation Language (DML) - Adding a New Row/Record - Customized Prompts -Updating Existing Rows/Records -Deleting Existing Rows/Records - Retrieving Data from a Table - Arithmetic Operations - Restricting Data with a WHERE clause - Sorting - Revisiting Substitution Variables - DEFINE Command - CASE Structure.
[Chapters:4,5]

Unit III: Working with Tables: Functions and Grouping: (10 hrs)

Built-In Functions - Grouping Data. **Multiple Tables: Joins and Set operators:** Join - Set Operators. **Subqueries: Nested Queries:** Subquery - Top N analysis - Merge statement - Correlated subquery.
[Chapters:6,7,8]

Unit IV: PL/SQL: A Programming Language: (11 hrs)

A Brief History of PL/SQL - Fundamentals of PL/SQL - PL/SQL Block Structure - Comments - Data Types - Other Data Types - Variable Declaration - Anchored Declaration - Assignment Operation - Bind Variables - Substitution Variables in PL/SQL - Printing in PL/SQL - Arithmetic Operators. **More On PL/SQL : Control Structures and Embedded SQL:** Control Structures - Nested Blocks - SQL in PL/SQL - Data Manipulation in PL/SQL - Transaction Control Statements.
[Chapters:10,11]

Unit V: PL/SQL Cursors and Exceptions: (11 hrs)

Cursors - Implicit Cursors - Explicit Cursors - Explicit Cursor Attributes - Implicit Cursor Attributes - Cursor FOR loops - SELECT...FOR UPDATE Cursor - WHERE CURRENT OF Clause - Cursor with Parameters - Cursor Variables: An Introduction - Exceptions - Types of Exceptions. **PL/SQL Composite Data Types:** Records, Tables and Varrays: Composite Data Types - PL/SQL Records - PL/SQL Tables - PL/SQL Varrays. **PL/SQL Named Blocks:** Procedures - Functions - Packages - Triggers - Data Dictionary Views.
[Chapters:12,13,14]

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6, 7,8,10,11,12,13,14)	Database Systems Using Oracle	Nilesh Shah	Pearson India Education Services Pvt Limited, Second Edition 2019.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Database System concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw Hill Education (India) Edition, Seventh Edition 2020.
2.	Database Management Systems	P.S.Gill	Wiley Publication, 2019

E-Resources: (Web resources & E-books)

1. https://www.tutorialspoint.com/dbms/dbms_tutorial.pdf
2. www.pdfdrive.com/database-management-system-books.html

**B.Sc Computer Science
Semester III**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part IV - Skill Enhancement Course I: Professional English for Computer Science	Course Code : 321SS1
Semester : III	No. of Credits : 2
No. of hours : 45	T:P : 7:38
CIA Max. Marks:100	ESE Max. Marks: --

(T: Tutorial, P: Practical)

Syllabus:

Unit I: Communicative Competence:	(8 hrs)
Listening - Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions) Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions) Reading: Two subject-based reading texts followed by comprehension activities/exercises Writing: Summary writing based on the reading passages.	

Unit II: Persuasive Communication:	(8 hrs)
Listening: Listening to a product launch- sensitizing learners to the nuances of persuasive communication Speaking: Debates - Just-A Minute Activities Reading: Reading texts on advertisements (on products relevant to the subject areas) and answering inferential questions Writing: Dialogue writing- writing an argumentative /persuasive essay.	

Unit III: Digital Competence:	(8 hrs)
Listening: Listening to interviews (subject related) Speaking: Interviews with subject specialists (using video conferencing skills) Creating Vlogs (How to become a vlogger and use vlogging to nurture interests - subject related) Reading: Selected sample of Web Page (subject area) Writing: Creating Web Pages Reading Comprehension: Essay on Digital Competence for Academic and Professional Life.	

Unit IV: Creativity and Imagination:	(7 hrs)
Listening: Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites - E.g. https://youtu.be/HDAo5DrTWvo) Speaking: Making oral presentations through short films - subject based Reading : Essay on Creativity and Imagination (subject based) Writing - Basic Script Writing for short films (subject based) - Creating blogs, flyers and brochures (subject based) - Poster making - writing slogans/captions (subject based)	

Unit V: Workplace Communication & Basics of Academic Writing: (7 hrs)

Speaking: Short academic presentation using PowerPoint
 Reading & Writing:
 Product Profiles, Circulars, Minutes of Meeting. Writing an introduction, paraphrasing
 Punctuation (period, question mark, exclamation point, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotation marks, and ellipsis)
 Capitalization (use of upper case)

E-Resources: (Web resources)

1. <https://www.learn-english-today.com/business-english/A-business-english-contents.html>
2. https://www.google.com/url?sa=t&source=web&rct=j&url=https://galgotiacollege.edu/assets/pdfs/study-material/Notesenglish.pdf&ved=2ahUKEwjcu_q6LTyAhXI8XMBHSEcBdUQFnoECA MQAQ&usg=AOvVaw20ghLKtw5gft0-NbLC6aHp&cshid=1629092134176

B.Sc. Computer Science / Information Technology**Semester IV****(For the students admitted from the academic year 2021 - 2022 onwards)**

Course: Part III - Core VI - Computer Networks	Course Code : 421S06/421G06
Semester : IV	No. of Credits : 5
No. of hours : 75	C:T:S : 65:5:5
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial, S: Seminar)**Syllabus:****Unit I: Introduction: (12 hrs)**

Introduction: Uses of Computer Networks- Network Hardware - Network Software: Protocol Hierarchies- Design Issues for the Layers - Connection Oriented and Connectionless Services - Reference Models: The OSI Reference Model- The TCP/IP Reference Model.
 [Chapter : 1]

Unit II: The Physical Layer: (13 hrs)

The Physical Layer: Guided Transmission Media-Wireless Transmission - The Public Switched Telephone Network: Structure of the Telephone System -Trunks and Multiplexing - Switching.
 [Chapter: 2]

Unit III: The Data Link Layer: (13 hrs)

The Data Link Layer: The Data Link Layer Design Issues: Services Provided to the Network Layer-Framing-Error Control-Flow Control- Error Detection and Correction: Error Correcting Codes-Error Detecting Codes - Elementary Data Link Protocols: A Utopian Simplex Protocol-A Simplex Stop-and-Wait Protocol for an Error-Free Channel - A Simplex Stop-and-Wait Protocol for a Noisy Channel.
 [Chapter: 3]

Unit IV: The Network Layer: (14 hrs)

The Network Layer: Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer - Routing Algorithms: Shortest Path Routing - Flooding - # Distance Vector Routing - # Link State Routing - Hierarchical Routing - Broadcast Routing.
(Simulation tools)
[Chapter: 5]

Unit V: The Transport Layer: (13 hrs)

The Transport Layer: The Transport Service - Elements of Transport Protocols: Addressing - Connection Establishment - Connection Release-Error Control and Flow Control. **The Application Layer: DNS -The Domain Name System- Electronic Mail. Network Security: Public Key Algorithms.**
[Chapters: 6,7,8]

Book for study:

Units	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,5,6,7,8)	Computer Networks	Andrew S. Tanenbaum,DavidJ.Wetherall	Dorling Kindersley IndiaPvt.Ltd. Third Impression, 2013

Books for Reference:

S No	Name of the Book	Authors	Publishers with Edition
1.	Computer Networking and the Internet	Fred Halsall, Lingana Gouda Kulkarni	Pearson Education, Edition-2011
2.	Data Communication and Networking	Behouza.Forouzan	McGraw-Hill Education, Fifth Edition 2013.

E-Resources: (Web resources & E-books)

- <https://www.pdfdrive.com/fundamentals-of-computer-networking-and-internetworking-d16587595.html>
- <http://file.allitebooks.com/20150523/Computer%20Networks,%205th%20Edition.pdf>
- <http://file.allitebooks.com/20170302/Introduction%20to%20Computer%20Networking.pdf>

**B.Sc Computer Science
Semester IV**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part IV - Skill Enhancement Course II: Software Testing Lab	Course Code: 421SS2
Semester : IV	No. of Credits : 2
No. of hours : 45	P:D : 38:7
CIA Max. Marks: 100	ESE Max. Marks: -

(P: Practical, D: Demo)

Syllabus:**List of programs:****(38 hrs)**

1. Program for testing a difference script in flight 1A.
2. Program for testing a GUI Checkpoints.
3. Program for testing a Bitmap Checkpoint.
4. Program for testing a Fax report graph in flight 1A.
5. Program to create a calculator testing in VB.
6. Program to create a Number conversion testing in VB.
7. Program to create a student details testing in VB.
8. Program to create an employee details testing in VB.
9. Program to create a Hotel management testing in VB
10. Program to create a shapes testing in VB

B.Sc Computer Science Semester V

(For the students admitted from the academic year 2021 - 2022 onwards)

Course Design : Part III - Core IX - Compiler	Course Code : 521S09
Semester : V	No. of Credits : 5
No. of hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T:Tutorial)

Syllabus:**Unit I: Introduction to Compilers:****(16 hrs)**

Compilation and Interpretation- Language Processing System- The phases of Compiler-Errors Encountered in Different Phases-Grouping of Phases- Compiler Construction Tools- Programming Language Basics. Lexical Analysis: Token, Pattern and Lexeme-Role of Lexical Analyzer-Lexical Errors-Input Buffering.
[Chapters: 1, 2]

Unit II: Lexical Analysis:**(13 hrs)**

Expressing Tokens by Regular Expression-Conversion of Regular Expression to DFA-Minimization of DFA-Lex- Design of Lexical Analyzer-Recognition of Tokens.
[Chapters: 2]

