Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly known as West Bengal University of Technology)

Syllabus of B.Sc. in Cyber Security

Effective from academic session 2023-2024

Fundamentals of Computing - using C and C++ Language

Credits : 3T + 2 P | Course Code – FYCYS 101 (Theory), FYCYS 191 (Practical)

Course Objective: The course is designed to provide a working knowledge and skills of programming with C and C++ language. Students will be able to develop logics which will help them to create programs. Also by learning the basic programming constructs they can easily be able to grasp any other new computer languages in future.

Sl	Course Outcome (CO)
1	Remember & Understand the Computer Fundamentals
2	Remember & Understand the Program methods using C
3	Understand general problem solving using C
4	Understand& Apply control flow, function of PS, Arrays & Pointers using C
5	Analyse the Structure and Input & Output using C
6	Remember & Understand the Program methods using C++
7	Application& Analysis using guided competitive programming laboratory work

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	1,2	6	10
CO2	1,2	3	10
CO3	1,2	6	20
CO4	1,2	16	20
CO5	1,2	4	20
CO6	1,2	5	20
		40	**100**

Practical

CO	Blooms Level	Total Hours	%age of questions
CO7	1,2	60	100
			100

Theory:

Module 1-Computer fundamentals: Computing systems: hardware & software, Architecture & organization history: von Neumann Architecture: memory, processor, I/O; Data vs Information: Bit, byte number system: binary, octal, hexadecimal, 1's, 2's complement arithmetic, digital logic: AND, OR etc. BIOS, Booting, Application software, system software, Introduction of Operating systems, program, process; introduction of programming languages: brief overview of Pascal, FORTRAN, and BASIC**.**

Module 2- Programming method: Debugging, macro, User defined Header, User defined Library Function

Module 3- General problem solving concepts: Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Variable Names, Data Type and Sizes , Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming

Module 4- Control Flow, Function, Arrays& Pointers: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Goto Labels. Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Preprocessor, Standard Library Functions and return types. Arrays, Pointers and address, Pointers and Function Arguments, Pointers, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialization of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

Module 5- Structures Input & Output: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions.

Module 6 - C++ Basics: Variable Names, Data Type and Sizes, Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, BitwiseOperators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming. Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Goto Labels.

Practical:

Module 7-

List of C Programs:

1)   Write a C program to print fibonacci series without using recursion and using recursion.

2)   Write a C program to check palindrome number.

3)   Write a C program to print number triangle.

4)   Write a C program to find the largest number of the three.

5)   Write a C program to check whether a person is eligible to vote or not.

6)   Write a C program to print table for the given number using do while loop, while loop and for loop.

7)   Write a C program to insert and delete an element in an array.

8)   Write a C program for swapping numbers using Function Call by Value.

9)   Write a C program to store n elements in an array and print the elements using a pointer.

10)   Write a C program to display age and weight using pointers to structures.

List of C++ Programs:

1)   Write a C++ program to check whether a character is Vowel or Consonant.
2)   Write a C++ program to print a full pyramid using *.

Besides above, respective faculty can choose any other programs according to the requirement.

Text Books:

1. AICTE's Programming for Problem Solving, Khanna Book Publishing.
2. Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw Hill.
3. B. Gottfried, "Programming in C", Second Edition, Schaum Outline Series.
4. R.S. Salaria, "Problem Solving and Programming in C", Khanna Publishing House
5.   E. Balagurusamy, "Programming in ANSI C", Eighth Edition, McGraw Hill.

Reference Books:

1. B. W. Kernighan and D. M. Ritchi, The 'C Programming Language", Second Edition, PHI.
2. Yashavant Kanetkar, "Let Us C", BPB Publications.

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Syllabus of B.Sc. in Cyber Security

Effective from academic session 2023-2024

Basic Mathematics and Statistics Credits- 3T +2P

Course Code – FYCYS 102 (Theory), FYCYS 192

(Practical)

Course Objective: The course is designed to provide a basic understanding and knowledge of Mathematics, Probability and Statistics for Computing. Students will be able to apply Mathematics and Statistics to solve problems related to Cyber Security.

