CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK
B.Sc Computer Science
Those who have joined in the Academic year 2023-24 onwards

Programme Outcomes (PO) of B.Sc. degree programme in Computer Science

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:
PO1: Knowledge
PO2: Problem Analysis
PO3: Design / Development of Solutions
PO4: Conduct investigations of complex problems
PO5: Modern tool usage
PO6: Applying to society

3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and realtime application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to a Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.

PO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Computing sciences.

CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

B.Sc Computer Science

Part	Courses	Subject	Code	Cr.	Hrs
SEMESTER - I					
I	Lang. – I	nghJj;jkpo; - **I**	230103101	3	6
II	Lang. - II	General English	231003101	3	4
III	CC – 1	Python Programming	232503101	4	4
	CC – 2	Python Programming Lab	232503102	4	6
	EC – I	Numerical Methods	232003122	3	4
IV	SEC –I (NME)	Office Automation	234603125	2	2
IV	FC	Problem Solving Techniques	234403125	2	2
	AECC – 1	Soft Skill - I	236003101	2	2
	Total			**23**	**30**
SEMESTER II					
I	Lang. -I	nghJj;jkpo; - **II**	230103201	3	6
II	Lang. -II	General English	231003201	3	4
III	CC – 3	Data Structure and Algorithms	232503201	4	4
	CC - 4	Data Structure and Algorithms Lab	232503202	4	6
	EC – II	Graph Theory and its applications	232003222	3	4
IV	SEC –II (NME)	Quantitative Aptitude	234603225	2	2
	SEC - III	Advanced Excel	234403225	2	2
	AECC –II	Soft Skill - II	236003201	2	2
				23	**30**
SEMESTER III					
I	Lang. -I	nghJj;jkpo; - **III**	230103301	3	6
II	Lang. -II	General English	231003301	3	4
III	CC – 5	Microprocessor and Microcontroller	232503301	4	4
	CC - 6	Microprocessor and Microcontroller Lab	232503302	4	6
	EC –3	Discrete Mathematical Structures	232503303	3	4
IV	SEC –IV	Web Application and Development	234403325	1	1
	SEC – V	Cloud Computing	238203325	2	2
	AECC – III	Soft Skill - 3	236003301	2	2
	EVS	Environmental Studies	234103301	1	1
				23	**30**

Part	Courses		Code	Cr.	Hrs
SEMESTER IV					
I	Lang. – I	nghJj;jkpo; - **IV**	230103101	3	6
II	Lang. - II	General English	231003101	3	4
III	CC – 7	Java Programming	232503401	4	4
	CC - 8	Java Programming Lab	232503402	4	5
	EC – IV	Statistics Analysis Using R	232503403	3	4
		Elective - IV	232503404		
IV	SEC –VI	PHP Programming	234403425	2	2
IV	SEC –VII	PHP Programming Lab	238203425	2	2
	AECC- IV	Soft Skill - IV	236003301	2	2
	EVS	Environmental Studies	234103401	1	1
	Total			**24**	**30**
SEMESTER V					
III	CC – 9	Software Engineering	232503501	4	5
	CC - 10	Database Management System	232503502	4	5
	CC - 11	Database Management System Lab	232503503	4	5
	Core 12	Project with Viva voce	232503504	4	4
	EC – V	Operating Systems	232503505	3	5
		Elective - V	232503506		
	EC – VI	Data Mining and Warehousing	232503507	3	5
		Elective - VI	232503508		
IV		Value Education	234303501	1	1
		Internship/Industrial Training(carried out in II year summer vacation)30 hrs	232503509	2	
				25	**30**
SEMESTER VI					
III	CC – 13	Computer Networks	232503601	4	5
	CC – 14	.NET Programming	232503602	4	5
	CC – 15	.NET Programming Lab	232503603	4	5
	EC –7	Introduction to Data Science	232503604	3	5
		Elective - VII	232503605		
	EC - 8	Cyber Security	232503606	3	5
			232503607		
IV	Processional competency skill enhancement course		232503608	2	4
		Value Education	234303601	1	1
V		Extension Activity (outside college hrs)	232503609	1	
				22	**30**

Title of the Course	**PYTHON PROGRAMMING**

Part		**III**						
Category	Core – 1	**Year**	I	**Credits**	4	**Course Code**	**232503101**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	--	4	25	75	100

Learning Objectives	
LO1	Describe the core syntax and semantics of Python programming language.
LO2	Discover the need for working with the strings and functions.
LO3	Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
LO4	Illustrate the process of database connectivity with python programming
LO5	Understand the usage of packages and Dictionaries