Unit III: Syntax Analysis:**(13 hrs)**

Parser-Role of Parser-Grammars-Derivations-Parse Tree-Top-down Parsing-Bottom-Up Parsing-LR Parsers.
[Chapters: 3]

Unit IV: Syntax Directed Translation and Run Time Environment:**(16 hrs)**

Directed Definition(SDD)-Types of Syntax Directed Definitions-Attribute Grammar-Annotated Parse Tree- Construction of Syntax Tree-Three Address Code-Declarations-Bottom-Up Evaluation of S-Attribute Definition-Design of Predictive Translator-Specification of Simple Type Checker-Equivalence of Type Expression-Type Conversions-

Run-Time Environment-Source Language Issues-Storage Organization-Storage Allocation Strategies-Parameter Passing-Symbol Table.
[Chapters: 4]

Unit V: Code Optimization and Code Generation: (17 hrs)

Optimization-Basic Block and Flow Graphs-Principal Sources of Optimization-DAG-Optimization of Basic Blocks-Introduction to Global Data Flow Analysis-Efficient Data Flow Algorithms-Code Generator-Register Allocation and Register Assignment-Simple Code Generator Algorithm-Loops-Depth First Ordering-Natural Loops-Peepphole Optimizations.
[Chapters: 5]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V (Chapters:1,2,3,4,5)	Compiler Design	S. Godfrey Winster, S. Aruna Devi, R. Sujatha	Yes Dee Publishing Pvt Ltd, 2016

Books for Reference:

S No	Name of the Book	Authors	Publishers with Edition
1.	Principles of Compiler Design	M. GanagaDurga, T.G. Manikumar	MJP Publishers,2013
2.	Principles of Compiler Design	V. Raghavan	McGraw Hill Education (India) Pvt. Ltd., Eighth Reprint 2015

E-Resources: (Web resources & E-books)

1. <https://nptel.ac.in/courses/106108113>
2. <https://holub.com/goodies/compiler/compilerDesignInC.pdf>
3. <http://www.a-zshiksha.com/forum/viewtopic.php?f=133&t=61508>

**B.Sc. Computer Science / Information Technology
Semester V**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part III - Core X - Data Mining	Course Code: 521S10 / 521G10
Semester : V	No. of Credits : 5
No. of hours : 75	C:T:S : 65:5:5
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial, S: Seminar)

Syllabus:

Unit I:Introduction:

What is Data Mining? - Motivating Challenges - The Origins of Data Mining - Data Mining Tasks. Data: Types of Data - Data Quality - Data Preprocessing - Measures of Similarity and Dissimilarity: Basics - Similarity and Dissimilarity between Simple Attributes - Dissimilarities between Data Objects - Similarities between Data Objects.

[Book 1: Chapters: 1, 2]

Unit II: Classification:

Basic Concepts, Decision Trees, and Model Evaluation: Preliminaries - General Approach to Solving a Classification Problem - Decision Tree Induction. Classification: Alternative Techniques: Rule-Based Classifier - Nearest-Neighbor Classifiers - Bayesian Classifiers. [Book 1: Chapters 4, 5]

Unit III: Association Analysis:

Basic Concepts and Algorithms: Problem Definition - Frequent Item set Generation - Rule Generation - Compact Representation of frequent Item sets - Alternative Methods for Generating Frequent Item sets - FP-Growth Algorithm - Evaluation of Association Patterns - Effect of Skewed Support Distribution. [Book 1: Chapters 6]

Unit IV: Cluster Analysis:

Basic Concepts and Algorithms: Overview - K-means - Agglomerative Hierarchical Clustering - DBSCAN. Cluster Analysis: Additional issues and Algorithms: Density-Based Clustering: Grid-Based Clustering - DENCLUE: A Kernel-Based Scheme for Density Based Clustering - Graph-Based Clustering - Chameleon: Hierarchical Clustering with Dynamic Modeling - Scalable Clustering Algorithms - BIRCH - CURE. [Book 1: Chapters: 8, 9]

Unit V: Data Mining Trends and Research Frontiers:

Other Methodologies of Data Mining: Statistical Data Mining-Views on Data Mining Foundations- Visual and Audio Data Mining. Data Mining Applications: Data Mining for Financial Data Analysis- Data Mining for Retail and Telecommunication Industries- Data Mining in Science and Engineering- Data Mining for Intrusion Detection and Prevention- Data Mining and Recommender Systems. Data Mining and Society: Ubiquitous and Invisible Data Mining- Privacy, Security, and Social Impacts of Data Mining. Data Mining Trends. **Case Study:** Which Technologies are used -Issues in Data Mining. [Book 2: Chapters: 13]

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - IV (Chapters 1,2,4,5,6,8,9)	Introduction to Data Mining	Pang - NingTan, MichaelSteinbach, VipinKumar	Pearson India Education Services Pvt. Ltd., first Impression 2016
V (Chapter 13)	Data Mining Concepts and Techniques	Jiawei Han, MichelineKamber, Ji anPei	Elsevier - 2013.

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	Data Mining	VikramPudi, P. RadhaKrishna	Oxford University press, Fourth Impression.
2.	Data Mining Introductory and Advanced Topics	Margaret H.Dunham	Pearson India Education Services Pvt. Ltd., eighth Impression

E-Resources : (Web resources & E-books)

1. <http://www.dataminingbook.info>
2. <https://www.pdfdrive.com/data-mining-d24225401.html>
3. [http://file.allitebooks.com/20150714/Data%20Mining-20Theories, %20Algorithms, %20and%20Examples.pdf](http://file.allitebooks.com/20150714/Data%20Mining-20Theories,%20Algorithms,%20and%20Examples.pdf)

B.Sc Computer Science/Information Technology/BCA Semester V

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Elective I - Introduction to IoT	Course Code: 521SE1 / 521GE1 / 521KE1
Semester : V	No. of Credits : 5
No. of Hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I : Introduction and Concepts:	(15 hrs)
Introduction to Internet of Things : Introduction - Physical Design of IOT - Logical design of IOT - IOT Enabling Technologies - IOT Levels & Deployment Templates. Domain Specific IoTs : Home Automation - Cities - Environment - Energy - Retail - Logistics - Agriculture - Industry - Health & Lifestyle. [Chapters : 1, 2]	

Unit II:IOT and M2M:	(15 hrs)
Introduction - M2M - Difference between IoT and M2M - SDN and NFV for IoT. IoT Platforms Design Methodology : Introduction - IoT Design Methodology - Case Study on IoT System for Weather Monitoring - Motivation For Using Python. IoT Systems - Logical Design using Python : Introduction - Python Data Types & Data Structures - Control Flow - Functions - Modules - Packages - Classes - Python Packages of Interest for IoT. [Chapters : 3, 5, 6]	

Unit III: IoT Physical devices & Endpoints:	(15 hrs)
What is an IoT Device - Exemplary Device: Raspberry Pi - About the Board - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Other IoT Devices. IoT Physical Servers & Cloud Offerings : Introduction to Cloud Storage Models & Communication APIs - WAMP - AutoBahn for IoT - Xively Cloud for IoT - Python Web Application Framework - Django - Amazon Web Services for IoT : Amazon EC2 - Amazon AutoScaling - Amazon DynamoDB - SkyNetIoT Platform. [Chapters : 7, 8]	

Unit IV: Data Analytics for IoT:	(15 hrs)
Introduction - Apache Hadoop - Using HadoopMapRTeduce for Batch Analysis - Apache Oozie - Apache Spark - Apache Storm - Using Apache Storm for Real time Data Analysis - REST-based approach - WebSocket-based approach - Structural Health Monitoring Case Study. [Chapters : 10]	

Unit V: Tools for IoT:	(15 hrs)
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Introduction - Chef - Chef Case Studies - Puppet - Puppet Case Study - Multi-tier Deployment - NETCONF-YANG Case Studies.

Case Studies Illustrating IoT Design

Home Automation: Smart Lighting - Cities: Smart Parking - Environment: Weather Monitoring System: REST based Implementation - Agriculture: Smart Irrigation.

[Chapters : 9, 11]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,5,6,7, 8,10,9,11)	Internet of Things A Hands-on Approach	ArshdeepBagha, Vijay Madiseti	UniversityPress (India) Private Limited, Reprinted 2020.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetete Robert Barton, Jerome Henry.	Cisco Press, 2017.
2.	The Technical Foundations of IoT	Boris Adryan, DominikObermaier, Paul Fremantle	Artech Houser Publishers, 2017.

E-Resources: (Web resources & E-books)

1. <https://www.udemy.com/internet-of-things-iot-for-beginners-getting-started/>
2. <http://www.megunolink.com/articles/arduino-garage-door-opener>
3. <http://www.makeuseof.com/tag/pi-overdose-heres-5-raspberry-pi-alternatives>

B.Sc. Computer Science / Information Technology/ B.C.A.

