Annexure B

Parvatibai Chowgule College of Arts and Science
(Autonomous)
Accredited by NAAC with Grade 'A+'
Best Affiliated College-Goa University Silver Jubilee Year Award

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE <u>HONOURS</u>

PROGRAMME IN B.Sc. COMPUTER SCIENCE
(Implemented from the Academic Year 2023-2024 onwards)

COURSE STRUCTURE

SEMSTER	MAJOR CORE	MINOR/ VOCATIONAL	MULTI-DISCIPLINARY COURSE (MDC)	VALUE ADDED COURSES (VAC)	SKILL ENHANCEMENT COURSE (SEC)	INTERNSHIP
I	UG-COM-101: Introduction to Programming	UG-COM-101: Introduction to Programming	UG-COM-MDC1: Office Automation UG-COM-MDC2: Introduction to Python Programming	UG-COM-VAC1: Cyber Security	UG-COM-SEC1: Programming with R	
II	UG-COM-102: Database Management Systems	UG-COM-102: Database Management Systems	UG-COM-MDC2: Introduction to Python Programming	UG-COM-VAC1: Cyber Security	UG-COM-SEC2: Programming In Python	

			UG-COM-MDC3: Introduction to R Programming			
III	**UG-COM-201:** Data Structures	**UG-COM-201:** Data Structures	**UG-COM-MDC4:** Fundamentals of Data Science		**UG-COM-SEC3:** UI/UX Design	
	UG-COM-202: Object Oriented Programming					
IV	**UG-COM-203:** Computer Architecture	**UG-COM-VOC-1:** Web Design				
	UG-COM-204: Operating System					
	UG-COM-205: Mobile Application Development					
	UG-COM-206: Software Engineering					
V	**UG-COM-301:** Full Stack Development	**UG-COM-VOC-2:** Digital Marketing				**UG-COM-INT:** Internship
	UG-COM-302: IOT					
	UG-COM-303: Computer Networks					
VI	**UG-COM-304:**	**UG-COM-VOC-3:**				

	Data Science	Software Testing				
	UG-COM-305 : Cloud Computing					
	UG-COM-306 : AI					
	UG-COM-PRJ Project					
VII	**UG-COM-401 :** Design and Analysis of Algorithms	**UG-COM-405:** Image Processing				
	UG-COM-402 : Software Architecture, Design Patterns and Frameworks					
	UG-COM-403 : Advanced DBMS					
	UG-COM-404 : Machine Learning					
VIII	**UG-COM-406 :** Compiler Design	**UG-COM-410:** Network Security				
	UG-COM-407 : Deep Learning					
	UG-COM-408 : NLP					
	UG-COM-409 : Educational Technology					

* Implementation of fourth year (semester VII & VIII) is subject to approval from DHE

SEMESTER I

DISCIPLINE SPECIFIC CORE COURSE

Course Title: Introduction to Programming
Course Code: UG-COM-101
Marks: 75
Credits: 3
Duration: 45 Hrs
Prerequisites courses: Nil

Course Objectives :
- ☐ To understand the concept of basic computer algorithm and flowchart and use the algorithm for various problem solving.
- ☐ To implement algorithms using a high level programming language.
- ☐ To understand basic principles of structured programming – example C.

Course Learning Outcome: Upon completion of the course students will be able to:

CLO1: Explain problem solving strategies.
CLO2: Draw a flowchart for a given problem.
CLO3: Write an algorithm for a given problem.
CLO4: Explain and Apply sorting and searching algorithms.
CLO5: Recognize and incorporate programming elements such as loops, decision making, functions, arrays, strings.
CLO6: Recognize and incorporate programming elements such as structures, pointers and files into applications that solve real world problems.

SYLLABUS

UNIT I [10 HRS]

Introduction to Computer Problem Solving: Algorithm, Flowchart, The Problem-Solving Aspect, General problem-solving strategies, Top-Down Design, Implementation of Algorithms, Efficiency of Algorithms, Recursive algorithms.

Basic Algorithms: Exchanging the values, Summation of a set of numbers, factorial computation, generation of the Fibonacci series, reversing the digits of an integer, base conversion.

Factoring Methods: Finding divisors of an integer, finding the Greatest Common Divisor of two integers, generating prime numbers, computing prime factors of an integers.

Sorting and Searching: Bubble sort, Insertion Sort, Sequential Search and Binary Search

UNIT II   [20 HRS]

C Language: History, Structure of a C program, Keywords, Identifiers, variables, constants, data types, Arithmetic Operators & Expressions, Logical operators and Relational Operators, Precedence and Associativity rules.

