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

Model curriculum structure for 4-year B.Sc in Cyber Security, MAKAUT WB

Sem	Major (Offline)	Minor (Blended Mode)	Inter Disciplinary (Offline)	Ability Enhancement (Offline)	Skill Enhancement (Online /Sessional)	Common Value added Course (SESSIONAL)	TOTAL CREDITS
I	Fundamentals of Computing – using C and C++ language (including lab) (Code Theory-FYCYS 101, Lab-FYCYS 191) - 3+2 credits Basic Mathematics and Statistics (including lab) (Code Theory-FYCYS 102, Lab-FYCYS 192) – 3+2 credits	(1 sub x 3 credits) Principles Of Management	Any one from GE baskets Basket A or D (3 credits)	AECC 101- English and Professional Communication	SEC 181- Life Skills & Personality Development (2 credits)	VAC 181A/B/C- Yoga/ Health & Wellness/ Sports (2 credits)	**22**
II	Computer Architecture and Object Oriented Concepts (including lab) (Code Theory-FYCYS 201, Lab-FYCYS 291) – 3+2 credits Data Structures and Algorithms (including lab) (Code Theory-FYCYS 202, Lab-FYCYS 292) – 3+2 credits	(1 sub x 3 credits) Organization Behaviour/Business Ethics & Corporate Governance	Any one from GE baskets Basket B or E (3 credits)	AECC 201- Modern Indian Languages and Literature (2 credits)	SEC 201- IT Skills (2 credits)	VAC281A/B/C/D- Critical Thinking / NSS/ Mental Health/ Environmental Studies (2 credits)	**22**
III	Python Programming (including lab) (Code Theory-FYCYS 301, Lab-FYCYS 391) – 3+2 credits Operating System and DBMS (including lab) (Code Theory-FYCYS 302, Lab-FYCYS 392) –3+2 credits	(1 sub x 4 credits) Principles of Marketing/Business & Sustainability	Any one from GE baskets Basket C or F(3 credits)	AECC 301- The Constitution, Human Rights and Law (2 credits)	SEC 301- Understanding basics of Cyber Security (2 credits)		**21**

IV	Design and Analysis of Algorithms (including lab) (Code Theory-FYCYS 401, Lab-FYCYS 491) – 2+2 credits Ethical Hacking and Systems Defence (including lab) (Code Theory-FYCYS 402, Lab-FYCYS 492)– 3+2 credits Cryptography and Information Security (including lab) (Code Theory-FYCYS 403, Lab-FYCYS 493)– 2+2 credits	Human resource management /Corporate Social Responsibility (CSR) (4 credits) Sales and distribution management /E-Commerce (4 credits)		AECC 401A Society Culture and Human Behavior (2 credits)			**23**
V	Cyber Systems & Cyber Threat and Modelling (including lab) (Code Theory-FYCYS 501, Lab-FYCYS 591) – 3+2 credits Vulnerability Analysis, Penetration Testing, and Incident Handling (including lab) (Code Theory-FYCYS 502, Lab-FYCYS 592) – 3+2 credits	Financial management (4 credits) Entrepreneurship (4 credits)			FYBMS581 Internship (4 credits)		**22**
VI	Cyber Forensics (Code FYCYS 601) – 4+1 credits Malware Analysis (Code FYCYS 602) – 4+1 Credits Advanced Computer Network and Security(including lab)	Customer relationship management (4 credits) Career planning and					**22**

	(Code Theory-FYCYS 603, Lab-FYCYS 693) – 2+2 credits	management/Managing Workplace Diversity (4 credits)					
VII	Minor Project (Code FYCYS 781) – 5 credits Software Project Management (Code FYCYS 701) – 4+1 credits Artificial Intelligence in Security (Code FYCYS 702) – 3+1 credits	Consumer behaviour / Exploring Business Opportunity (4 credits) Strategic management/ Intellectual Property Rights (4 credits)					**22**
VIII	Major Project (continuation of minor project) (Code FYCYS 881)– 5 credits Security in E-business (Code FYCYS 801) - 4+1 credits				**Capstone/** [Code FYCYSC881] **Or Research project** [Code FYCYSR882] 12 credits		**22**
	19 sub - 91 credits	**11 sub – 42 credits**	**3 sub – 09 credits**	**4 sub – 08 credits**	**3 sub & Int & Proj - 22 credits**	**2 sub – 4 credits**	**176**

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Syllabus of B.Sc. in Cyber Security

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SEMESTER 1

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.

SI	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

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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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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 knowledgeof 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**

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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

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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.

Sl	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**	

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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

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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.

Sl	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	Bloom sLevel
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

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SEMESTER 1

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.

SI	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
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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

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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:

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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.
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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 knowledgeof 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**

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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

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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.

Sl	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**	

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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

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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.