UNIT	**Details**	**No. of Periods for the Unit**
I	Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-Computer Hardware-Computer Software-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / output.	**12**
II	Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List and Dictionary, Manipulations Building blocks of python programs, Understandig and using ranges.	**12**
III	Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python - Default Arguments in Python-Variable Scope. Recursion: Recursive Functions	**12**
IV	Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules - Text Files: Opening, reading and writing text files – Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, String Processing - Exception Handling.	**12**
V	Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism. Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.	**12**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Develop and execute simple Python programs	PO1
CO2	Write simple Python programs using conditionals and looping for solving problems	PO1, PO2
CO3	Decompose a Python program into functions	PO4, PO6, PO7
CO4	Represent compound data using Python lists, tuples, dictionaries etc	PO4, PO5, PO6
CO5	Represent compound data using Python lists, tuples, dictionaries etc.	PO3, PO7,PO8

Text Books (Latest Editions)	
1.	Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.
2.	Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016

References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1.	Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
2.	Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
3.	John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1590282410.
4.	Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009.
Web Resources	
1.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview
2.	https://www.w3schools.com/python
3.	https://www.javatpoint.com/python-tutorial

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	S	M	S	S	M
CO2	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S
CO4	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M	S	S

S – Strong, M – Medium , L - Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3

Title of the Course		**PYTHON PROGRAMMING LAB**						
Part		**III**						
Category	Core	**Year**	I	**Credits**	4	**Course Code**	**232503102**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		-	1	5	6	40	60	100
Pre-requisite		Basic of programming skill						

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

- Acquire programming skills in core Python.
- Acquire Object-oriented programming skills in Python.
- Develop the skill of designing graphical-user interfaces (GUI) in Python.
- Develop the ability to write database applications in Python.
- Acquire Python programming skills to move into specific branches

Course Outcomes: (for students: To know what they are going to learn)

CO1: To understand the problem solving approaches

CO2: To learn the basic programming constructs in Python

CO3: To practice various computing strategies for Python-based solutions to real world problems

CO4: To use Python data structures - lists, tuples, dictionaries.

CO5: To do input/output with files in Python.

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

	List of Exercises:	**Required Hours**

1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.

2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria:
   Grade A: Percentage >=80 Grade B: Percentage >=70 and 80
   Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60
   Grade E: Percentage < 40

3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.

4. Write a Python script that prints prime numbers less than 20.

5. Program to find factorial of the given number using recursive function.

6. Write a Python program to count the number of even and odd numbers from array of N numbers.

7. Write a Python class to reverse a string word by word.

8. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

9. Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).

10. Write a Python program to construct the following pattern, using a nested loop

```
*
**
***
****
*****
****
***
**
*
```

11. Read a file content and copy only the contents at odd lines into a new file.
12. Create a Turtle graphics window with specific size.
13. Write a Python program for Towers of Hanoi using recursion
14. Create a menu driven Python program with a dictionary for words and their meanings.
15. Devise a Python program to implement the Hangman Game.

Learning Resources:

- **Recommended Texts**

  1. Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.
  2. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition , Pearson Education, 2016

- **Reference Books**

  1. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
  2. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
  3. John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410
  4. Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

- **Web resources**

1.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview
2.	https://www.w3schools.com/python
3.	https://www.javatpoint.com/python-tutorial

Title of the Course		**Office Automation**						
Part		**IV**						
Category	SEC-1 NME	**Year**	I	**Credits**	2	**Course Code**	**234603125**	
		Semester	I					
Instructional Hours per week :2		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives	
	The major objective in introducing the Computer Skills course is to impart training for students in Microsoft Office which has different components like MS Word, MS Excel and Power point.
	To acquire knowledge on editor, spread sheet and presentation software.

UNIT	**Details**	**No. of Periods for the Unit**
I	Introductory concepts: Memory unit – CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS – UNIX– Windows. Introduction to Programming Languages.	**6**
II	Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing – Preview, options, merge.	**6**
III	Spreadsheets: Excel – opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying; Charts – creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	**6**
IV	Database Concepts: The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS – Access).	**6**
V	Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition – Animation effects, audio inclusion, timers.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Understand the basics of computer systems and its components.
CO2	Understand the basic concepts of operating system and Programming Languages
CO3	Understand and apply the basic concepts of a word processing package.
CO4	Understand and apply the basic concepts of electronic spread sheet software.
CO5	Understand and create a presentation using PowerPoint tool.