Conditions and Iterations: Conditions and Actions, Condition statement, Simple control statement (if, if-else,switch), Iterative control statements (for, while, do-while).

Functions: What is a function, Advantages of functions, Standard library functions; User define functions – declaration, definition, function call, parameter passing, return keyword. Scope of variables, Storage classes, Recursion.

Arrays: One- and Two-dimensional arrays: Array declaration, initialization, accessing the values, passing arrays to functions.

Pointers: Pointer declaration, initialization, Pointer arithmetic, Pointer to Pointer, Arrays and Pointers, Functions and Pointers – passing pointers to functions, function returning pointer, dynamic memory allocation.

UNIT III   [15 HRS]

Strings: Declaration and initialization, standard library string functions, strings and pointers, array of strings.

Structure and Union: Creating structures, accessing structure members, array of structures, passing structure to functions, nested structure, pointers and structures, union, difference between structures and unions.

File Handling: FILE variable, file access modes, operations on files, random access to files, command line arguments.

Pre-processing: Format of Preprocessor directive, File Inclusion directive, Macro substitution, conditional compilation.

REFERENCES:

MANDATORY:
1. Dromey, R. G. (1982). How to Solve it by Computer. Prentice-Hall, Inc..
2. Kanetkar,Y. (2012). Let us C, BPB Publications,
3. Forouzan, B. A., & Gilberg, R. F. (2000). Computer Science: A structured programming approach

using C. Brooks/Cole Publishing Company..

SUPPLEMENTARY:
1. Horowith,E.,Sahni ,S.,Sanguthevar,R. (2008). Fundamentals of Computer algorithm, Orient Longman.
2. Gottfried,B. (2010). Programming with C, Tata McGraw Hill.

WED BASED:
1. GNU GCC (GNU Compiler Collection) @http://gcc.gnu.org, with source codes.
2. Bjarne Stroustrup's C++11 FAQ @http://www.stroustrup.com/C++11FAQ.html.
3. https://www.tutorialspoint.com/cprogramming
4. https://www.javatpoint.com/c-programming-language-tutorial
5. https://www.w3schools.in/c-tutorial/
6. https://www.guru99.com/c-programming-tutorial.html
7. https://www.geeksforgeeks.org/c-programming-language/
8. E Book - https://www.edutechlearners.com/download/books/Let%20Us%20C%20by%20Yashavant%20Kanetkar%20PDF.pdf
9. E Book - http://www2.cs.uregina.ca/~hilder/cs833/Other%20Reference%20Materials/The%20C%20Programming%20Language.pdf
10. E Book - http://www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf

Practical: Introduction to Programming
Credit: 1
Marks: 25
Duration: 30 Hrs

Programs using C language that covers the following concepts:
1. Conditions
   ● if..else
   ● nested if

2. Iterative Control Statements
   ● for
   ● while
   ● do…while

3. Functions.
   ● Standard Library functions
   ● Call by Value
   ● Call by reference
   ● Recursive functions

4. Arrays.
   ● One Dimensional Arrays
   ● Two Dimensional Arrays

5. Sorting
   ● Bubble sort
   ● Insertion sort

6. Searching.
   ● Sequential search
   ● Binary search

7. Pointers.
● Arrays and Pointers
● Function returning pointers
● Dynamic memory allocation

8. Strings.
● Standard Library string functions
● Strings and Pointers
● Array of Strings

9. Structure and Union
● Array of structures
● Passing Structure to functions
● Nested structure
● Structure and Pointer
● Union

10. File Handling.
● Text file
● Binary file
● Random Access to a file
● Command Line arguments

MULTIDISCIPLINARY COURSES (MDC)

Following are the list of MDCs*:

Course Title: Office Automation
Course Code: UG-COM-MDC1

Course Title: Introduction to Python Programming
Course Code: UG-COM-MDC2

Course Title: E-Learning
Course Code: UG-COM-MDC3

Course Title: Introduction to R Programming
Course Code: UG-COM-MDC4

Course Title: Multimedia
Course Code: UG-COM-MDC5

* The syllabus of all the five courses have been approved by BOS. However, for semester I and II, minimum two MDCS will be offered.

Course Title: Office Automation
Course Code : UG-COM-MDC1
Marks: 50
Credits: 2
Duration: 30 Hrs

Prerequisites Course:
Nil

Course Objectives:
- To explore the features of a few automation tools used in office work.