Sl	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	Bloom sLevel
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

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SEMESTER 3

Python Programming & Python Programming Lab

Credits- 3+2

Course Code FYCYS 301 (Theory) + FYCYS 391 (Practical)

Course Objective: The course is designed to provide a working knowledge and skills of programming with Python 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	Explain the basic concepts of Python
2	Explain the different conditions and iterations of Python
3	Explain the concept of recursion, string, dictionary, list and tuples using Python
4	Explain the concept of class and object.

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3	12	20
CO2	2,3	8	20
CO3	2,3	10	30
CO4	2,3	10	30
		40	**100**

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Practical

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3,4	18	20
CO2	2,3,4	12	20
CO3	2,3,4	15	30
CO4	2,3,4	15	30
		60	**100**

Theory (Course Code-FYCYS 301) and Practical (Course Code-FYCYS 391)

Module I: Introduction to Python(12L)

1. Introduction to Python
2. Python variables, expressions, statements
3. Variables, 2.2 Keywords, 2.3 Operators & operands, 2.4 Expressions, 2.5 Statements,
4. 2.6 Order of operations, 2.7 String operations, 2.8 Comments, 2.9 Keyboard input, 2.10 Example programs
5. Functions

Type conversion function, 3.2 Math functions, 3.3 Composition of functions,

3.4 Defining own function, parameters, arguments, 3.5 Importing functions, 3.6Example programs

Module II: Conditions & Iterations(8L)

Conditions

Modulus operator, 1.2 Boolean expression, 1.3 Logical operators, 1.4 if, if-else, if- elif-else, 1.5 Nested conditions, 1.6 Example programs

Iteration

while, 2.2 for, 2.3 break, 2.4 continue, 2.5 Nested loop, 2.6 Example programs

Module III: Recursion, Strings, List, Dictionaries, Tuples(10L)

Recursion

Python recursion, 1.2 Examples of recursive functions, 1.3 Recursion error,

1.4 Advantages & disadvantages of recursion

Strings

Accessing values in string, 2.2 Updating strings, 2.3 Slicing strings, 2.4 String methods – upper(), find(), lower(), capitalize(), count(), join(), len(), isalnum(), isalpha(), isdigit(), islower(), isnumeric(), isspace(), isupper() max(), min(), replace(), split(), 2.5 Example programs

List

Introduction, 3.2 Traversal, 3.3 Operations, 3.4 Slice, 3.5 Methods, 3.6 Delete element, 3.7 Difference between lists and strings, 3.8 Example program

Dictionaries

Introduction, 4.2 Brief idea of dictionaries & lists 5 Tuples (1L)

5.1 Introduction, 5.2 Brief idea of lists & tuples, 5.3 Brief idea of dictionaries & tuples

Module IV: Classes& Objects(10L)

Classes & Objects

Creating class, 1.2 Instance objects, 1.3 Accessing attributes, 1.4 Built in class attributes, 1.5 destroying objects, 1.6 Inheritance, 1.7 Methodoverriding, 1.8 Overloading methods, 1.9 Overloading operators, 1.10 Data hiding, 1.11 Example program

Suggested Readings:

Learn Python The Hard Way, Zed A. Shaw, ADDISON-WESLEY

Introduction to Computing & Problem Solving With PYTHON, Jeeva Jose, Khanna Publishing House (AICTE Recommended Textbook)

Introduction To Python Programming, Venkatesh, Nagaraju Y, Khanna Publishing House (AICTE Recommended Textbook)

Taming PYTHON By Programming, Jeeva Jose, Khanna Publishing House (AICTE Recommended Textbook)

Learning Python, Mark Lutz, O'REILY

Programming In Python, Dr. Pooja Sharma, BPB

Python Programming - Using Problem Solving Approach, Reema Thareja, OXFORD UNIVERSITY PRESS

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Operating Systems and Database Management Systems

Credits- 3T +2P

Course Code – FYCYS 302(Theory), FYCYS 392(Practical)

Course Objective: The course is designed to provide a basic understanding and knowledge of different aspects ofoperating systems and database management system.

SI	Course Outcome (CO)
1	Make use of the basics of operating systems
2	Make use of the concept of process
3	Make use of the concept of resource manager
4	Make use of the concept of data and data management
5	Make use of the concept of data models and architecture
6	Make use of the concept of data modeling using ER modeling
7	Explain the concept of relational model and relational database managementsystem

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3	3	10
CO2	2,3	10	25
CO3	2,3	8	10
CO4	2,3	4	10
CO5	2,3	6	20
CO6	2,3	7	10
CO7	2,3	7	15
		45	**100**

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Practical

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3,4	3	10
CO2	2,3,4	15	25
CO3	2,3,4	9	10
CO4	2,3,4	6	10
CO5	2,3,4	9	20
CO6	2,3,4	9	10
CO7	2,3,4	9	15
		60	**100**