Text Books (Latest Editions)	
	"Peter Norton, "Introduction to Computers" –Tata McGraw-Hill.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGraw-Hill.
Web Resources	
	Web resources: Web content from NDL / SWAYAM or open source web resources

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO1	S	S	S	M	S	S	S	M	S	M
CO2	M	S	S	M	S	S	M	M	S	M
CO3	M	S	S	S	M	S	S	S	M	M
CO4	S	S	S	M	M	M	S	S	S	S
CO5	S	M	M	M	S	S	S	S	M	S

3 – Strong, 2 – Medium , 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3

Title of the Course	**PROBLEM SOLVING TECHNIQUES**

Part	**IV**						
Category	FC	**Year**	I	**Credits**	2	**Course Code**	**234403125**
		Semester	I				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
	2	-	--	2	25	75	100

Pre-requisite	Basic of Problem-solving skills

Learning Objectives:

- ✍ To understand the importance of algorithms and programs, and to know of the basic problem solving strategies.
- ✍ To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems.

Units	**Details**	**No. of Periods for the Unit**
I	**Introduction:**Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.	**6**
II	**Fundamental Algorithms**: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.	**6**
III	**Factoring Methods**: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the *n*th Fibonacci number.	**6**
IV	**Array Techniques**: Array order reversal – Array counting or histogramming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the k^{th} smallest element – Longest monotone subsequence.	**6**
V	**Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. **Recursive algorithms**: Towers of Hanoi – Permutation generation.	**6**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the systematic approach to problem solving.	PO1
CO2	Know the approach and algorithms to solve specific fundamental problems.	PO1, PO2
CO3	Understand the efficient approach to solve specific factoring-related problems.	PO4, PO6
CO4	Understand the efficient array-related techniques to solve specific problems.	PO4, PO5, PO6
CO5	Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.	PO3, PO6

Text Books (Latest Editions)	
1	R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1	George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013).
2	Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996.
Web Resources	
	Web content from NDL / SWAYAM or open source web resources

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	S	M	S	S	M
CO2	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S
CO4	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M	S	S

S – Strong, M – Medium , L - Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**APSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3

Title of the Course		**Data Structures & Algorithms**						
Part		**III**						
Category	Core	**Year**	I	**Credits**	4	**Course Code**	**232503201**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	--	4	25	75	100

Learning Objectives

- To impart the basic concepts of data structures and algorithms.
- To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures.
- This course also gives insight into the various algorithm design techniques

UNIT	**Details**	**No. of Periods for the Unit**
I	**INTRODUCTION TO DATA STRUCTURES:** • Data Structures: Definition- Time & Space Complexity, • Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation, • Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists- Dynamic Storage management.	**12**
II	**STACKS:** • Operations, array and linked representations of stack, stack applications, infix to postfix conversion, postfix expression evaluation, recursion implementation	**12**
III	**QUEUES, TREES & GRAPHS:** • **Queues**: operations on queues, array and linked representations. • **Circular Queue:** operations,, applications of queues. • **Trees:** Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder), • Binary search trees **Graphs** : Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- -Applications of graphs –	**12**
IV	**INTRODUCTION TO ALGORITHMS:** • **INTRODUCTION**: Definition of Algorithms- Overview and importance of algorithms- pseudocode conventions, Asymptotic notations, practical complexities. • **Divide-and-Conquer:** : General Method – Binary Search- Quick Sort- Merge Sort. • **Greedy Method:** General method- Knapsack problem- Tree vertex splitting- Job sequencing with deadlines	**12**
V	**DYNAMIC PROGRAMMING, BACKTRACKING & BRANCH & BOUND** • **Dynamic programming**: General method, Multistage Graphs, All pairs shortest path, Single source shortest path. • **Backtracking:** General method, 8 Queens, Graph coloring, Hamiltonian cycle. **Branch & Bound**: General method, Travelling salesperson problem.	**12**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To introduce the concepts of Data structures and to understand simple linear data structures.	PO1
CO2	Learn the basics of stack data structure, its implementation and application.	PO1, PO2

CO3	Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.	PO4, PO6
CO4	To introduce the basic concepts of algorithms.	PO5, PO6,PO7
CO5	To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound.	PO3, PO8, PO9

Text Books (Latest Editions)	
1.	Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press.
2.	E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,"Fundamentals of Computer Algorithms " Universities Press.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill.
2.	R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata McGrawHill – 2008.
3.	A.K.Sharma, Data Structures using C , Pearson Education India,2011.
4.	G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI, New Delhi, 1997.
5.	A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer.
6.	Algorithms", Addison Wesley, Boston, 1974
7.	Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.
8.	Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.
Web Resources	
1.	Web resources from NDL Library, E-content from open source libraries
2.	https://www.geeksforgeeks.org/data-structures
3.	https://www.javatpoint.com/data-structure-tutorial

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	M	M	S
CO3	S	S	M	M	S	S	S	S	M
CO4	M	S	S	S	S	M	S	S	S
CO5	S	S	S	S	M	S	S	S	S