Semester V

(For the Students admitted from the academic year 2021 - 2022 onwards)

Course: Part III - Elective I - Introduction to Data Science	Course Code : 521SE2/ 521GE2/521KE2
Semester : V	No. of Credits : 5
No. of hours : 90	C:T:S : 75:10:5
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial, S: Seminar)

Syllabus:

<p>Unit I: (15 hrs)</p> <p>Data science in Big DataWorld: Benefits and uses of data science and big data - Facts of data - The data science process - The big data ecosystem and data science - An introductory working example of Hadoop. The Data Science Process: Overview of the data science process - Step 1: Defining research goals and creating a project character - Step 2: Retrieving data - Step 3: Cleansing, Integrating and Transforming data - Step 4: Exploratory Data Analysis - Step 5: Build the Models - Step 6: Presenting finding and building applications on top of them.</p>
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(Chapters: 1,2)

Unit II: (15 hrs)

Machine Learning: What is machine learning and why should you care about it? - The Modeling process - Types of machine learning - Semi-supervised learning. Handling Large Data on a Single Computer: The problems you face when handling large data - General techniques for handling large volumes of data -General Programming tips for dealing with LargeData Sets- Case study 1: Predicting malicious URLs - Case study 2: Building a recommender system inside a database.

(Chapters: 3,4)

Unit III: (15 hrs)

First Steps in Big Data: Distributing data storage and processing with frameworks - Case study: Accessing risk when loaning money. Join the NoSQL Movement: Introduction to NoSQL - Case study: What disease is that?

(Chapters: 5,6)

Unit IV: (15 hrs)

The Rise of Graph Databases: Introducing connected data and graph databases - Introducing Neo4j: a Graph Database - Connected data example: A Recipe recommendation engine. Text Mining and Text Analytics: Text mining in the real world - Text mining techniques - Case study: Classifying reddit posts.

(Chapters: 7,8)

Unit V: (15 hrs)

Data Visualization to The End User: Data visualizations options - Cross filter, the JavaScript map reduce library - Creating an interactive dashboard with dc.js - Dashboard development tools.

(Chapter: 9)

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters: 1,2,3,4,5,6,7,8,9)	Introducing Data Science Big Data, Machine Learning, And More, Using Python Tools	Davy Cielen Arno D. B. Meysman Mohamed Ali	Manning Publications Co,2016.

Books for Reference:

S No	Name of the Book	Authors	Publishers with Edition
1	Data Science from Scratch	Joel Grus	O'Reilly Publisher,2nd Edition, May 2019
2	Big Data Analytics: A Practitioner's Approach	V. Bhuvanewari, T. Devi	Sci-Tech Publications, 2016.

E-Resources: (Web resources & E-books)

1. <https://builtin.com/data-science>
2. https://www.w3schools.com/datascience/ds_introduction.asp
3. https://www.w3schools.com/datascience/ds_database.asp
4. https://www.w3schools.com/datascience/ds_python.asp
5. <https://www.udacity.com/course/intro-to-data-science--ud359>
6. https://www.tutorialspoint.com/python_data_science/index.htm

B. Sc Computer Science/ Information Technology/ BCA Semester V

(For the students admitted during the academic year 2021 - 2022 onwards)

Course: Part III - Elective I - Trends in Computing	Course Code: 521SE3/ 521GE3/521KE3
Semester : V	No. of Credits : 5
No. of hours : 90	C: T :75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: (15 hrs)
Grid Computing Overview: Introduction - Definitions - Classifying Grid Systems - Grid Applications - Grid Architecture - Grid Computing Projects - Grid Evolution. **Data Management in Grids:** Introduction - From data Sources to databases...to data sources - Positioning the data management in Grids within distributed systems - Links with the other Services of the Middleware - Problems and Some Solutions - Towards pervasive, Automatic and On-demand data management.

Unit II: (15 hrs)
Future of Grids Resources Management: Introduction - Several Computing Paradigms - Definition of Cloud Computing - Cloud Services - Cloud Resource Management - Future directions of Resource Scheduling. **Broadcasting for Grids:** Introduction - Broadcastings - Heuristics for Broadcasting - Related work and Related Methods.

Unit III: (15 hrs)
Introduction: Introduction to Soft Computing - Evolutionary Computing - Hard Computing Vs Soft Computing - Soft Computing Methods - Recent Trends in Soft Computing. **Fundamentals of Artificial Neural Networks:** Introduction - Model of Biological Neuron - Mathematical Model of Neuron - ANN Architecture - Learning Rules - Learning Paradigms - Perception Network - Adaline and Madaline Networks - Applications of Neural Networks.

Unit IV: (15 hrs)
Associative Memory: Introduction - Auto-associative Memory - Hetero-associative Memory - Bidirectional Associative Network - Applications of Associative Memory. **Associate Models:** Hopfield Network - Boltzmann Network - Simulated Annealing - Applications of Networks.

Unit V: (15 hrs)
Genetic Algorithm: History of Evolutionary Computing - Crossover and Mutation Properties - Genetic Algorithm Cycle - Fitness Function - Applications of Genetic Algorithm. **Applications of Soft Computing Techniques:** Pattern Recognition - Image Processing - Application of Soft Computing in Real Estate - Soft Computing in Mobile Ad hoc Network - Soft Computing in Information Retrieval and Semantic Web - Soft Computing in Software Engineering.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I, II	Fundamentals of Grid Computing Theory, Algorithms and Technologies.	Frederic Magoules	CRC Press, 2010
III - V	Soft Computing Advances and Applications	B.K.Tripathy, J.Anuradha	Cengage Learning India Pvt.Ltd, 2015

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	Smart Grid Fundamentals of Design and Analysis	James Momoh	Wiley India P. Ltd, 2012
2.	Principles of Soft Computing	S.N.Sivanandam, S.N.Deepa	Wiley India P. Ltd, Reprint 2010
3.	Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithms	Samir Roy, Udit Chakraborty	Dorlink Kindersley (India) Pvt.Ltd, 2013

E-Resources: (Web resources & E-books)

- <https://searchmobilecomputing.techtarget.com>
- http://www.dauniv.ac.in/downloads/Mobilecomputing/MobileCompChap01L07_MobComputing.pdf

B.Sc Computer Science Semester VI

(For the students admitted from the academic year 2021 - 2022 onwards)

Course	: Part III - Core XIII - Computer	Course Code	: 621S13
Semester	: VI	No. of Credits	: 5
No. of hours	: 75	C:T	: 65:10
CIA Max. Marks:	50	ESE Max. Marks:	50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: A survey of Computer Graphics:	(13 hrs)
<p>Computer Aided Design-Presentation Graphics-Computer Art-Visualization-Image Processing-Graphical user interface. Overview of Graphics Systems: Color CRT Monitors- Direct - View Storage Tubes-Flat - Panel Displays - Three - Dimensional Viewing Devices - Stereoscopic and Virtual - Reality Systems - Output Primitives: Points and Lines - Line Drawing Algorithms - Loading the Frame Buffer - Line Function - Circle Generating Algorithm - Ellipse - Generating Algorithms. [Chapters: 1,2,3]</p>	
Unit II: Attributes of Output Primitives:	(13 hrs)
<p>Line Attributes - Curve Attributes - Color and Grayscale Levels - Area - Fill Attributes -Character Attributes. Two Dimensional Geometric Transformations: Basic Transformations - Matrix representations and Homogeneous Coordinates - Composite Transformations - Other Transformations. Two-Dimensional Viewing: The Viewing pipeline - Viewing Coordinate Reference frame- Window-to-Viewport Coordinate Transformation - Two dimensional Viewing Function - Clipping Operation - Point Clipping.</p>	

[Chapters: 4,5,6]

Unit III: Structures and hierarchical modeling: (13 hrs)

Structure concepts - Editing structure - Basic modeling concepts - Hierarchical modeling with structure. **Three Dimensional Concepts:** Three dimensional display methods - Three dimensional graphics packages. **Three Dimensional Object Representations:** Polygon surfaces - curved lines and surfaces - Quadric surfaces - Super quadrics - Blobby objects.

[Chapters: 7,9,10]

Unit IV: Three Dimensional Geometric and Modeling Transformations: (13 hrs)

Translation - Rotation -Scaling - Other transformations. Three dimensional viewing - Viewing pipeline - Viewing Coordinates - Projections - Clipping. **Visible - Surface Detection Methods:** Classification of Visible - Surface Detection Algorithms - Back face Detection - Depth-Buffer Method - A Buffer Method - Scan-Line Method - Depth Sorting Method.

[Chapters:11,12,13]

Unit V: Illumination models and Surface Rendering Models: (13 hrs)

Light Sources-Basic Illumination models. **Color Models and Color Applications:** Properties of Light-standard primaries and the chromaticity diagram-RGB Color Model - YIQ Color Model - CMY Color Model - HSV Color Model - Conversion between HSV and RGB Models - HLS Color Model - **Computer Animation.**

[Chapters: 14,15,16]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V (Chapters 1,2,3,4,5,6,7,9,10,11,12, 13,14,15,16)	Computer Graphics C version	Donald Hearn, M. Pauline Baker	Second Edition Baker, Prentice-Hall India Private Limited, 2014.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Computer Graphics Principles and Practice in C	James D.Foley ,Andries van Dam, Steven K.Feiner, F.Hughes John	Second Edition, Pearson Publication 2013.
2.	Computer Graphics C version	Donald Hearn, M. Pauline Baker	Second Edition Baker, Prentice-Hall India Private Limited, 2011.