- Study and implement the features of spreadsheets, and Image/Graphic design tools.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Understand basic Spreadsheet features.
CLO2: Work with different worksheets.
CLO3: Analyze the data using various graphs.
CLO4: Analyze data using various spreadsheet features such as lookup tables, Pivot tables, and other statistical features.

CLO5: Use different features of DTP software.
CLO6: Develop a desktop Publishing Application using given software.

SYLLABUS

UNIT I
Spreadsheets: [**8 HRS**]
Spread Sheet & its Applications, Spreadsheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. Entering & Deleting Data- Entering data filling. Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Data from external files, Frames, Clipart, Pictures, Files etc, Inserting Functions, Manual breaks, Setting Formula - finding total in a column or row.
Mathematical operations: (Addition, Subtraction, Multiplication, Division, Exponentiation), Using other Formulae. Formatting Spreadsheets, Sorting, Filtering, Validation, Consolidation, and Subtotal. Using Tools – Error checking, Spell Checks, Formula Auditing, Creating & Using Templates, Pivot Tables, Tracking Changes, Security, Customization.

Presentation Software and Graphics editor – GIMP   [**10 HRS**]
Introduction & area of use; Creating a New Presentation; Working with Presentation; Using Wizards; Slides & it's different views; Inserting, Deleting and Copying of Slides; Working with Notes, Handouts, Columns & Lists; Adding Graphics, Sounds and Movies to a Slide; Working with Objects; Designing & Presentation of a Slide Show; Printing Presentations, Notes, Handouts with print options.

Graphics editor – GIMP   : Introduction, Introducing the Workspace, Learning all the primary Tools: Working with Layers, Colors, Filters , Dealing with text and Fonts. Basics of Photo editing.

UNIT II
Inkscape: - Vector Graphics design: -   [**12 HRS**]
Introduction: Introduction to Inkscape, Features of Inkscape, Inkscape Interface, learning about Raster and Vector Graphics.
Basic Drawing Skills: Selecting and Manipulating Objects, Drawing and Shaping Objects, Arranging Objects.
Mastering Different Tools: Using Text and Color, layers, groups, align and distribute, transformation tools.
Applying Special Effects: Learning Blending modes, Distortion, Contour Effects on text, Envelope effect, Clip image. tracing image with different modes.
  Saving, Exporting and printing: Different Saving options, exporting your designs into different formats for printing, Creating layouts and finalizing content for printing.

REFERENCES:
MANDATORY:
1.   Mark Moore, (2015), Mastering Excel: Building Dashboards, (1stEd.), CreateSpace Independent Publishing Platform.

2.   Dinesh Maidasani, (2008), Straight to the Point – MS Office 2003, (1stEd.), Firewall Publications.

SUPPLEMENTARY:
1.   Ramesh Bangia, (2017), Learning PageMaker 7, (Ed), Khanna Book Publishing Co Pvt Ltd.

2.   Michael S. Toot, (2017), Master Visually Microsoft Office 2003, (Ed), Visual Publishers.

3.   Mansfield, (2017), Mastering WORD 6 for Windows, (Ed), BPB

4.   Townsend, (2017), Mastering EXCEL 4 for Windows, (Ed), BPB

WEB BASED:
1.   https://www.guru99.com/excel-tutorials.html
2.   https://www.gimp.org
3.   https://www.gimp.org/tutorials
4.   https://www.javatpoint.com/gimp
5.   https://inkscape.org
6.   'https://inkscape.org/learn/tutorials

Practicals: Office Automation
Credit: 01
Marks: 25
Duration: 30 Hours

List of practical :

Spreadsheet and Presentation Software (4P)
Using formulas and functions:
To prepare a Worksheet showing the monthly sales of a company in different branch, offices (Showing Total Sales, Average Sales).Prepare a Statement for preparing Result of 10 students in 5 subjects (using formula to get Distinction, I Class, II Class and Fail under Result column against each student).

Operating on the sheets:
Finding, deleting and adding records, formatting columns, row height, merging, splitting columns etc. Connecting the Worksheets and enter the data.

Creating a Chart:
To create a chart for comparing the monthly sales of a company in different branch offices.

Using the data consolidate command:
1. To use the data consolidate command to calculate the total amount budgeted for all departments (wages, travel and entertainment, office supplies and so on) or to calculate the average amount budgeted for – say, department office expenses.
2. Sorting Data, Filtering Data and creation of Pivot tables.