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Theory (Course Code – FYCYS 302) and Practical (Course Code – FYCYS 392) :

1. Module I: Introduction

Importance of OS, Basic concepts and terminology, Types of OS, Different views, Journey of a command execution, Design andimplementation of OS

2. Module II: Process

Concept and views, OS view of processes, OS services for process management, Scheduling algorithms, Performance evaluation; Inter-process communication and synchronization, Mutual exclusion, Semaphores, Hardware support for mutual exclusion, Queuing implementation of semaphores, Classical problem of concurrent programming, Critical region and conditional critical region, Monitors, Messages, Deadlocks

3. Module III: Resource Manager

Memory management, File management, Processor management, Device management

4. Module IV: Introducing to Data and Data Management

Introduction, Data and Information, Database and Data Base Management System, Components of Database System, Basics of Database Management System, File-based System and Database Management System, Advantages of using Database over File based system, Data Dictionary andMetadata, ANSI-SPARC Architecture, Database Users, Role of Database Administrator (DBA) and Data Administrator(DA), Database Environment, Need for a Database, Characteristics, or Features, or Advantages of Database Systems, Limitations of Database.

5. Module V: Data Models and Architecture of DBMS

Schemas and Instances, DBMS Architecture, Three Level Architecture of Database, Evolution of Data Models, Hierarchical Data Model, Network Data Model, Relational Data Model Object-oriented Data Model, Object-relational Data Model, Data and Structural Independence, Database Languages DDL, DML, DCL, TCL, Database Access, Database Structure

6. Module VI: Data Modeling using ER Modeling

Basic Terminology related to ER Model, Relational Model – Introduction, Advantages and Disadvantages, Identifying Entities, and Relationships, Types of Relationships, Relationship Participation, Notations in ER Model, Strong and Weak entity sets Composite entity, ManagingMany-to-many, Relationship, Example of E-R Model, Types ofIntegrity Constraints, Extended E-R Model, Translating the ER Model into Relational Model, Object Modeling, Subclass and Super class, Specialization, Generalization and Aggregation, Class Diagram

7. Module VII: Relational Model and Relational Database Management System

Introduction,RDBMSTerminology,VariousTypesofKeys,RelationalIntegrityRulesEntityintegrity Rule, referential integrity rule,FunctionalDependency,ArmstrongAxioms,RelationalSetOperators,

Retrieval Operators, CODD's Twelve Rules of Relational Database, ACID properties, Views and their purpose, Database Life Cycle, Data Dictionary, Relational Algebra and relational calculus, exercise on Relational calculus and relational algebra, Comparisons of

relational algebra and calculus Tuple Relational Calculus, Domain Relational Calculus, IntroductiontoSQL

Suggested Readings:

1. Operating System Concpets, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook)
2. Operating Systems, Galvin, John Wiley
3. Operating Systems , Milankovic,TMH
4. An Introduction to Operating System, Bhatt,PHI
5. Korth, Silberschatz, Sudarshan – Database System Concepts; Tata Mc. Graw Hill
6. R. P. Mahaptra, Databse Management Systems, Khanna Publishing House (AICTE Recommended Textbook)
7. Ramez Elmasri, Shamkant B Navathe - Fundamentals of Database Systems; Pearson
8. C.J. Date - An Introduction to Database Systems, 8e, Pearson Education

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SEMESTER 4

Design and Analysis of Algorithms

Credits- 2T +2P

Course Code – FYCYS 401(Theory), FYCYS 491(Practical)

Course Objective:

1	To be familiar with algorithm complexity analysis.
2	To understand and apply several algorithm design strategies.

Sl.No.	Course Outcome
1.	Discuss Complexity Analysis
2.	Demonstrate Algorithm Design by Divide and Conquer.
3.	Analyse Disjoint Set Data Structure.
4.	Make use of Algorithm Design by Greedy Strategy.
5.	Make use of Algorithm Design by Dynamic Programming
6.	Make use of Algorithm Design by Backtracking.

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Theory

Module Number	Content	Total Hours	%age of questions	Blooms Level
1	Complexity Analysis	8	20	2,3,4
2	Algorithm Design by Divide and Conquer	8	20	2,3,4
3	Disjoint Set Data Structure	8	20	2,3,4
4	Algorithm Design by Greedy Strategy	8	10	2,3,4
5	Algorithm Design by Dynamic Programming	8	10	2,3,4
6	Algorithm Design by Backtracking	8	20	2,3,4
		48	100	

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Practical

Module Number	Content	Total Hours	%age of questions	Blooms Level
2	Implement Merge sort	9	10	2,3,4
2	Implement Quicksort	9	10	2,3,4
2	Find maximum and minimum elements from an array of integers using divide and conquer strategy.	6	10	2,3,4
4	Implement fractional knapsack	6	10	2,3,4
4	Implement Job sequence with deadline	9	10	2,3,4
4	Implement Kruskal's algorithm	9	10	2,3,4
4	Implement Prim's algorithm	9	10	2,3,4
5	Implement Dijkstra's algorithm	9	10	2,3,4
5	Implement Matrix Chain Multiplication	9	10	2,3,4
5	Implement Floyd Warshall Algorithm	9	10	2,3,4
		58	100	

Module 1: Complexity Analysis

Time and Space Complexity, Different Asymptotic notations big O,Ω,$^{\emptyset}$, Little o,,ω andtheirmathematical significance and proof.