E-Resources: (Web resources & E-books)

1. http://library.aceondo.net/ebooks/Fine_Arts/Computer.Graphics.And.Multimedia.Applications.Problems.and.Solutions.pdf
2. http://www.faadoengineers.com/threads/3175-Computer-Graphics-FREE-E_book-covering-full-semester-syllabus

B.Sc Computer Science Semester VI

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Part IV - Skill Enhancement Course IV - Node.js	Course Code : 621SS4
Semester : VI	No. of Credits : 2
No. of Hours : 45	P:D : 38:7
CIA Max. Marks: 100	ESE Max. Marks: -

(P: Practical, D:Demo)

Course Objectives: The Course aims

- To understand the JavaScript and technical concepts behind Node JS
- To understand and use the Event Emitter
- To understand how the MEAN stack works

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop the web and web applications using JavaScript.	A
CO2	Develop Dynamic web pages using JavaScript.	A
CO3	Design the loops and decision making statements to solve the problem.	A

Syllabus:

List of programs:	(38 hrs)
<ol style="list-style-type: none">1. Design a Command Line Application using node js2. Create MySQL database in node js3. Create Table using MySQL node js4. Write a program to access the global variable in node js5. Create Load and use core http module using node js6. Create a Local module in node js7. Create a Export module in node js8. Create a simple node js web server9. Write http request and response in node js10. Design reading existing TestFile.txt asynchronously.11. Create a new file called test.txt and writes "Hello World" into it asynchronously.12. Program to create opens an existing file and reads its content.	

Curriculum Design
Sri G.V.G Visalakshi College for Women (Autonomous)

Affiliated to Bharathiar University

M.Sc. Computer Science

Scheme of Examination - CBCS and OBE Pattern

(For the students admitted from the academic year 2021 - 2022 onwards)

Sem	Course Code	Course Title	Ins. Hrs/Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	21MS01	Core I- Advanced Operating System	5	3	50	50	100	4
	21MS02	Core II- Advanced Java Programming	5	3	50	50	100	4
	21MS03	Core III- Data Mining and Warehousing	5	3	50	50	100	4
	21MS04	Core IV- Object Oriented Analysis and Design with UML	5	3	50	50	100	5
	21MSP1	Core Practical I- Advanced Java Programming	4	3	50	50	100	3
	21MSE1/ 21MSE2	Elective I- Enterprise Resource Planning / Parallel Processing	6	3	50	50	100	5
II	21MS05	Core V-Research Methodologies	4	3	50	50	100	4
	21MS06	Core VI- Data Science with Python	4	3	50	50	100	4
	21MS07	Core VII- Internet of Things	5	3	50	50	100	5
	21MS08	Core VIII- Design and Analysis of Algorithms	4	3	50	50	100	4
	21MSP2	Core Practical II- Advanced Python Programming	3	3	50	50	100	3
	21MSP3	Core Practical III- R Programming	2	3	50	50	100	2
	21MSE3/ 21MSE4	Elective II- Embedded Systems / Network Security and Cryptography	6	3	50	50	100	5
	21MGCA	Cyber Security Advanced	2	2	50	-	50	Grade
	21MSA1/ 21MSA2	Advanced Learners Course I- Nano Computing / Online Course	-	3	-	100	100	4*
III	21MS09	Core IX- Wireless Communication	5	3	50	50	100	5
	21MS10	Core X- Digital Image Processing	5	3	50	50	100	5
	21MS11	Core XI- Android Programming	4	3	50	50	100	4
	21MS12	Core XII-	5	3	50	50	100	4

		Software Project Management						
	21MSP4	Core Practical IV- Digital Image Processing	3	3	50	50	100	3
	21MSP5	Core Practical V- Android Programming	2	3	50	50	100	2
	21MSE5/ 21MSE6	Elective III- Soft Computing / Data Compression	6	3	50	50	100	5
IV	21MSPV	Project and Viva Voce	-	-	100	150	250	10
	21MSA3	Advanced Learners Course- II- Robotics	-	3	-	100	100	4*
Total							2300	90

***Starred credits are treated as additional credits (Optional)**

Employability Courses

M. Sc Computer Science

Semester I

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core II- Advanced Java Programming	Course Code : 21MS02
Semester : I	No. of Credits : 4
No. of hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Objects, Classes, Exception and Multi Threading: (13 hrs)
Introduction to Object Oriented Programming - Using Predefined Classes - Defining Classes - Static Fields and Methods - Method Parameters - Object Construction. Exception Handling :Exceptions- Handling Exceptions - An Example - Types of Exceptions - Catching Exception - Tracing Stack - Multiple Catch Blocks - throw - throws - finally - An example - Some properties - try-with-resources Statement -Nested try-catch -Custom Exception Classes. Multi-threading: Introduction - Main Thread - Using Sleep - Creating Thread - Extending Thread- Implementing Runnable - Interrupting Thread -Suspending and Resuming - Thread Priority- Using join() -Synchronization- Synchronization and Atomicity - Deadlock - Inter-thread Communication. [Book 1: Chapter: 4] [Book 2: Chapter: 2,3]
Unit II: Streams, AWT and Swings: (13 hrs)
Streams: Byte Stream - Character Stream - Bridging Stream - Buffered Stream- Reading from Keyboard - Formatting - Data Streams - Object Stream - Reading/writing Arrays via Streams - Pipes -File I/O - Path - File. AWT and Swing: Introduction - AWT Class Hierarchy-Creating Container- Adding Components - Layout - Using Panel - Text Field - TextArea - List - Checkbox - Check Box Group - Choice - Event Handling - Dialog Boxes- ScrollBar- Menu-Swing. [Book 2: Chapter:9,11]
*Unit III: Networking Programming: (13 hrs)
Remote Method Invocation: Introduction - Remote Method Invocation -Java RMI Interfaces and Classes - An Application - Compiling the Program-Generating Stub Classes-Running the Program- Callback-Another Callback Application-Dynamic Object Activation-Dynamic Class Downloading- An Example. Applets: Client Side Java - Life Cycle -Writing an Applet- Generating Class File - Running the Applet -Security - Utility Methods - Using Status Bar - Applet Context Interface - Document Base and Code Base - Passing Parameter - Event Handling - Communication Between Two Applets [Book 2: Chapter: 14,16]
Unit IV:JavaMail API and Java XML-RPC: (13hrs)
Java Mail API : E-mail - JavaMail API - Installing JavaMail - Sending Emails -Sending Emails Directly- Secured SMTP- Email Message Revisited - Email with HTML Content- Accessing Email - Deleting Mails- Replying to Mails - Forwarding Mails - Copying Emails - List of SMTP, POP3 and IMAP Servers. Java XML-RPC : Introduction - XML-RPC Operational Principle - Data Types - XML-RPC Messages - Java XML-RPC - Installing the Apache XML-RPC Java Library - XML-RPC versus Java Data Types - Example - Dynamic Proxies - Using XmlRpcServlet - Using ServletWebServer- Introspection -Limitations of XML-RPC. [Book 2: Chapter: 15,17]

Unit V: JavaBeans Components:	(13 hrs)
Why JavaBeans? - The Bean Writing process - Using Beans to Built an Application - Naming patterns for Bean Properties and Events - Bean Property Types - BeanInfo Classes -JavaBeans Persistence. Security: Class Loaders - Bytecode Verification - Security Managers and Permissions. [Book 3: Chapters: 8,9]	

*Starred unit is a self study unit.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I (Chapters 2,3)	Core Java Volume I - Fundamentals	Cay S. Horstmann, Gary Cornell	Ninth Edition, Pearson, 2014
II-IV (Chapters 9,11,14,15,16,17)	Advanced Java Programming	Uttam K. Roy	Oxford University Press YMCA Library Building, 1 Jai Singh Road, New Delhi 110001, India, 2015
V (Chapters 8,9)	Core Java Volume II - Advanced Features	Cay S. Horstmann, Gary Cornell	Ninth Edition, Pearson, 2013

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Programming with JAVA A Primer 5e	E. Balagurusamy	The TataMcGraw Hill Publishing Company Limited, New Delhi, 2016
2.	JAVA 2 The Complete Reference	Herbert Schildt	The Tata McGraw Hill Publishing Company Limited, New Delhi, 5 th Edition, 2015

E-Resources: (Web Resources & E-books)

- <http://iiti.ac.in/people/~tanimad/JavaTheCompleteReference.pdf>
- <http://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf>

**M.Sc Computer Science
Semester I**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Core Practical I- Advanced Java Programming	Course Code : 21MSP1
Semester : I	No. of Credits : 3
No. of hours : 60	P :D : 52:08
CIA Max. Marks: 50	ESE Max. Marks: 50

(P - Practical, D - Demo)

Syllabus:

List of Programs:	(52 hrs)
<ol style="list-style-type: none"> Write a Java program to implement RPC under Client-Server environment. Write a Java program to add a class into a Package. Write a Java program to display a text message using RMI. Write a Java program to perform File handling operations. Write a Java program to perform Multithreading Operation 	

6. Write a Java program to use buttons in a frame using AWT border control.
7. Write a Java program to create a frame using AWT. Implement mouseClicked(), mouseEntered() and mouseExited() events. Frame should become visible when mouse enters it.
8. Write a Java program using AWT to display a string in frame window with pink colour as background.
9. Write a Java program to design an Online Application program using Swing.
10. Write a Java program to Check the User Name and Password using Swing.
11. Write a Java program for displaying product list along with their prices and then allow user to buy any one from them with required quantity.
12. Write a Java program to create a list of vegetables if you click on one of the items of the list items would be displayed in text box.

M.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core VI - Data Science with Python	Course Code : 21MS06
Semester : II	No. of Credits : 4
No. of hours : 60	C:T : 52:8
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I :Data Science in a big data world : **(10 hrs)**

Benefits and uses of data science and big data -Facets of data - The data science process - The big data ecosystem and data science - An introductory working example of Hadoop.**The Data Science Process** : Overview of the data science process - Step 1: Defining research goals and creating a project charter - Step 2: Retrieving data - Step 3: Cleansing, integrating, and transforming data - Step 4: Exploratory data analysis - Step 5: Build the models - Step 6: Presenting findings and building applications on top of them.