3. Working on presentation (any open source presentation software such as impress or equivalent).

GIMP and Inkscape (11 P)
1. Introduction to GIMP workspace.

2. Basic Drawing Skills and using the tools of GIMP.

3. Removing the background and water mark of the image using GIMP.

4. Editing the image using GIMP tools.

5. Introduction to Inkscape tools with properties.

6. Designing the posters on different themes - Inkscape

7. Adding special effects

8. Creating a logo (Vector graphics design)

9. Advanced effects

10. Trace image with different modes.

11. Use gradient tool to create realistic images.

Course Title: Introduction to Python Programming
Course Code: UG-COM-MDC2
Marks: 50
Credits: 2
Duration: 30 Hrs
Pre-requisite courses : Nil

Course Objectives :
● To understand the concept of basic computer algorithm and flowchart and use the algorithm for various problem solving.
● To implement algorithms using programming language.
● To provide skills of data analysis using Python programming language.

Course Learning Outcome: Upon completion of the course students will be able to

CLO1: Write an algorithm and draw flowchart for a given problem.
CLO2: Understand the basics (Operations, Control structures, data types,etc).
CLO3: Write programs using conditional statements, loops.
CLO4: Apply required List,Tuple and dictionary function.
CLO5: Write Python program specific to the domain of the given problem.
CLO6: Create applications using python programming.

SYLLABUS

UNIT I   **[15 HRS]**

1. Basics of Python Programming: Features of Python, Applications of Python, writing and executing Python Program.
2. Introduction to Problem Solving Strategies, Program Design tools: Algorithms, flowcharts. Basic Algorithms: Exchanging the values, Summation of a set of numbers, factorial computation, generation of the Fibonacci series, reversing the digits of an integer, base conversion.
3. Basic Syntax: Variable and Data Types, Operator, Conditional Statements - if, if- else, Nested if-else. Looping – For, While, Nested loops. Control Statements – Break, Continue, Pass
4. Strings: Accessing Strings, Basic Operations, String slices, Function and methods.
5. Tuple and Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods. Introduction Accessing tuples, Operations, Working, Functions and Methods.

UNIT II   **[15 HRS]**

1. Dictionaries: Introduction, accessing values in dictionaries, Working with dictionaries, Properties.
2. Functions: Defining a function, Calling a function, Types of functions, Function arguments, Anonymous functions, global and local variables.
3. Module: Importing module. Math module. Random Module.
4. Input-Output: Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions. Printing on screen, reading data from keyboard, Opening and closing file, Reading and writing files, Functions.

REFERENCES:

MANDATORY:
1. Dromey, R. G. (1982). How to Solve it by Computer. Prentice-Hall,
2. Inc.. Mark Lutz, Learning Python, O'Reilly Media, Fifth Edition.

SUPPLEMENTARY:
1. Reema Thareja (2020), Python Programming Using problem solving approach, Oxford Higher Education
2. Horowith ,E.,Sahni ,S.,Sanguthevar,R. (2008). Fundamentals of Computer algorithm, Orient Longman.
3. Alex Martelli, (2006)Python – A Nutshell, O'Reilly Media, Second Edition. Wes McKinney, (2012)Python for Data Analysis, O'Reilly Media.

WEB BASED:
1. https://www.w3schools.com
2. https://www.tutorialspoint.com

3. https://www.javatpoint.com
4. https://www.geeksforgeeks.org
5. https://www.guru99.com

Practicals: Introduction to Python Programming
Credit: 01
Marks: 25
Duration:30 Hrs

List of Experiments using Python Language:

1. Write a python program to compute a given formula. [1P]
2. Write a python program to implement an if else statement. [1P]
3. Write a python program to implement nested if else statements. [1P]
4. Implement for and while loop in python. [2P]
5. Write a string manipulation in python. [2P]
6. Write a program to implement lists in python. [2P]
7. Write a python program to implement tuple. [1P]
8. Write a python program to implement a dictionary. [2P]
9. Write python program to implement function [1P]
10. Write a python program to implement Input-Output File Operations in python. [2P]

Course Title: E-Learning
Course Code: UG-COM-MDC3
Marks: 50
Credits: 2
Duration: 30 Hrs

Pre-requisite courses : Nil

Course Objectives:
1. To understand the basic concept of ICT (Information Communications Technology) in education.
2. To understand the basic concept of Instructional Design principles.
3. To develop E-content in various application areas related to ICT and Education.