Module 2: Algorithm Design by Divide and Conquer

Basic concept of divide and conquer, Merge sort, Quick sort, heap sort and theircomplexity analysisin best case, worst case and average case.

Module 3: Disjoint Set Data Structure

Set Manipulation Algorithm by Union-Find, Union by Rank, Path Compression

Module 4: Algorithm Design by Greedy Strategy

Basic concept, Activity Selection Problem, Fractional Knapsack problem, Jobsequencing withdeadline, Prims, Kruskal.

Module 5: Algorithm Design by Dynamic Programming

Basic concept, 0/1 Knapsack Problem, Matrix Chain Multiplication, All Pair Shortest Path -FloydWarshall Algorithm, Dijkstra's Algorithm.

Module 6: Algorithm Design by Backtracking

Basic concept, Use - N-Queen Problem, Graph Coloring Problem, Hamiltonian Path Problem

Suggested Reading-

E.Horowitz and Sahni	Fundamentals of Computer Algorithms
Gajendra Sharma	Design & Analysis of Algorithms

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T. H. Cormen, C. E. Leiserson, R. L. Rivestand C. Stein	Introduction to Algorithms

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Ethical Hacking and Systems Defence

Credits- 3T +2P

Course Code – FYCYS 402(Theory), FYCYS 492 (Practical)

Course Objective: The course is designed to provide an elaborate idea about the different system hacking techniques with proper ethics and applying system defencetechniques.

Sl	Course Outcome
1	Apply experiment with ethical hacking.
2	Apply experiment with system hacking.
3	Make use of TCP/IP overview concepts and port scanning.
4	Analyse desktop and server operating systems(OS)vulnerabilities.
5	Assess details of system and network security.
6	Inspect vulnerabilities in OS.

Theory

Modules	Headline	TotalHours	%age of questions	Blooms Level
M1	Introduction to Ethical Hacking	10	25	2,3,4
M2	System Hacking	14	25	2,3,4
M3	TCP/IP-OverviewConcepts and PortScanning	14	30	2,3,4
M4	Desktop and Server OS Vulnerabilities	10	20	2,3,4
		48	**100**	

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Practical

Modules	Headline	Total Hours	%age of questions	Bloom s Level
M5	System and Network Security	24	60	2,3,4
M6	Identifying vulnerabilities in OS	24	40	2,3,4
		58	**100**	

Theory (Course Code – FYCYS402) and Practical (Course Code – FYCYS 492) :

MODULE 1: INTRODUCTION TO ETHICAL HACKING:

Introduction: Hacking/ Ethical hacking, Types of Hacking/Hackers, Cybercrime, Types of cybercrime, Hacker Mind set, Threats, Concept of ethical hacking, Phases involvedin ethical hacking, Role of Ethical Hacking, Common Hacking Methodologies, Profilesof Hackers, Benefits of Ethical Hacking, Limitations of Ethical Hacking, Foot printing- Social Engineering-Scanning and enumeration

MODULE 2: SYSTEM HACKING:

System hacking, Types of System hacking, ha4cking tools, Computer Hole, Hacking Process,Various methods of password cracking, Remote Password Guessing, Role of eavesdropping, Keystroke Loggers, Types of Keystroke Loggers, Detection, Prevention and Removal, Rootkits-Trojans-Backdoors-Viruses and worms, sniffers- denial of service-Session hijacking.

MODULE 3: TCP/IP OVERVIEW CONCEPTS AND PORT SCANNING:

Review of TCP/IP Internetworking, Networking and Security Overview, Attack Methods, Access Control and Site Security, Host Security, Security issues in Internet protocols: TCP, DNS, and routing, Overview of TCP/IP-IP addressing-numbering systems- Introduction to port scanning-types of port scan port scanning tools-ping sweeps- Understanding scripting- Enumeration.

MODULE 4: DESKTOP AND SERVER OS VULNERABILITIES: OS Security Vulnerabilities, Programming Bugs and Malicious code, Windows OS vulnerabilities-toolsfor identifyingvulnerabilities in windows-Linux OS vulnerabilities, vulnerabilities of embedded OS.