SI	Course Outcome (CO)
1	Learn & Understand the Mathematics for Computation
2	Relate the Mathematics to Computational Problems
3	Explain Probability Theory and Basic Statistics
4	Define Combinatorics to Build Statistical Distribution
5	Recall Probability Theory to Cyber Security Problems
6	Compare Data to Build Statistical Models
7	Application of C program to different Mathematical and Statistical operations

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	1,2	8	10%
CO2	1,2	8	25%
CO3	1,2	6	10%
CO4	1,2	10	25%
CO5	1,2	14	20%
CO6	1,2	10	10%
		56	**100**

PRACTICAL

CO	Blooms Level	Total Hours	%age of questions
CO7	1,2	**20**	**100**
		20	**100**

Theory:

Module 1: Discrete Mathematics

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product ofFunctions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 2: Algebraic Structures and Morphism

Algebraic Structures with one Binary Operation, Semi-Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Module 3: Combinatorics and Probability

Set Theory, Basic Probability and Venn diagram, Compound Probability of independentevents, Dependant events, Permutations and Combinations, Probability using Combinatorics, pigeon-hole principle.

Module 4: Frequency Distribution

Data presentation- Frequency table, histogram, Bar chart and frequency polygons, stem and leaf plots, measure of location and spread, box and whisker plots.

Module 5: Introduction to Statistics

Definition and scope of Statistics, concepts of statistical population and sample.

Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and Ogives. Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Module 6: Bivariate Statistics

Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

Practical:

Module 7:

1)   Write a C program to implement various set operations.

2)   Write a C program to demonstrate basic Euclidean Algorithm.
3)   Write a C program that prints X with probability=0.1, Y with probability=0.3, and Z with probability=0.6
4)   Write a C program to find mean, median and mode.
5)   Write a C program to calculate standard deviation.

Besides above, respective faculty can choose any other programs according to the requirement.

Text Books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics andOptimisation
2. S.B. Singh, Discrete Structures, Khanna Book Publishing Co.
3. Manish Sharma, The Practice of Business Statistics, Khanna Book Publishing Co.
4. Goon A.M.,Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata

SEMESTER 2

Computer Architecture and Object Oriented Concepts

Credits- 3T +2P

Course Code – FYCYS 201 (Theory), FYCYS 291 (Practical)

Course Objective: The course is designed to provide an elaborate idea about the different memory systems and buses and introduce processor architecture to students.Also give them a knowledge about object oriented programming concepts to enable them to develop efficient codes.

SI	Course Outcome
1	Remember & Understand the structure, function and characteristics of computersystems
2	Remember & Understand the design of the various functional units and components of computers
3	Understand and identify the elements of modern instructions sets and their impacton processor design.
4	Understand & Apply the function of each element of a memory hierarchy
5	Infer the Structure and Input & Output using Java
6	Application & Analysis using guided competitive programming laboratory work

Theory

Module Number	Content	Total Hours	%age of questions	Blooms Level
M 1	Computer Organization & Memory System	10	20	1,2
M 2	Computer Arithmetic	10	25	1,2
M 3	Input and Output System	10	30	1,2
M 4	Instruction Set and addressing modes	10	25	1,2
		40	**100**	

Practical

Module Number	Content	Total Hours	%age of questions	Blooms Level
M 5	Concepts of OOP & Basics of Java	15	40	1,2
M 6	Objects and Classes	45	60	1,2
		60	**100**	

Theory

Module I: Computer Organization & Memory System

Computer types, Structure with basic computer components, Function in brief with instruction fetch and execute, Interrupts and I/O communication, Interconnection

structure, bus interconnection, Multiple Bus hierarchies, Elements of bus design Performance metrics and measurement.

Memory hierarchy, Main memory definition, types of main memory, types of RAM, ROM, difference between SRAM & DRAM. Cache memory, Cache memory mapping – Direct, Associative, Set Associative, Virtual memory, mapping using pages, page fault,mapping using segments, TLB

Module II : Computer Arithmetic

Addition and Subtraction algorithm of sign magnitude number. Addition and subtraction algorithm for signed 2's complement data. Multiplication algorithm, Booth's algorithm and division algorithm.