Course Learning Outcomes:
On completion of this course the student will be able to:
CLO1: Explain the working of an E-learning module.
CLO2: Develop E-Content using the Instructional Design Process and upload on LMS.
CLO3: Evaluate and apply appropriate E-Learning Strategy to a given topic.
CLO4: Differentiate between Summative and Formative assessment.

SYLLABUS

UNIT I: Introduction and Course Development [15 HRS]

1. Scope and form of E-learning, Role of an E-learning project Phases in E-learning project. Instructional Design: The process of Designing Instruction.
2. Developing Materials (Storyboarding, Content Integration, and SCORM Compliance). Working with L.M.S. (Learning Management System)- Installation and use of the administrator, teacher and student interface; Course Definition, Registration and upload, tracking of results.

UNIT II: E-learning Strategies & Assessment Design [15 HRS]
1. E-Learning Strategies: Simulation, Drill, Interactive Learning, Problem Solving, Tutorials.

2. Assessment: Online formative and summative assessment. Rubrics for Assessment-Analytic and Holistic Rubrics, Security and Authentication.

REFERENCES:

MANDATORY:
Shelly Cashman Gunter.(2011).Teachers Discovering Computers: Integrating Technology in the Classroom,(7th ed.).Wadsworth Publishing Co Inc.

SUPPLEMENTARY:
1. Smith, P. L. & Ragan, T. J.(2008). Instructional design(4rth ed.). New York: John Wiley & Sons. ISBN:0471393533
2. M.D. Roblyer, Aaron H. Doering(2018). Integrating Educational Technology into Teaching: Student Value Edition (8th ed.). Publisher: Pearson ISBN-10: 013289680X, ISBN-13:978- 0132896801.
3. Dick, W., Carey, L., & Carey, J. O.(2014). The systematic design of instruction (8th ed.). Boston

WEB BASED:

1.https://www.udemy.com/course/instructional-design-for-elearning/
2.https://nptel.ac.in/courses/127101013/
3.https://nptel.ac.in/courses/121105010/
4. https://www.plesyoutube.com/watchv=0flnAoX9QEw
5.https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/121106012/lec13.pdf

Practicals: **Elearning**

 Credit : 1
Marks : 25
Duration: 30 Hrs

Suggested list of practical (Numbers in brackets indicate examples of Free Open-Source ICT Tools that are available and the number of practicals)

1. Construct a Mind Map (Free Mind/Mindomo) - (1 P)
2. Create a Storyboard (PPT/Movie Maker/PowToon's/Storyboardthat) -(2 P)
3. Screen Recording S/W(Screencast/OBS/Filmora) - (2 P)
4. Collaborative Tools (G Suite) - (1 P)
5. Creating Blogs-(Blogger/Word Press) - (2 P)
6. Installation, Creation & Running of an LMS- (Moodle/Google Classroom - (1 P) 7. Uploading Resources & Activities in the LMS-(Moodle/ Google Classroom - (2 P)
8.Creating a Complete Course in the LMS- (2 P)
9. Design Rubrics for Scenarios-(Hot Potatoes/Ed puzzle/Poll Everywhere) - (2 P)

Course Title: Introduction to R Programming

Course Code: UG-COM-MDC4
Marks: 50

Credits: 2
Duration:30 Hrs.

Prerequisite Courses : Nil

Course Objectives:
• To make the student understand the fundamentals of R language.
• To implement algorithms using R.
• To connect R with other data sources and perform computation
• To use R for plotting charts and graphs

Course Learning Outcomes:

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

CLO1 : Develop solutions to problems and implement these solutions in R.

CLO2 : Use R with various data sources and perform computation.

CLO3 : Solve mathematical problems using R.

CLO4 : Plot charts and graphs using R.

SYLLABUS

UNIT I   **[15 Hrs]**
Introduction to R:
R console to perform basic arithmetic operations, display strings and workspace variables, R Overview.
R Data Types:
Determining the data type of a variable, boolean, integer, numeric, character, complex and raw. Vectors, Lists, Matrices, Data Frames, Factors and Arrays
R Operators:
Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators Miscellaneous Operators (Colon, %in% and %*%)
Control Flow and Iterations:
The if, if-else, if – else if-else and switch statements, while and for loops, loops for vectors, matrices, data frames and lists. Programs to test understanding of the same.

UNIT II   **[15 Hrs]**
Functions in R:
Writing an R function, Nested Functions, Function Scoping, Recursion, Loading an R package, Mathematical Functions, Cumulative sums and products, Calculus, Input and Output operations, Selection and Bubble sort, Linear and Binary Search.