3 – Strong, 2 – Medium , 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3

Title of the Course		**Data Structures & Algorithms Lab**						
Part		**III**						
Category	Core	**Year**	I	**Credits**	4	**Course Code**	**232503202**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		--	1	5	6	40	60	100

Pre-requisite	Basic skills in problem solving

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

Course Outcomes: (for students: To know what they are going to learn)

CO1: Implement data structures using C

CO2: Implement various types of linked lists and their applications

CO3: Implement Tree Traversals

CO4: Implement various algorithms in C

CO5: Implement different sorting and searching algorithms

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

	List of Exercises:	**Required Hours**
	Implement the following exercises using C Programming language: 1. Array implementation of stacks 2. Array implementation of Queues 3. Linked list implementation of stacks 4. Linked list implementation of Queues 5. Binary Tree Traversals (Inorder, Preorder, Postorder) 6. Implementation of Linear search and binary search 7. Implementation Insertion sort, Quick sort and Merge Sort 8. Implementation of Depth-First Search & Breadth-First Search of Graphs. 9. Finding all pairs of Shortest Path of a Graph. 10. Finding single source shortest path of a Graph.	**60**

Learning Resources:

Learning Resources:

- **Recommended Texts**

1. Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press

2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,"Fundamentals of Computer Algorithms " Universities Press

- **Reference Books**

01. Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill.
02. R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata McGrawHill – 2008.
03. A.K.Sharma, Data Structures using C , Pearson Education India,2011.
04. G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI, New Delhi, 1997.
05. A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer Algorithms", Addison Wesley, Boston, 1974
06. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009
07. Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

- **Web resources:** Web resources from NDL Library, E-content from open source libraries

Title of the Course		**Quantitative Aptitude**						
Part		**IV**						
Category	SEC – II NME	**Year**	I	**Credits**	2	**Course Code**	**234603225**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives		
LO1	✍ To improve the quantitative skills of the students	
LO2	✍ To prepare the students for various competitive exams	
UNIT	**Details**	**No. of Periods for the Unit**
I	Numbers - HCF and LCM of numbers - Decimal fractions - Simplification - Square roots and cube roots - Average - problems on Numbers	**6**
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion - partnership - Chain rule	**6**
III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - simple interest - compound interest - Logarithms - Area - Volume and surface area - races and Games of skill.	**6**
IV	Permutation and combination - probability - True Discount - Bankers Discount Height and Distances - Odd man out & Series.	**6**
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation - Bar Graphs - Pie charts - Line graph	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	gain knowledge on LCM and HCF and its related problems
CO2	get an idea of age, ratio and proportion related problems solving
CO3	understand time series and problems on trains
CO4	Understanding the problem related to probability, and series
CO5	Able to understand graphs, charts

Text Books (Latest Editions)	
1	"Quantitative Aptitude", R.S. AGGARWAL., S. Chand & Company Ltd.,
References Books (Latest editions, and the style as given below must be strictly adhered to)	
	Quantitative Aptitude for competitive Examinations Abhijit Guha July 2020 7th edition July 2020 ,Mc Graw Hill Education Education
Web Resources	
	Web resources: Authentic Web resources related to Competitive examinations

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	S	S	M	S	M

3 – Strong, 2 – Medium , 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	2
CO2	3	3	3	2	3
CO3	3	3	2	2	3
CO4	3	3	3	3	2
CO5	3	3	2	2	3
Weightage	15	15	12	13	13
Weighted percentage of Course Contribution to Pos	3	3	2.4	2.6	2.6

68/75=90.6%

Title of the Course		**Advanced Excel**						
Category	SEC - III	**Year**	I	**Credits**	2	**Course Code**	**234403225**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives

(for teachers: what they have to do in the class/lab/field)

The objective of this course is to help the students learn the advanced features of Excel, to summarise, analyse, explore, and present visualisations of data in the form of charts, graphs.

UNIT	**Details**	**No. of Periods for the Unit**
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	**6**
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	**6**
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	**6**
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	**6**
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Handle large amounts of data
CO2	Aggregate numeric data and summarise into categories and subcategories
CO3	Filtering, sorting, and grouping data or subsets of data
CO4	Create pivot tables to consolidate data from multiple files
CO5	Presenting data in the form of charts and graphs

Text Books (Latest Editions)	
1	Excel 2019 All-in-One For Dummies – 2018- Greg Harvey

References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
	Microsoft Excel 2019 Pivot Table Data Crunching-2019,Bill Jelen and Michael Alexander
Web Resources	
	Web resources from NDL Library, E-content from open source libraries

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	S	M	S	S	M
CO2	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S
CO4	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M	S	S

3 – Strong, 2 – Medium , 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3