[Chapters : 1, 2]

Unit II : Machine Learning : **(10 hrs)**

What is machine learning and why should you care about it? - The modeling process - Types of machine learning - Semi-supervised learning.**First steps in big data** : Distributing data storage and processing with frameworks.

[Chapters : 3, 5]

***Unit III :Introduction:** **(11 hrs)**

Why Choose Python for Data Science & Machine Learning - Python vs R - Widespread Use of Python in Data Analysis Clarity - Prerequisites & Reminders - Python & Programming Knowledge - Installation & Setup - Is Mathematical Expertise Necessary? - Python Quick Review - Tips for Faster Learning - Overview & Objectives - Data Analysis vs Data Science vs Machine Learning - Possibilities Limitations of Data Analysis & Machine Learning - Accuracy & Performance.

[Chapters : 1, 2, 3, 4, 5]

Unit IV :A Quick Example : **(10 hrs)**

Iris Dataset - Potential & Implications. **Getting & Processing Data** :CSV Files - Feature Selection - Online Data Sources - Internal Data Source. **Data Visualization**:Goal of Visualization - Importing & Using Matplotlib. **Supervised & Unsupervised Learning**:What is Supervised Learning? - What is Unsupervised Learning? - How to Approach a Problem.

[Chapters : 6, 7, 8, 9]

Unit V : Regression:

(11 Hrs)

Simple Linear Regression - Multiple Linear Regression - Decision Tree - Random Forest. Classification: Logistic Regression - K-Nearest Neighbors - Decision Tree Classification - Random Forest Classification. **Clustering:**Goals& Uses of Clustering - K-Means Clustering - Anomaly Detection. Association Rule Learning: Explanation - Apriori. **Reinforcement Learning:** What is Reinforcement Learning? - Comparison with Supervised & Unsupervised Learning - Applying Reinforcement Learning.

[Chapters : 10, 11, 12, 13, 14]

***Starred unit is a self study unit.**

Books for study:

Unit	Name of the Book	Authors	Publisherswith Edition
I, II (Chapters: 1,2,3,5)	Data Analysis From Scratch with Python, Step By Step Guide.	Peters Morgan	AI Sciences, 2016.
III, IV, V Chapters (1,2,3,4,5,6,7,8,9,10, 11,12,13,14)	Introducing Data Science Big Data, Machine Learning and More, using Python tools	Davy Cielen, Arno D.B.Meysman, Mohamed Ali	Manning Publications, 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Hands-On Data Analysis with NumPy and pandas - Implement Python packages from data manipulation to processing	Curtis Miller	Packt Publishing Ltd, 2018.
2.	Python Data Analytics Data Analysis and Science Using Pandas, Matplotlib, and the Python Programming Language	Fabio Nelli	APress Publication, 2015.

E-Resources : (Web resources & E-books)

1. <https://bedford-computing.co.uk/learning/wp-content/uploads/2015/10/Python-for-Data-Analysis.pdf>
2. <https://pandas.pydata.org/docs/pandas.pdf>
3. https://www.researchgate.net/publication/332539010_Introduction_to_Data_Science_Analysis_using_Python

**M.Sc Computer Science
Semester II**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core VII - Internet of Things	Course Code : 21MS07
Semester : II	No. of Credits : 5
No. of hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I : Preliminaries, Motivation, and Related Work :

(13 hrs)

What is the Internet of Things? - Wireless Ad-hoc and Sensor Networks : The Ancestors without IP - IoT-enabled Applications.**Standards** : The Internet of Things - Designing the Architecture of an IP-based Internetof Things - Physical/Link Layer - Network Layer - Transport Layer - Application Layer

- CoAP - Protocol overview - CoAP URI - CoAP messaging - CoAP message format . The Industrial IoT.
[Chapters : 1, 2]

Unit II : Interoperability : (13 hrs)

Applications in the IoT - The Verticals: Cloud-based Solutions - REST Architectures: The Web of Things - REST: The Web as a Platform - The Web of Things - Discoverability in Constrained Environments - Data Formats: Media Types for SensorMarkupLanguage.**Discoverability** : Service and Resource Discovery - Local and Large Scale Service Discovery - Scalable and Self-configuring Architecture for Service Discovery in the IoT - IoT Gateway - A P2P based Large scale Service Discovery Architecture - Zeroconf based Local Service Discovery for Constrained Environments - Lightweight Service Discovery in Low-power IoT Networks.

[Chapters : 3, 4]

Unit III : Security and Privacy in the IoT: (13 hrs)

Security Issues in the IoT - Security Mechanisms Overview : Authorization Mechanisms for Secure IoT Services - Privacy Issues in the IoT : The Role of Authorization.**The IoT in Practice** : Hardware for the IoT - Software for the IoT - Effective Authorization for the Web of Things.

[Chapters : 5, 7]

***Unit IV : Demystifying the IoT Paradigm:** (13 hrs)

Why the IoT is Strategically Sound - The Brewing and Blossoming Trends in IT Space - Illustrating the Device-to-Device/Machine-to-Machine Integration Concept - Describing the Sensor-to-Cloud Integration Concept - Azure IoT Hub Device Management - The IoT: The Key Application Domains.**Infrastructure and Service Discovery Protocols for the IoT Ecosystem** : Layered Architecture for IoT - Protocol Architecture of IoT: Infrastructure Protocols - Routing Protocol - EPC Global - Long Term Evolution Advanced - Z-Wave - ZigBee - Device or Service Discovery for IoT - Protocols for IoT Service Directory -

[Book 2 : Chapters : 1, 3]

Unit V : The Enablement Platforms for IoT Applications and Analytics : (13 hrs)

The IoT Building Blocks - Characterizing IoT or Machine-to-Machine Application Platforms - IoT AEPs - The Architectural Building-Blocks - Azure IoT Hub - Amazon Web Service IoT Platform - The IoT Data Analytics Platforms - The IoT Data Virtualization Platforms - IoT Data Visualization Platform. **The Next-Generation Clouds for IoT Applications and Analytics** : About the Cloud Technology - The Cloud Service Ecosystem - IoT and Cloud-Inspired Smarter Environments - The Building Blocks of Software-Defined Clouds - Software-Defined Storage (SDS).**Smart Use Cases of IoT** : Governance Use Cases - Smart Industrial Use Cases of IoT- Smart Lighting for Energy Conservation - Smart Transportation Systems - Role of Building Automation Systems in Smarter Homes and Buildings - Smart Education Systems Using Wearable Devices.

[Book 2 : Chapters : 5, 6, 11]

***Starred unit is a self study unit.**

Books for study:

Unit	Name of the Book	Authors	Publisherswith Edition
I, II, III (Chapters 1,2,3,4,5,7)	Internet of Things Architectures, Protocols and Standard	Simone Cirani, Gianluigi Ferrari, Macro Picone, Luca Veltri	Wiley Publication, 2019.

IV, V (Chapters 1,3,5,6,11)	The Internet of Things Enabling Technologies, Platforms and UseCases	Pethuru Raj and Anupama C. Raman	CRC Press, Taylor & Francis Group, 2017.
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Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Internet of Things Challenges, Advances, and Applications	Qusay F. Hassan Atta ur Rehman Khan Sajjad A. Madani	CRC Press Taylor & Francis Group, 2018.
2	Internet of Things A Hands-on Approach	ArshdeepBagha, Vijay Madiseti	University Press (India) Private Limited, Reprinted 2020.

E-Resources : (Web resources & E-books)

1. http://uru.ac.in/uruonlinelibrary/Internet_of_Things/IOT.pdf
2. tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf

M.Sc Computer Science Semester IV

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Advanced Learners Course II - Robotics	Course Code : 21MSA3
Semester : IV	No. of Credits : 4*
No. of hours : --	C:T : --
CIA Max. Marks: --	ESE Max. Marks: 100

(C: Contact hours, T: Tutorial)

*Self Study

Syllabus:

Unit I: Introduction to Robotics:
Introduction: Background - The mechanics and control of mechanical manipulators. Spatial descriptions and transformations: Introduction - Descriptions - Mappings - Operators - Transformation Arithmetic - Transform Equations. [Book 1: Chapters: 1,2]

Unit II: Manipulator Kinematics:
Introduction - Link description - Link connection description - Manipulator Kinematics - Actuator space, joint space and cartesian space. Inverse Manipulator Kinematics: Introduction - Solvability - Algebraic Vs Geometric - Algebraic solution by reduction to polynomial. [Book 1: Chapters: 3,4]

Unit III: Manipulator Dynamics:
Introduction - Acceleration of a rigid body - Mass distribution - Newton's Equation, Euler's Equation - Interactive Newton-Euler Dynamic formulation - The structure of Manipulator's dynamic equations - Formulating manipulator dynamics in cartesian space. Manipulator Mechanism design: Basing the design on task requirements - Kinematic configuration - Quantitative measures of workspace attributes - Redundant and closed chain structures. [Book 1: Chapter: 6,8]

Unit IV: Robotic Sensors:

Introduction - Types of sensors in robots - Exteroceptors or external sensors - Tactile sensors - Proximity sensors - Machine vision sensors - Velocity sensors. Robot and Effectors: Introduction - End effector - classification of end effectors - Tools - Types of tools - Characteristics of End-of-Arm tooling - Elements of End-of-Arm tooling.
[Book 2: Chapters: 14,15]

Unit V: Robot Programming:

Introduction - Robot programming - Robot programming techniques - Task level programming - Motion Programming - Overview of robot programming languages - Robot languages - Types of robot languages. Applications of Robots: Introduction - Robot capabilities - Applications of robots - Manufacturing applications. Robots using real time embedded systems: Introduction - Robotic arm - Actuation - Sensing - Tasking - Automation and Autonomy.
[Book 2: Chapters: 16,17,18]

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-III (Chapters 1,2,3,4,6,8)	Introduction to Robotics - Mechanics and Control	John J.Craig	Pearson Education Inc, 2005
IV,V (Chapters 14,15,16,17,18)	Industrial Automation and Robotics	A.K.Gupta, S.K.Arora, J.R.Westcott	Mercury Learning and Information, 2017

Book for Reference:

S.No	Name of the Book	Author	Publishers with Edition
1	Fundamental of Robotic Mechanical Systems - Robots Robotics	Jorge Angeles	Mechanical Engineering Series , Springer 2005

E-Resources : (Web resources & E-books)

1. [https://www.pdfdrive.com/Fundamentals of Robotic Mechanical Systems - robots robotics \(PDFDrive \).pdf](https://www.pdfdrive.com/Fundamentals_of_Robotic_Mechanical_Systems_-_robots_robotics_(PDFDrive).pdf)
2. [https://www.pdfdrive.com/Fundamentals of Robot Technology An Introduction to Industrial Robots, Teleoperators and Robot Vehicles \(PDFDrive \).pdf](https://www.pdfdrive.com/Fundamentals_of_Robot_Technology_An_Introduction_to_Industrial_Robots,_Teleoperators_and_Robot_Vehicles_(PDFDrive).pdf)

Entrepreneurship Courses

**M.Sc Computer Science
Semester I**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Core IV - Object Oriented Analysis and Design with UML	Course Code : 21MS04
Semester : I	No. of Credits : 5
No. of Hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: The Object Model:	(13 hrs)
The Evolution of the Object Model - Foundations of the Object Model - Elements of the Object Model - Applying the Object Model.	

[Chapter: 2]

Unit II: Classes and Objects:

(12 hrs)

The Nature of an Object - Relationships among Objects - The Nature of a Class. **Classification:** Identifying Classes and Objects - Key Abstraction and Mechanisms.

[Chapters: 3,4]

Unit III: Notation:

(14 hrs)

The Unified Modeling Language: A Brief Historical Perspective - Models and Multiple Views - Diagram Taxonomy - The use of diagrams in Practice - Conceptual, Logical and Physical Models - Package Diagrams - Component Diagrams: The Component Notation - Component Diagram - Component Interfaces - Deployment Diagrams - Use Case Diagrams - Activity Diagrams - Class Diagrams: The Class Notation - Class Relationships - Template Classes - Visibility - Sequence Diagrams: Objects and Interactions - Lifelines and Messages - Destruction Events - Execution Specification.

[Chapter: 5]

Unit IV: Process:

(13 hrs)

The Macro Process: The Software Development Lifecycle: Overview - The Macro Process Content Dimensions-Disciplines - Macro Process Time Dimensions-Milestones and Phases - Iterations - Release Planning - The Micro Process: The Analysis and Design Process: Overview - Levels of Abstraction - Activities - Products - The Micro Process and Levels of Abstraction - Identifying Elements - Defining Element Collaborations - Defining Element Relationships - Detailing Element Semantics.

[Chapter: 6]

***Unit V:Pragmatics**

(13 hrs)

Management and Planning - Staffing - Release Management - Reuse - Quality Assurance and Metrics - Documentation. **Applications: Control System: Traffic Management:** Inception - Elaboration - Construction.

[Chapter: 7,9]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 2,3,4,5,6,7,9)	Object Oriented Analysis And Design With Applications	Grady Booch, RoberetA.Maksimchuk Michael W.Engle, Bobbi J.Young, Jim Conallen, Kelli A.Houston	Pearson Education, Eighth Impression, Third Edition, 2013.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Object Oriented Systems Development	Ali Bahrami	Tata McGraw-Hill Edition, 2011
2.	UML Distilled - A Brief Guide To The Standard Object Modeling Language	Martin Fowler	Pearson Education, Third Edition, 2013

E-Resources: (Web Resources & E-books)

1. https://www.tutorialspoint.com/object_oriented_analysis_design/ood_tutorial.pdf
2. <https://www.startertutorials.com/uml/category/ood>

M.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Core Practical II - Advanced Python Programming	Course Code : 21MSP2
Semester : II	No. of Credits : 3
No. of Hours : 45	P:D : 38:7
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical D:Demo)

Syllabus:

List of Programs:	(38 hrs)
<ol style="list-style-type: none"> 1. Write a Python Program using i) Tuples and ii) Dictionaries. 2. Create a Python Program for Filtering Arrays using Numpy Library: <ol style="list-style-type: none"> a) Create a filter array that will return only values higher than 50. b) Create a filter array that will return only even elements from the original array. 3. Create a Python Program to Perform set operations for intersection, union and difference using Numpy. 4. Create a Python Program to generate triangulations through <code>Delauunay()</code> Triangulation using Scipy. 5. Create a Python Program to Perform Iris Classification Using Pandas. 6. Create a Python Program to display the scatter plot with the training set using matplotlib. 7. Create a Python Program to draw bar graphs with the training set in matplotlib. 8. Create a Program to show the Temperature Graph using <code>plot()</code> Function in matplotlib. 9. Create a Program to shade regions between two curves using <code>fill_between()</code> function. 10. Create a Machine Learning Program for Fitting Simple Linear Regression to the Training Set. 11. Write a program to demonstrate the working of the decision tree using an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 12. Create a Program to Simulate elliptical orbits and Bouncing ball in Pygame. 	

Mapping of Course outcome with POs& PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	Bloom's Taxonomy level
CO 1	H	H	M	M	M	M	M	M	A
CO 2	M	H	M	H	M	H	H	M	A
CO 3	H	H	M	H	H	H	H	M	An

Correlation Level: H - High, M- Moderate, L-Low

M.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core Practical III- R Programming	Course Code : 21MSP3
Semester : II	No. of Credits : 2
No. of hours : 30	P:D : 27:3
CIA Max. Marks: 50	ESE Max. Marks: 50

(P: Practical, D: Demo)

Syllabus:

List of Programs:	(27 hrs)
<ol style="list-style-type: none"> 1. Write a R program to Read and Write Different types of Data sets. 	

2. Write a R Program to Read Excel data sheet in R.
3. Write a R Program to take input from the User and display the values and also print the version of R installation.
4. Write a R Program to perform the Association Rules.
5. Write a R Program to perform K - Means Clustering.
6. Write a R Program to perform Hierarchical Clustering.
7. Write a R Program to implement Decision tree.
8. Write a R Program for performing Classification.
9. Write a R Program to apply Linear regression.
10. Write a R Program for Data Visualization.

M.Sc Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course: Elective II - Network Security and Cryptography	Course Code : 21MSE4
Semester : II	No. of Credits : 5
No. of Hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Classical Encryption Techniques	(15 hrs)
<p>Classical Encryption Techniques: Symmetric Cipher Model - Substitution Techniques: Caesar Cipher - Monoalphabetic Ciphers - Playfair Cipher - Hill Cipher - Polyalphabetic Ciphers - one-Time Pad-Transposition Techniques-Rotor Machines - Steganography. Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure: Stream Ciphers and Block Ciphers - Motivation for the Feistel Cipher Structure- The Feistel Cipher - The Data Encryption Standard -DES Encryption-DES Decryption- A DES Example-The Strength of DES-Block Cipher Design Principles. [Chapters: 1, 2]</p>	
Unit II: Advanced Encryption Standard	(15 hrs)
<p>Advanced Encryption Standard: AES Structure - AES Transformation Functions-AES Key Expansion-An AES Example-AES Implementation- Block Cipher Operation: Multiple Encryption and Triple DES - Electronic Code Book - Cipher Block Chaining Mode - Cipher Feedback Mode - Output Feedback Mode - Counter Mode-Pseudorandom Number Generation and Stream Ciphers: Principles of Pseudorandom Number Generation-Pseudorandom Number Generation-Pseudorandom number Generator-PNG using a Block Cipher-Stream Cipher. [Chapters: 4, 5,6]</p>	
* Unit III: Public-Key Cryptography	(15 hrs)
<p>Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems - The RSA Algorithm- Other Public Key Cryptosystems: Diffie-Hellman Key Exchange-Elgamal Cryptographic System-Elliptic Curve Arithmetic-Elliptic Curve Cryptography-PRNG Based on an Asymmetric Cipher-Cryptographic Hash Functions: Application of Cryptographic Hash Functions-Two Simple Hash Functions-Requirements and Security-Hash Functions Based on Cipher Block Chaining-Secure Hash Algorithm(SHA). [Chapters: 8,9,10]</p>	
Unit IV: Message Authentication Codes	(15 hrs)

Message Authentication Codes: Message Authentication Requirements - Message Authentication Functions - Requirements for Message Authentication Codes -Security of MACs- MACs Based on Hash Functions: HMAC - MACs Based on Block Ciphers: DAA and CMAC. Digital Signatures: Digital Signatures -Elgamal Digital Signature Scheme-Schnorr Digital Signature Scheme-**Elliptic Curve Digital Signature Algorithm-Key Management And Distribution:** Symmetric Key Distribution Using Symmetric Encryption- Symmetric Key Distribution Using Asymmetric Encryption-Distribution of Public keys-X.509 Certificates-Public key infrastructures.
[Chapters:11, 12,13]

Unit V: User Authentication (15 hrs)

User Authentication: Remote User-Authentication Principles - Remote User-Authentication Using Symmetric Encryption - Personal Identity Verification. Transport-Level Security: Transport Level Security -Web security considerations-SSL-Transport Layer Security- HTTPS-Secure Shell (SSH). **Wireless Network Security:** Wireless Security - Mobile Device Security. IP Security: IP Security Overview - IP Security Policy-Internet Key Exchange-Cryptographic Suites.
[Chapters: 15, 16, 18]

*Starred unit is a self study unit.