Module III : Input and Output System

Peripheral devices, Input – output interface, Isolated I/O, Memory mapped I/O, Asynchronous data transfer: strobe & handshaking, Programmed I/O, Interrupt initiatedI/O, Basic idea of DMA

Module IV : Instruction Set and addressing modes

Instruction codes, Direct address, Indirect address & Effective address, List of basic computer registers, Computer instructions: memory reference, register reference & input – output instructions, Block diagram & brief idea of control unit of basic computer,Instruction cycle

PRACTICAL

Module V: Introduction of Object-Oriented Concept

Class, object, encapsulation, data hiding, inheritance, polymorphism, sample Java programs.

Module VI : Objects and Classes

Basic of objects and classes in Java, Private and public, static data and function member, constructor and their types, destructor, Inheritance, Polymorphism.

Text Books:

1.   Computer System Architecture, M. Morris Mano, PEARSON
2.   Computer Organization & Architecture – Designing For Performance, William Stallings, PEARSON
3.   Computer Architecture & Organisation, J.P. Hayes, TATA MCGRAW HILL
4.   Computer Organization and Architecture, T. K. Ghosh, TATA MCGRAW-HILL
5.   Computer Architecture, Behrooz Parhami, OXFORDUNIVERSITY PRESS
6.   Programming with Java, E Balagurusamy, TMH
7.   The Complete Reference Java, Herbert Schildt, McGraw Hill

Data Structures and AlgorithmsCredits- 3T +2P

Course Code – CYS 202 (Theory), CYS 292

(Practical)

Course Objective: The course is designed to introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms. In addition, another objective of the course is to develop effective software engineering practice, emphasizing such principles as decomposition, procedural abstraction, and software reuse.

SI	Course Outcome
1	Remember & Understand how the choice of data structures and algorithm designmethods impacts the performance of programs.
2	Remember & Understand how to solve problems using data structures such aslinear lists, stacks, queues, hash tables, binary trees
3	Understand and identify the ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
4	Understand & Apply the appropriate data structure and algorithm design method for a specified application
5	Relate the ability to apply design and development principles in the constructionof software systems of varying complexity
6	Application & Analysis using guided competitive programming laboratory work

Theory

Module Number	Content	Total Hours	%age of questions	Blooms Level
M 1	Concepts of Abstract data type	6	10	1,2
M 2	Data Structure using Array	6	20	1,2
M 3	Searching and Sorting	6	20	1,2
M 4	Linked List	6	20	1,2
M5	Trees	6	10	1,2
M6	Graphs & Hashing	10	20	1,2
		40	**100**	

Practical

Module Number	Content	Total Hours	%age of questions	Blooms Level
M 2	Data Structure using Array	6	20	1,2

M 3	Searching and Sorting	12	20	1,2
M 4	Linked List	12	20	1,2
M5	Trees	15	20	1,2
M6	Graphs & Hashing	15	20	1,2
		60	**100**	

Theory

Module I: Concepts of Abstract data type

Concept of abstract data types, Structure, union, enum, pointer to structure, Self-referential structure, Pointer to pointer

Theory + Practical

Module II: Data Structure using Array

stack, queue, circular queue, priority queue, dequeue and their operations and applications.

Module III: Searching and Sorting

Searching: linear search, Binary search, their comparison, Sorting: insertion sort, Selection sort. Quick sort, Bubble sort Heap sort, Comparisonof sorting methods , Analysis of algorithm, complexity using big 'O' notation

Module IV: Linked List

Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked list and their operations and applications.

Module V: Trees

Binary trees, binary search trees, representations and operations, thread representations, sequential representations, B tree B+ tree,

Module VI: Graphs & Hashing

Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depthfirst search and Breadth firstsearch. Spanning Trees, minimum spanning Tree, Shortest path algorithm. Definition of hashing, Hashing functions, Load factor and collision, open addressing (linear

probing) and chaining method to avoid collision.

Text Books

1. Expert Data Structures With C++ - R.B. Patel
2. Data structure using c and c++ - Tanenbaum
3. Fundamentals of Data structure in c++ - E.Horwitz,Sahni, D.Mehta