R Data Interfaces: R and Database Connectivity , creating and dropping tables, inserting data and updating table rows, querying and querying with filters.
R and CSV files – Inputting, Reading, Writing to and Analyzing csv files.
R and Spreadsheets – Reading from, writing to and analyzing spreadsheets
R and XML files – Reading and processing XML files.

Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.

REFERENCES:

MANDATORY:

1. K. G. Srinivasa, G. M. Siddesh et al, Statistical Programming in R, Oxford University Press.

SUPPLEMENTARY:
1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education.
2. Tilman M. Davies,The Book for R, No Starch Press.
3. Emmanuel Paradis, R Programming for Beginners.

WEB BASED:
1.   https://www.tutorialspoint.com/r/index.htm

2. https://www.javatpoint.com/r-tutorial
3. https://www.w3schools.com/r/
4. https://www.programiz.com/r
5. https://intellipaat.com/blog/tutorial/r-programming/

Practicals: Introduction to R Programming
Credit:1
Marks:25
Duration:30 Hrs

1. R-Programming Basics: Installing R Studio, Using R console to perform basic arithmetic operations, display strings and workspace variables. [1P]
2. Data types in R. [1P]
3. Data Structures: Vectors, Lists, Matrices, Data Frames, Factors and Arrays[3P]
4. Operators in R.[1P]
5. Control Flow and Iterations.[3P]
6. Functions in R.[2P]
7. R Data Interfaces: R and Database Connectivity ,creating and dropping tables, inserting data and updating table rows, querying and querying with filters.[2P]
8. Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.[2P]

SKILL ENHANCEMENT COURSE (SEC)

Course Title:Programming with R
Course Code: UG-COM-SEC1
Marks: 50
Credits: 2
Duration: 30 Hrs.
Prerequisite Courses : Nil

Course Objectives:
➢ To make the student understand the fundamentals of R language.
➢ To implement algorithms using R.
➢ To connect R with other data sources and perform computation
➢ To use R for plotting charts and graphs

Course Learning Outcomes:

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

CLO1 : Develop solutions to problems and implement these solutions in R.

CLO2 : Use R with various data sources and perform computation.

CLO3 : Solve mathematical problems using R.

CLO4 : Plot charts and graphs using R.

SYLLABUS

UNIT I   **[15 Hrs]**
Introduction to R:
R console to perform basic arithmetic operations, display strings and workspace variables, R Overview.
R Data Types:
Determining the data type of a variable, boolean, integer, numeric, character, complex and raw. Vectors, Lists, Matrices, Data Frames, Factors and Arrays
R Operators:
Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators Miscellaneous Operators (Colon, %in% and %*%)
Control Flow and Iterations:
The if, if-else, if – else if-else and switch statements, while and for loops, loops for vectors, matrices, data frames and lists. Programs to test understanding of the same.

UNIT II   **[15 Hrs]**

Functions in R:
Writing an R function, Nested Functions, Function Scoping, Recursion, Loading an R package, Mathematical Functions, Cumulative sums and products, Calculus, Input and Output operations, Selection and Bubble sort, Linear and Binary Search.

R Data Interfaces: R and Database Connectivity , creating and dropping tables, inserting data and updating table rows, querying and querying with filters.

R and CSV files – Inputting, Reading, Writing to and Analyzing csv files.

R and Spreadsheets – Reading from, writing to and analyzing spreadsheets

R and XML files – Reading and processing XML files

Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.

REFERENCES:

MANDATORY:

1. K. G. Srinivasa, G. M. Siddesh et al, Statistical Programming in R, Oxford University Press.

SUPPLEMENTARY:
1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education.
2. Tilman M. Davies,The Book for R, No Starch Press.
3. Emmanuel Paradis, R Programming for Beginners.

WEB BASED:
1. https://www.tutorialspoint.com/r/index.htm
2. https://www.javatpoint.com/r-tutorial
3. https://www.w3schools.com/r/
4. https://www.programiz.com/r
5. https://intellipaat.com/blog/tutorial/r-programming/

Practicals: Programming with R
Credit:1
Marks:25
Duration:30 Hrs

1.   R-Programming Basics: Installing R Studio, Using R console to perform basic arithmetic operations, display strings and workspace variables. [1P]
2.   Data types in R. [1P]
3.   Data Structures: Vectors, Lists, Matrices, Data Frames, Factors and Arrays[3P]
4.   Operators in R.[1P]
5.   Control Flow and Iterations.[3P]
6.   Functions in R.[2P]
7.   R Data Interfaces: R and Database Connectivity ,creating and dropping tables, inserting data and updating table rows, querying and querying with filters.[2P]
8.   Charts and Graphs : Generating Pie charts, Bar Charts and Line Graph.[2P]