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,4,5,6,8,9,10,11,12, 13,15,16,18)	Cryptography and Network Security - Principles and Practice	William Stallings	Pearson Education, Sixth Edition, 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Cryptography and Network Security	Atul Kahate	Tata McGraw Hill Education, Fourth Edition, 2013.
2.	Cryptography and Network Security	Behrouz A. Forouzan	Tata McGraw Hill Education, 2016.
3.	Network Security and Management	Brijendra Singh,	PHI Learning Private Ltd,3e,2015

E-Resources : (Web resources & E-books)

1. http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

**M.Sc Computer Science
Semester III**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core Practical V - Android Programming	Course Code : 21MSP5
Semester : III	No. of Credits : 2
No. of Hours : 30	P:D : 27:03
CIA Max. Marks: 40	ESE Max. Marks: 60

(P: Practical, D: Demo)

Syllabus:

List of Programs: (27 hrs)

1. Develop an application that uses GUI components, Font and Colors.
2. Program to demonstrate the sound button application and a video view.
3. Program to create multiple activities within an application.

4. Develop an application using database.
5. Create an application that implements Multi-threading.
6. Develop a native application that uses GPS location information.
7. Program to demonstrate Reading and writing to a file.
8. Implement an application that creates an alert upon receiving a message.
9. Design a mobile application that creates alarm clock.
10. Develop a native calculator application.

Skill Development Courses

M.Sc Computer Science Semester I

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core I - Advanced Operating System	Course Code : 21MS01
Semester : I	No. of Credits : 4
No. of hours : 75	C:T : 65:10
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Fundamentals Of Operating Systems	(13 hrs)
What Operating Systems Do - Computer-System Organization - Computer-System Architecture - Operating-System Operations - Resource Management - Security and Protection - Virtualization - Distributed Systems - Kernel Data Structures - Computing Environments - Free and Open-Source systems. [Book 1: Chapter: 1]	
Unit II: LINUX bash Shell Commands	(12 hrs)
Starting the Shell - Using the Shell Prompt - Interacting with the bash Manual - Navigating the Filesystem - Listing Files and Directories - Handling Files - Managing Directories - Viewing File Contents. More bash Shell Commands: Monitoring Programs - Monitoring Disk Space - Working with Data Files. [Book 2: Chapter: 5,6]	
Unit III: LINUX File Systems:	(14 hrs)
Linux Security - Using Linux Groups - Decoding File Permissions - Changing Security Settings - Sharing Files. Exploring Linux File Systems - Understanding the basic Linux file systems - Understanding journaling File Systems - Understanding the copy-on-write filesystems - Working with File Systems - Managing Logical Volumes. [Book 2: Chapters: 7, 8]	
*Unit IV: Virtual Memory	(13 hrs)
Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table - Swapping . Virtual Memory: Background - Demand Paging - Copy-on-Write - Page Replacement - Allocation of Frames - Thrashing - Memory Compression. [Book 1: Chapters: 9, 10]	
Unit V: Networks and Distributed Systems	(13 hrs)

Virtual Machines: Benefits and Features - Building Blocks - Types of VMs and Their Implementations - Virtualization and Operating-System Components - Examples - Virtualization Research. **Networks and Distributed Systems:** Advantages of Distributed - Systems - Network Structure - Communication Structure -Network and Distributed Operating Systems - Design Issues in Distributed Systems - Distributed File Systems - DFS Naming and Transparency - Remote File Access - Final Thoughts on Distributed File Systems.

[Book 1: Chapters: 18, 19]

***Starred unit is a self study unit.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,IV,V (Chapters 1,9,10,18,19)	Operating systems	Abraham Silberschatz, Peter Baer Galvin And Greg Gagne	Wiley Publications & 10 Edition, 2018.
II-III (Chapters 5,6,7,8)	Linux Command Line and Shell Scripting Bible	Richard Blum and Christine Bresnahan	John Wiley & Sons, Reprint 2016.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Modern Operating Systems	Andrew Tanenbaum, Herbert Bos	Pearson; 4th edition (10 March 2014)
2.	Operating Systems: Internals and Design Principles	William Stallings	Pearson Publications, 8th Edition, 2015

E-Resources: (Web Resources & E-books)

- <https://www.cse.iitb.ac.in/>
- <https://dampeeiitb.wordpress.com/2020/01/04/cs-347-operating-systems/>

M.Sc Computer Science Semester I

(For the students admitted from the academic year 2021 - 2022 onwards)

Course	: Core III - Data Mining and Warehousing	Course Code	: 21MS03
Semester	: I	No. of Credits	: 4
No. of Hours	: 75	C:T	: 65:10
CIA Max. Marks:	50	ESE Max. Marks:	50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Introduction to Data Mining: (13 hrs)

Introduction to Data Mining - Need of Data Mining - What can Data Mining Do and Not Do? - Data Mining Applications - Data Mining Process - Data Mining Techniques - Difference between Data Mining and Machine Learning. **Beginning with Weka and R Language:** About Weka-Installing Weka - Understanding Fisher's Iris Flower Dataset - Preparing the Dataset - Understanding ARFF (Attribute Relation File Format) - Working with a Dataset in Weka - Introduction to R - Variable Assignment and Output Printing in R - Data Types - Basic Operators in R - Installing Packages - Loading of Data. **Data Preprocessing:** Need for Data Preprocessing - Data Preprocessing Methods. [Chapter: 2,3,4]

Unit II: Classification:

(13 hrs)

Introduction to Classification - Types of Classification - Introduction to the Decision Tree Classifier: Building Decision Tree - Concept of information theory - Defining information in terms of probability - information gain - Building a decision tree for the example dataset-Naïve Bayes Method - Understanding Metrics to Assess the Quality of Classifiers. **Implementing Classification in Weka and R:**Building a Decision Tree Classifier in Weka - Applying Naïve Bayes - Decision Tree Operation with R - Naïve Bayes Operation using R.

[Chapters: 5,6]

Unit III: Cluster Analysis:

(13 hrs)

Introduction to Cluster Analysis-Applications of Cluster Analysis - Desired Features of Clustering - Distance Metrics - Major Clustering Methods/Algorithms - Partitioning Clustering. **Implementing Clustering with Weka and R:** Introduction - Clustering Fisher's Iris Dataset with the Simple k-Means Algorithm - Handling Missing Values - Results Analysis after Applying Clustering - Classification of Unlabeled Data - Clustering in R using Simple k-Means.

[Chapters: 7,8]

Unit IV: Association Mining:

(13 hrs)

Introduction to Association Rule Mining - Defining Association Rule Mining - Representations of Items for Association Mining - The Metrics to Evaluate the Strength of Association Rules - The Naïve Algorithm for Finding Association Rules - The Apriori Algorithm. **Implementing Association Mining with Weka and R:** Association Mining with Weka- Applying the Apriori Algorithm in Weka - Applying the Apriori Algorithm in Weka on a Real World Dataset - Applying Association Mining in R - Implementing Apriori Algorithm - Generation of Rules Similar to Classifier.

[Chapters: 9,10]

***Unit V: Data Warehouse:**

(13 hrs)

The Need for an Operational Data Store (ODS) - Operational Data Store - Data Warehouse - Data Marts - Comparative Study of Data Warehouse with OLTP and ODS. **Data Warehouse Schema:** Introduction to Data Warehouse Schema - Star Schema - Snowflake Schema - Fact Constellation Schema (Galaxy Schema) - Comparison among Star, Snowflake and Fact Constellation Schema. **Online Analytical Processing:** Introduction to Online Analytical Processing - Representation of Multi-dimensional Data - Implementing Multi-dimensional View of Data in Oracle - Improving efficiency of OLAP by pre-computing the queries - Types of OLAP Servers - OLAP Operations.