MODULE 5: System and Network Security: Desktop Security, Operating System Security: Designing Secure Operating Systems, Understanding routers-understanding firewalls-risk analysis tools for firewalls- understanding intrusion and detection and prevention systems- honeypots, Disaster recovery, Digital Signature, International Standards maintained for Cyber Security, Security Audit, and Investigation by Investing Agency.

MODULE 6: Practical: Identifying vulnerabilities in OS, Computer Forensics, Practical: hacking the server (through virtual machine), Micro Project.

Suggested Readings:

1 Hacking by Harsh Bothra, Khanna Publishing House (AICTE Recommended)
2 Cyber Crime & Its Prevention in Easy Steps by Chatterjee, Khanna Publishing House (AICTE Recommended)
3 Michael T. Simpson, Kent Backman, James Corley —Hands-On EthicalHacking andNetwork Defense‖,2016
4 Steven DeFino, Barry Kaufman, Nick Valenteen —Official Certified EthicalHackerReview Guide‖,2015

REFERENCE BOOKS 1 The Basics of Hacking and Penetration Testing: Ethical Hackingand Penetration Testing Made Easy (Syngress Basics Series)

E BOOKS: https://www.nationalcyberwatch.org/resource/ethical-hacking-systems-defense-nationalcyberwatch-center-edition/

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Cryptography and Information Security

Credits-2T+2P

Course Code – FYCYS 403(Theory), FYCYS 493(Practical)

Course Objective: The course is designed to provide an elaborate idea about thedifferent cryptography techniques, development of key generation algorithms for information protection.

Sl. No.	Course Outcome
1.	Apply the concept of cryptography.
2.	Apply One time pad and stream ciphers.
3.	Apply Block ciphers
4.	Apply message integrity
5.	Apply public key cryptography.
6.	Make use of digital signature and protocols

Theory

Module Number	Headline	Total Hours	%age of questions	Blooms Level
M1	Overview of cryptography, numbersystem	10	20	2,3,4
M2	One time pad andstream ciphers	10	20	2,3,4

M3	Block ciphers, message integrity	14	30	2,3,4
M4	Public key cryptography, digital signature	14	30	2,3,4
		48	100	

Practical

Module Number	Headline	Total Hours	%age of questions	Blooms Level
M5	Arithmetic modulo, programming	28	40	2,3,4
M6	Cryptography algorithm design and programming	30	60	2,3,4
		58	100	

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Theory (Course Code – FYCYS 403) and Practical (Course Code – FYCYS 493)

MODULE 1: Overview of cryptography, number system:

Arithmetic modulo operations, Abstract algebra, modular inverse, mathematicsof SecureCommunications; Classical Cryptosystems etc.

MODULE 2: Classical cryptosystem, one time pad and stream ciphers: Classical Cryptosystems, Substitution Cipher, Play Fair Cipher, Vignere cipher,Introduction tostream cipher, RC4, ARC4 algorithms.

MODULE 3: Block ciphers, message integrity:

Symmetric key encryption, block cipher mode of operations, Fiestel Cipher, DES,AES, 3-DES, useof block cipher,

MODULE 4: Public key cryptography, digital signature:

Public key Cryptosystems Diffie-Hellman key exchange, semantically secure El-Gamal encryption,RSA and other Cryptosystems, Key Exchange Protocols, Hash Functions, Digital signature.

MODULE 5: Arithmetic modulo, programming:

Euclidean Algorithm, Extended Euclidean Algorithm, random number generation andprogramming.

MODULE 6: Cryptography algorithm design and programming:

Polynomial arithmetic, implementation of symmetric and asymmetric keyalgorithms, design ofcryptography algorithms.

Suggested Readings:

William Stallings: Cryptography and Network security, Pearson Education
V.K. Jain: Cryptography and Network security, Khanna Publishing House
Alfred Menezes: Handbook of Applied Cryptography.

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SEMESTER 3

Python Programming & Python Programming Lab

Credits- 3+2

Course Code FYCYS 301 (Theory) + FYCYS 391 (Practical)

Course Objective: The course is designed to provide a working knowledge and skills of programming with Python 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	Explain the basic concepts of Python
2	Explain the different conditions and iterations of Python
3	Explain the concept of recursion, string, dictionary, list and tuples using Python
4	Explain the concept of class and object.