VALUE ADDED COURSES (VAC)

Course Title: Cyber Security

Course Code : UG-COM-VAC1
Marks: 50
Credits : 2
Duration : 30 Hrs

Course Objectives:
□ Learn the foundations of Cyber security
□ Equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
□ Develop skills in students that can help them to ensure the protection of information technology assets.
□ Expose students to responsible use of online social media networks.

Course Learning Outcomes:
Upon completion of the course students will be able to:

CLO1: Understand the cyber security threat landscape.
CLO2: Understand cyber laws
CLO3 : Develop a deeper understanding and familiarity with various types of cyber attacks cyber crimes, vulnerabilities and remedies thereto
CLO4 : Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

SYLLABUS

UNIT I   **[15 HRS]**
Introduction to Cyber Security :Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.
  Cyber Crime and Cyber Law : Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cyber criminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures,

Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offenses, Organizations dealing with Cyber crime and Cyber security in India, Case studies, Cyber Forensics.

Unit II :   **[15 Hrs]**

Social Media Overview and Security

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Best practices for the use of Social media, Case Studies.

E - C o m m e r c e and Digital Payments

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007.

Digital Devices Security , Tools and Technologies for Cyber Security :

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Configuration of basic security policy and permissions.

Suggested activities :

1. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
2. Setting and configuring two factor authentication in the Mobile phone.
3. Security patch management and updates in Computer and Mobiles.
4. Managing Application permissions in Mobile phone.
5. Installation and configuration of computer Anti-virus.
6. Installation and configuration of Computer Host Firewall

REFERENCES:

MANDATORY:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

SUPPLEMENTARY:

1. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
   Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
4. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

SEMESTER II

DISCIPLINE SPECIFIC CORE COURSE

Course Title: Data Base Management Systems
Course Code : UG-COM-102
Marks: 75
Credits:3
Duration: 45 Hrs

Course Prerequisites: Nil

Course Objectives:
- □ To provide basic knowledge of a database management system.
- □ To understand importance of Entity Relationship diagram.
- □ To formulate queries in Relational Algebra and SQL for Database manipulation.
- □ Familiarity with any RDBMS during practical sessions.

Course learning outcomes:
Upon completion of the course students will be able to:

CLO1: Explain the various concepts of database system.
CLO2: Design ER-models to represent simple database application scenarios.
CLO3: Convert an ER diagram to a database schema.
CLO4: Formulate queries in Relational Algebra, and SQL to manipulate the database.
CLO5: Analyze the schema to see if they fulfill Normalization criterion.

SYLLABUS

UNIT I: Overview of DBMS, Design and ER model.   **[15 HRS]**
Overview of database management : Data, information, database, database management system; Managing data; File systems versus a DBMS, advantages of a DBMS; Data abstraction, instances and schemas, data models; Data manipulation language, data definition language; Architecture of a DBMS; Users of a DBMS, database administrator.

Database design and the ER model: Design phases – conceptual design, logical design, physical design; ER model – entities, attributes, and relationships, mapping cardinalities, keys; ER diagrams – strong entities, weak entities, generalization, specialization, aggregation; Converting ER diagram to relational schemes.

Unit II : Functional dependency and normalization   **[10 HRS]**

Atomic domain, nested relation; Key, super key, primary key, candidate key; Functional dependency, axioms, closure of a set of attributes, closure of a set of functional dependencies; Purpose of normalization; 1NF; 2NF;3NF; BCNF.

UNIT III : Relational model and SQL   [20 HRS]

Relational model: Relation, properties of relational model; Entities, integrity constraints, referential integrity constraints; Relational algebra – select, project, cross product, set operations, rename operation; Other relational operations – natural join, outer join.

SQL: Basic structure of SQL query – Create, select, where, from, rename operation; Set operations; Aggregate functions; Group by, having clauses; DDL Nested queries; Views; Insert, delete, update.

REFERENCES

MANDATORY:

1. Silberschatz, A. (2006). Database system concepts.—6th ed.

SUPPLEMENTARY:

1. Ramakrishnan, R., & Gehrke, J. (2000). Database management systems. McGraw Hill.
2. Elmasri, R., & Navathe, S. (2017). Fundamentals of database systems. Pearson.