[Chapters: 12, 13, 14]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 2,3,4,5,6,7,8,9, 10,12,13,14)	Data Mining and Data Warehousing Principles and Practical Techniques	Parteek Bhatia	Cambridge University Press, 2019. (ebook)

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Data Mining concepts and Techniques	Jiawei Han, MichelineKamberandJian Pei	Third Edition, 2012, by Elsevier Inc
2.	Data Mining For Business Analytics Concepts, Techniques and Applications in R.	GalitShmueli, Peter C. Bruce, InbalYahav, Nitin R. Patel, Kenneth C. Lichtendahl.	John Wiley & Sons, Inc,2018 (ebook)

3.	Data Warehousing in the Real World A Practical Guide for Building Decision Support System	Sam Anahory, Dennis Murray	Pearson Education Ltd, 20011.
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E-Resources: (Web Resources & E-books)

1. <https://www.javatpoint.com/data-mining>
2. https://www.tutorialspoint.com/dwh/dwh_overview.htm

**M.Sc Computer Science
Semester I**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Elective I - Parallel Processing	Course Code : 21MSE2
Semester : I	No. of Credits : 5
No. of hours : 90	C:T : 75:15
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I: Genesis of Parallel Computing:	(15 hrs)
Processor Basics: Processor - Aspects of Processor Performance - Enhancing Uniprocessor Performance - Distributed Systems Basics: Distributed Systems - Distributed System Benefits - Distributed Computation Systems - Processor Physics and Moore's Law: Speed of Processing and Power Problem - Area, Delay and Power Consumption - Area, Latency and Power Trade - offs - Moore's Law - Performance Wall. [Chapters: 3,5,2]	

Unit II: Road to Parallel Computing:	(15 hrs)
Parallel Systems: Flynn's Taxonomy for Parallel Computer Architectures - Types of Parallel Computers- Characteristics of Parallel Systems - Parallel Computing Models: Shared memory models - Interconnection Network Models - Dataflow Model - Parallel Algorithms: Classes of Problems Solvable through Parallelization - Types of Parallelization - Granularity of Parallelization - Assigning Computational Tasks to Processors - Illustrating Design of a Parallel Algorithm - Parallel Algorithms for Conventional Computations - Parallel Algorithms for Unconventional Computations. [Chapters: 6,7,8]	

Unit III: Parallel Computing Architectures:	(15 hrs)
Parallel Computing Architecture Basics: High - Performance Distributed Computing - Performance Evaluation - Application Architecture - Maximum Performance Computing Approach - Parallel Computing Basics - Parallel Computing Paradigms - Shared Memory Architecture: Shared Memory Paradigm - Cache - Write Policy - Cache Coherence -Memory Consistency - Message Passing Architecture: Message Passing Paradigm - Routing - Switching. [Chapters: 9,10,11]	

*Unit IV: Stream Processing Architecture:	(15 hrs)
Data Flow Paradigm - Parallel Accelerators - Stream Processors - Parallel Computing Programming Basics: Shared Memory programming - Message Passing Programming - Stream Programming. Case Study: Appendix: Functional Programming - Hadoop MapReduce. [Chapters: 12,13]	

Unit V: Shared Memory Programming with OpenMP:	(15 hrs)
OpenMP - Overview of Features - Additional Feature Details - Message Passing Parallel Programming with MPI: Introduction to MPI - Basic Point-to-Point Communication Routines - Basic	

MPI Collective Communication Routines - Environment Management Routines - Point-to-Point Communication Routines - Collective Communication Routines - **Stream Processing Program with CUDA, OpenCL and OpenACC**: CUDA - OpenCL - OpenACC.
[Chapters: 14,15,16]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-V (Chapters: 2,3,5,6,7,8,9,10,11,12, 13,14,15,16)	Parallel Computing Architectures and APIs	Vivek Kale	CRC Press, Taylor & Francis Group, 2020

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Parallel Computing	Roman Trobec, Bostjan Slivnik, Patricio Bulic, Borut Robic	Springer Nature Switzerland AG, 2018
2.	Parallel Programming with Intel Parallel Studio XE	Stephen Blair-Chappell and Andrew Stokes	Springer - VerlagNewYork, Inc, 2012

E-Resources : (Web resources & E-books)

1. <http://www.sop.inria.fr/oasis/Denis/ProgRpt/COURS/IntroductionToParallelProgramming.pdf>
2. <http://juser.fz-juelich.de/record/60553/files/NIC225296.pdf>

M.Sc. Computer Science Semester II

(For the students admitted from the academic year 2021 - 2022 onwards)

Course	: Core V - Research Methodologies	Course Code	: 21MS05
Semester	: II	No. of Credits	: 4
No. of hours	: 60	C:T	: 52:8
CIA Max. Marks: 50		ESE Max. Marks: 50	

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I : Research: A Way of Thinking:	(10 hrs)
Research: a way to gather evidence for your practice - Applications of research - Research: what does it mean? - The research process: characteristics and requirements - Types of research - Paradigms of research. The Research Process : A Quick Glance : The research process: an eight-step model - Phase I: deciding what to research - Phase II: Planning A Research Study - Phase III: Conducting A Research Study. Reviewing the Literature : The place of the literature review in research - How to review the literature - How to review the literature. [Chapters : 1, 2, 3]	

Unit II : Formulating a Research problem :	(10 hrs)
The research problem - The importance of formulating a research problem - Sources of research problems - Considerations in selecting a research problem - Steps in formulating a research problem - The formulation of research objectives - Formulating a research problem in qualitative research.	

Identifying Variables : What is a variable? - The difference between a concept and a variable - Converting concepts into variables - Types of variable - Types of measurement scale
Constructing Hypotheses : The definition of a hypothesis - The functions of a hypothesis - The testing of a hypothesis - The characteristics of a hypothesis - Types of hypothesis - Errors in testing a hypothesis - Hypotheses in qualitative research.
 [Chapters : 4, 5, 6]

Unit III : The Research Design : (11 hrs)

What is a research design? - The functions of a research design - The theory of causality and the research design.
Selecting a Study Design : Differences between quantitative and qualitative study designs - Study designs in quantitative research - Other designs commonly used in quantitative research - Study designs in qualitative research - Other commonly used philosophy-guided designs.
Selecting a Method of Data Collection : Differences in the methods of data collection in quantitative and qualitative research - Major approaches to information gathering - Collecting data using primary sources - Methods of data collection in qualitative research - Collecting data using secondary sources
 [Chapters : 7, 8, 9]

***Unit IV : Selecting a Sample:** (10 hrs)

The differences between sampling in quantitative and qualitative research - Sampling in quantitative research - Sampling in qualitative research.
How to Write a Research Proposal : The research proposal in quantitative and qualitative research - Contents of a research proposal - Work schedule.
Considering Ethical Issues in Data Collection : Ethics: the concept - Stakeholders in research - Ethical issues to consider concerning research participants - Ethical issues to consider relating to the researcher - Ethical issues regarding the sponsoring organization.
 [Chapters : 12, 13, 14]

Unit V : Processing Data : (11 hrs)

Steps in data processing - Data processing - Editing - Coding.
Displaying Data: Methods of communicating and displaying analysed data.
Writing a research report : Writing a research report - Developing an outline - Writing about a variable - Referencing - Writing a bibliography.
Research Methodology and Practice Evaluation : What is evaluation? - Why evaluation? - Intervention-development-evaluation process - Perspectives in the classification of evaluation studies - Types of evaluation from a focus perspective - Types of evaluation from a philosophical perspective - Undertaking an evaluation: The process.
 [Chapters : 15, 16, 17, 18]

***Starred unit is a self study unit.**

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V (Chapters 1,2,3,4,5,6,7,8,9,12,13, 14,15,16,17,18)	Research Methodology a step-by-step guide for beginners	Ranjit Kumar	3 rd Edition, SAGE Publications India Pvt Ltd, 2015.

Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Introduction to Research Methodology	Dr Imre Boncz	University of Pecs, 2015 Edition.

2	Research Methodology Methods and Techniques	C R Kothari	New Age International Private Limited Publishers, 2016.
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E-Resources : (Web resources & E-books)

1. https://www.researchgate.net/publication/319207471_HANDBOOK_OF_RESEARCH_METHODODOLOGY
2. https://www.researchgate.net/publication/303381524_Fundamentals_of_research_methodology_and_data_collection

**M.Sc Computer Science
Semester II**

(For the students admitted from the academic year 2021 - 2022 onwards)

Course : Core VIII - Design and Analysis of Algorithms	Course Code : 21MS08
Semester : II	No. of Credits : 4
No. of hours : 60	C:T : 52:8
CIA Max. Marks: 50	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

Syllabus:

Unit I:Introduction:	(11 hrs)
What is an Algorithm? - Fundamentals of Algorithmic Problem solving - Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework -Asymptotic Notations and Basic Efficiency Classes [Book 1: Chapter:1,2]	
Unit II: Selection sort and Bubble sort:	(10 hrs)
Selection sort and Bubble sort -Sequential Search and Brute force String matching - Exhaustive search -Depth first and Breadth first search. [Book 1:Chapter: 3]	
*Unit III:Merge sort:	(10 hrs)
Merge sort - Quick sort - Binary tree Traversals and related properties.- Balanced Search trees - Heaps and Heap sort. [Book 1:Chapter: 6]	
Unit IV:Three basic examples:	(10 hrs)
Three basic examples -Warshall's and Floyd's Algorithms. Prim's Algorithm - Kruskal's Algorithm - Dijkstra's Algorithm [Book 2: Chapter:8,9]	
Unit V:String Matching and Finger printing:	(11 hrs)
String Matching and Finger printing - Path problems: Bellman-Ford SSSPalgorithm- All Pair shortest paths Algorithm. Basic Graph Algorithms -Basic Geometric Algorithms. [Book 2:Chapter: 8, 10,14]	

***Starred unit is a self study unit.**

Books for Study:

Unit	Name of the Book	Authors	Publishers with Edition
I - IV (Chapters)	Introduction to the Design and Analysis of Algorithms	AnanyLevitin	Pearson India Education Services,2017

1,2,3,6,8,9)			
V (Chapters 8,10,14)	Design and Analysis of Algorithms - A Contemporary Perspective	Sandeep Sen, Amit Kumar	Cambridge University,2019

Book for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1.	Design & Analysis of Algorithms	Mrs.Anuradha A Puntambekar	Technical Publications.

E-Resources : (Web resources & E-books)

1. https://www.google.co.in/books/edition/DESIGN_AND_ANALYSIS_OF_ALGORIT_HMS/WUcBD81gtJMC?hl=en&gbpv=1&dq=Ebook+for+DAA&printsec=frontcover