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3	12	20
CO2	2,3	8	20
CO3	2,3	10	30
CO4	2,3	10	30
		40	**100**

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Practical

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3,4	18	20
CO2	2,3,4	12	20
CO3	2,3,4	15	30
CO4	2,3,4	15	30
		60	**100**

Theory (Course Code-FYCYS 301) and Practical (Course Code-FYCYS 391)

Module I: Introduction to Python(12L)

1. Introduction to Python
2. Python variables, expressions, statements
3. Variables, 2.2 Keywords, 2.3 Operators & operands, 2.4 Expressions, 2.5 Statements,
4. 2.6 Order of operations, 2.7 String operations, 2.8 Comments, 2.9 Keyboard input, 2.10 Example programs
5. Functions

Type conversion function, 3.2 Math functions, 3.3 Composition of functions,

3.4 Defining own function, parameters, arguments, 3.5 Importing functions, 3.6Example programs

Module II: Conditions & Iterations(8L)

Conditions

Modulus operator, 1.2 Boolean expression, 1.3 Logical operators, 1.4 if, if-else, if- elif-else, 1.5 Nested conditions, 1.6 Example programs

Iteration

while, 2.2 for, 2.3 break, 2.4 continue, 2.5 Nested loop, 2.6 Example programs

Module III: Recursion, Strings, List, Dictionaries, Tuples(10L)

Recursion

Python recursion, 1.2 Examples of recursive functions, 1.3 Recursion error,

1.4 Advantages & disadvantages of recursion

Strings

Accessing values in string, 2.2 Updating strings, 2.3 Slicing strings, 2.4 String methods – upper(), find(), lower(), capitalize(), count(), join(), len(), isalnum(), isalpha(), isdigit(), islower(), isnumeric(), isspace(), isupper() max(), min(), replace(), split(), 2.5 Example programs

List

Introduction, 3.2 Traversal, 3.3 Operations, 3.4 Slice, 3.5 Methods, 3.6 Delete element, 3.7 Difference between lists and strings, 3.8 Example program

Dictionaries

Introduction, 4.2 Brief idea of dictionaries & lists 5 Tuples (1L)

5.1 Introduction, 5.2 Brief idea of lists & tuples, 5.3 Brief idea of dictionaries & tuples

Module IV: Classes& Objects(10L)

Classes & Objects

Creating class, 1.2 Instance objects, 1.3 Accessing attributes, 1.4 Built in class attributes, 1.5 destroying objects, 1.6 Inheritance, 1.7 Methodoverriding, 1.8 Overloading methods, 1.9 Overloading operators, 1.10 Data hiding, 1.11 Example program

Suggested Readings:

Learn Python The Hard Way, Zed A. Shaw, ADDISON-WESLEY

Introduction to Computing & Problem Solving With PYTHON, Jeeva Jose, Khanna Publishing House (AICTE Recommended Textbook)

Introduction To Python Programming, Venkatesh, Nagaraju Y, Khanna Publishing House (AICTE Recommended Textbook)

Taming PYTHON By Programming, Jeeva Jose, Khanna Publishing House (AICTE Recommended Textbook)

Learning Python, Mark Lutz, O'REILY

Programming In Python, Dr. Pooja Sharma, BPB

Python Programming - Using Problem Solving Approach, Reema Thareja, OXFORD UNIVERSITY PRESS

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Operating Systems and Database Management Systems

Credits- 3T +2P

Course Code – FYCYS 302(Theory), FYCYS 392(Practical)

Course Objective: The course is designed to provide a basic understanding and knowledge of different aspects ofoperating systems and database management system.

SI	Course Outcome (CO)
1	Make use of the basics of operating systems
2	Make use of the concept of process
3	Make use of the concept of resource manager
4	Make use of the concept of data and data management
5	Make use of the concept of data models and architecture
6	Make use of the concept of data modeling using ER modeling
7	Explain the concept of relational model and relational database managementsystem

Theory

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3	3	10
CO2	2,3	10	25
CO3	2,3	8	10
CO4	2,3	4	10
CO5	2,3	6	20
CO6	2,3	7	10
CO7	2,3	7	15
		45	**100**

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Practical

CO	Blooms Level	Total Hours	%age of questions
CO1	2,3,4	3	10
CO2	2,3,4	15	25
CO3	2,3,4	9	10
CO4	2,3,4	6	10
CO5	2,3,4	9	20
CO6	2,3,4	9	10
CO7	2,3,4	9	15
		60	**100**

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Theory (Course Code – FYCYS 302) and Practical (Course Code – FYCYS 392) :

1. Module I: Introduction

Importance of OS, Basic concepts and terminology, Types of OS, Different views, Journey of a command execution, Design andimplementation of OS

2. Module II: Process

Concept and views, OS view of processes, OS services for process management, Scheduling algorithms, Performance evaluation; Inter-process communication and synchronization, Mutual exclusion, Semaphores, Hardware support for mutual exclusion, Queuing implementation of semaphores, Classical problem of concurrent programming, Critical region and conditional critical region, Monitors, Messages, Deadlocks

3. Module III: Resource Manager

Memory management, File management, Processor management, Device management

4. Module IV: Introducing to Data and Data Management

Introduction, Data and Information, Database and Data Base Management System, Components of Database System, Basics of Database Management System, File-based System and Database Management System, Advantages of using Database over File based system, Data Dictionary andMetadata, ANSI-SPARC Architecture, Database Users, Role of Database Administrator (DBA) and Data Administrator(DA), Database Environment, Need for a Database, Characteristics, or Features, or Advantages of Database Systems, Limitations of Database.