WEB BASED:

1.   https://www.db-book.com/db6/slide-dir/ (Sixth edition Powerpoint , PDF of A Silberschatz, H F Korth, S Sudarshan, Database system concepts,)
2.   https://www.db-book.com/db7/
3.   https://www.tutorialspoint.com › dbms
4.   https://www.w3schools.in › dbms
5.   https://www.studytonight.com › dbms
6.   https://www.oracletutorial.com

Practical: Database Management Systems Credit :1 Marks :25 Duration: 30 Hrs	
1. ER diagram	(2P)
2.ER diagram with specialization/generalization and aggregation.	(1P)
3. Converting ERD into Schema.	(2P)
4 SQL	(2P)
5 Nested Queries	(2P)
6.Normalization	(2P)
7. Mini Project	(4P)

SKILL ENHANCEMENT COURSE (SEC)

Course Title: Programming in Python

Course Code: UG-COM-SEC2

Marks: 50

Credits: 2

Duration: 30 HRS

Course prerequisite:

Introduction to Programming (UG-COM-101)

Course Objectives:

- To apply various data types and control structures.
- To apply python data structures - list, tuple and dictionary.
- To structure a python program as a set of functions.
- To do input/output with files in Python.
- To provide skills of data analysis using Python programming language.

Course Learning Outcomes:

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

CLO1: Understand syntax of Python Programming.
CLO2: Write a program using conditional statements, loops.
CLO3: Apply required List,Tuple and Dictionary function.
CLO4: Write Python program specific to the domain of the given problem.

CLO5: Create applications using python programming.

SYLLABUS

UNIT I   **[15 HRS]**
Motivation, programming paradigms, What Python can do, Python's technical strength, Python interpreter, Program execution, Execution model variations, How to run programs.

Basic Syntax :
Variable and Data Types, Operator, Conditional Statements - if, if- else, Nested if-else. Looping – For, While, Nested loops. Control Statements – Break, Continue, Pass.

Strings :
Accessing Strings, Basic Operations, String slices, Function and Methods.

Tuples and Lists :
Introduction, Accessing list, Operations, Working with lists, Function and Methods.
Introduction Accessing tuples, Operations, Working, Functions and Methods.

UNIT II [15 HRS]
Dictionaries:
Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

Functions:
Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules:
Importing module. Math module. Random Module.

Exception Handling:
Exception. Exception Handling - Except clause, Try , except, finally clause. User Defined Exceptions.

Input-Output :
Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions.

REFERENCES:

MANDATORY:

1. Mark Lutz,Learning Python, O'Reilly Media, Fifth Edition.

SUPPLEMENTARY:
   1. Alex Martelli, (2006)Python – A Nutshell, O'Reilly Media, Second Edition.
   2. Wes McKinney, (2012)Python for Data Analysis, O'Reilly Media.

WEB BASED:

   1. https://www.w3schools.com
   2. https://www.tutorialspoint.com
   3. https://www.javatpoint.com
   4. https://www.geeksforgeeks.org
   5. https://www.guru99.com

Practicals: Programming in Python

Credit: 01

Marks: 25

Duration:30 Hrs

List of Experiments using Python Language:

1. Write a python program to compute a given formula. [1P]

2. Write a python program to implement an if else statement. [1P]

3. Write a python program to implement nested if else statements. [1P]

4. Implement for and while loop in python. [2P]

5. Write a string manipulation in python. [2P]

6. Write a program to implement lists in python. [2P]

7. Write a python program to implement tuple. [1P]

8. Write a python program to implement a dictionary. [2P]

9. Write python program to implement function [1P]

10. Write a python program to implement Input-Output File Operations in python. [2P]

VALUE ADDED COURSES (VAC)

Course Title: Cyber Security

Course Code : UG-COM-VAC1
Marks: 50
Credits : 2
Duration : 30 Hrs

Course Objectives:
- □ Learn the foundations of Cyber security
- □ Equip students with the technical knowledge and skills needed to protect and defend against cyber threats.
- □ Develop skills in students that can help them to ensure the protection of information technology assets.
- □ Expose students to responsible use of online social media networks.

Course Learning Outcomes:
Upon completion of the course students will be able to:

CLO1: Understand the cyber security threat landscape.
CLO2: Understand cyber laws
CLO3 : Develop a deeper understanding and familiarity with various types of cyber attacks cyber crimes, vulnerabilities and remedies thereto
CLO4 : Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.

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Fundamentals of Network Security