5. Module V: Data Models and Architecture of DBMS

Schemas and Instances, DBMS Architecture, Three Level Architecture of Database, Evolution of Data Models, Hierarchical Data Model, Network Data Model, Relational Data Model Object-oriented Data Model, Object-relational Data Model, Data and Structural Independence, Database Languages DDL, DML, DCL, TCL, Database Access, Database Structure

6. Module VI: Data Modeling using ER Modeling

Basic Terminology related to ER Model, Relational Model – Introduction, Advantages and Disadvantages, Identifying Entities, and Relationships, Types of Relationships, Relationship Participation, Notations in ER Model, Strong and Weak entity sets Composite entity, ManagingMany-to-many, Relationship, Example of E-R Model, Types ofIntegrity Constraints, Extended E-R Model, Translating the ER Model into Relational Model, Object Modeling, Subclass and Super class, Specialization, Generalization and Aggregation, Class Diagram

7. Module VII: Relational Model and Relational Database Management System

Introduction,RDBMSTerminology,VariousTypesofKeys,RelationalIntegrityRulesEntityintegrity Rule, referential integrity rule,FunctionalDependency,ArmstrongAxioms,RelationalSetOperators,

Retrieval Operators, CODD's Twelve Rules of Relational Database, ACID properties, Views and their purpose, Database Life Cycle, Data Dictionary, Relational Algebra and relational calculus, exercise on Relational calculus and relational algebra, Comparisons of

relational algebra and calculus Tuple Relational Calculus, Domain Relational Calculus, IntroductiontoSQL

Suggested Readings:

1. Operating System Concpets, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook)
2. Operating Systems, Galvin, John Wiley
3. Operating Systems , Milankovic,TMH
4. An Introduction to Operating System, Bhatt,PHI
5. Korth, Silberschatz, Sudarshan – Database System Concepts; Tata Mc. Graw Hill
6. R. P. Mahaptra, Databse Management Systems, Khanna Publishing House (AICTE Recommended Textbook)
7. Ramez Elmasri, Shamkant B Navathe - Fundamentals of Database Systems; Pearson
8. C.J. Date - An Introduction to Database Systems, 8e, Pearson Education

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SEMESTER 4

Design and Analysis of Algorithms

Credits- 2T +2P

Course Code – FYCYS 401(Theory), FYCYS 491(Practical)

Course Objective:

1	To be familiar with algorithm complexity analysis.
2	To understand and apply several algorithm design strategies.

Sl.No.	Course Outcome
1.	Discuss Complexity Analysis
2.	Demonstrate Algorithm Design by Divide and Conquer.
3.	Analyse Disjoint Set Data Structure.
4.	Make use of Algorithm Design by Greedy Strategy.
5.	Make use of Algorithm Design by Dynamic Programming
6.	Make use of Algorithm Design by Backtracking.

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Theory

Module Number	Content	Total Hours	%age of questions	Blooms Level
1	Complexity Analysis	8	20	2,3,4
2	Algorithm Design by Divide and Conquer	8	20	2,3,4
3	Disjoint Set Data Structure	8	20	2,3,4
4	Algorithm Design by Greedy Strategy	8	10	2,3,4
5	Algorithm Design by Dynamic Programming	8	10	2,3,4
6	Algorithm Design by Backtracking	8	20	2,3,4
		48	100	

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Practical

Module Number	Content	Total Hours	%age of questions	Blooms Level
2	Implement Merge sort	9	10	2,3,4
2	Implement Quicksort	9	10	2,3,4
2	Find maximum and minimum elements from an array of integers using divide and conquer strategy.	6	10	2,3,4
4	Implement fractional knapsack	6	10	2,3,4
4	Implement Job sequence with deadline	9	10	2,3,4
4	Implement Kruskal's algorithm	9	10	2,3,4
4	Implement Prim's algorithm	9	10	2,3,4
5	Implement Dijkstra's algorithm	9	10	2,3,4
5	Implement Matrix Chain Multiplication	9	10	2,3,4
5	Implement Floyd Warshall Algorithm	9	10	2,3,4
		58	100	

Module 1: Complexity Analysis

Time and Space Complexity, Different Asymptotic notations big O,Ω,$^{\emptyset}$, Little o,,ω andtheirmathematical significance and proof.

Module 2: Algorithm Design by Divide and Conquer

Basic concept of divide and conquer, Merge sort, Quick sort, heap sort and theircomplexity analysisin best case, worst case and average case.

Module 3: Disjoint Set Data Structure

Set Manipulation Algorithm by Union-Find, Union by Rank, Path Compression

Module 4: Algorithm Design by Greedy Strategy

Basic concept, Activity Selection Problem, Fractional Knapsack problem, Jobsequencing withdeadline, Prims, Kruskal.

Module 5: Algorithm Design by Dynamic Programming

Basic concept, 0/1 Knapsack Problem, Matrix Chain Multiplication, All Pair Shortest Path -FloydWarshall Algorithm, Dijkstra's Algorithm.

Module 6: Algorithm Design by Backtracking

Basic concept, Use - N-Queen Problem, Graph Coloring Problem, Hamiltonian Path Problem

Suggested Reading-

E.Horowitz and Sahni	Fundamentals of Computer Algorithms
Gajendra Sharma	Design & Analysis of Algorithms

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T. H. Cormen, C. E. Leiserson, R. L. Rivestand C. Stein	Introduction to Algorithms

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Ethical Hacking and Systems Defence

Credits- 3T +2P

Course Code – FYCYS 402(Theory), FYCYS 492 (Practical)

Course Objective: The course is designed to provide an elaborate idea about the different system hacking techniques with proper ethics and applying system defencetechniques.

Sl	Course Outcome
1	Apply experiment with ethical hacking.
2	Apply experiment with system hacking.
3	Make use of TCP/IP overview concepts and port scanning.
4	Analyse desktop and server operating systems(OS)vulnerabilities.
5	Assess details of system and network security.
6	Inspect vulnerabilities in OS.

Theory

Modules	Headline	TotalHours	%age of questions	Blooms Level
M1	Introduction to Ethical Hacking	10	25	2,3,4
M2	System Hacking	14	25	2,3,4
M3	TCP/IP-OverviewConcepts and PortScanning	14	30	2,3,4
M4	Desktop and Server OS Vulnerabilities	10	20	2,3,4
		48	**100**	

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Practical

Modules	Headline	Total Hours	%age of questions	Bloom s Level
M5	System and Network Security	24	60	2,3,4
M6	Identifying vulnerabilities in OS	24	40	2,3,4
		58	**100**	

Theory (Course Code – FYCYS402) and Practical (Course Code – FYCYS 492) :

MODULE 1: INTRODUCTION TO ETHICAL HACKING:

Introduction: Hacking/ Ethical hacking, Types of Hacking/Hackers, Cybercrime, Types of cybercrime, Hacker Mind set, Threats, Concept of ethical hacking, Phases involvedin ethical hacking, Role of Ethical Hacking, Common Hacking Methodologies, Profilesof Hackers, Benefits of Ethical Hacking, Limitations of Ethical Hacking, Foot printing- Social Engineering-Scanning and enumeration

MODULE 2: SYSTEM HACKING:

System hacking, Types of System hacking, ha4cking tools, Computer Hole, Hacking Process,Various methods of password cracking, Remote Password Guessing, Role of eavesdropping, Keystroke Loggers, Types of Keystroke Loggers, Detection, Prevention and Removal, Rootkits-Trojans-Backdoors-Viruses and worms, sniffers- denial of service-Session hijacking.

MODULE 3: TCP/IP OVERVIEW CONCEPTS AND PORT SCANNING:

Review of TCP/IP Internetworking, Networking and Security Overview, Attack Methods, Access Control and Site Security, Host Security, Security issues in Internet protocols: TCP, DNS, and routing, Overview of TCP/IP-IP addressing-numbering systems- Introduction to port scanning-types of port scan port scanning tools-ping sweeps- Understanding scripting- Enumeration.

MODULE 4: DESKTOP AND SERVER OS VULNERABILITIES: OS Security Vulnerabilities, Programming Bugs and Malicious code, Windows OS vulnerabilities-toolsfor identifyingvulnerabilities in windows-Linux OS vulnerabilities, vulnerabilities of embedded OS.

MODULE 5: System and Network Security: Desktop Security, Operating System Security: Designing Secure Operating Systems, Understanding routers-understanding firewalls-risk analysis tools for firewalls- understanding intrusion and detection and prevention systems- honeypots, Disaster recovery, Digital Signature, International Standards maintained for Cyber Security, Security Audit, and Investigation by Investing Agency.

MODULE 6: Practical: Identifying vulnerabilities in OS, Computer Forensics, Practical: hacking the server (through virtual machine), Micro Project.

Suggested Readings:

1 Hacking by Harsh Bothra, Khanna Publishing House (AICTE Recommended)
2 Cyber Crime & Its Prevention in Easy Steps by Chatterjee, Khanna Publishing House (AICTE Recommended)
3 Michael T. Simpson, Kent Backman, James Corley —Hands-On EthicalHacking andNetwork Defense‖,2016
4 Steven DeFino, Barry Kaufman, Nick Valenteen —Official Certified EthicalHackerReview Guide‖,2015

REFERENCE BOOKS 1 The Basics of Hacking and Penetration Testing: Ethical Hackingand Penetration Testing Made Easy (Syngress Basics Series)

E BOOKS: https://www.nationalcyberwatch.org/resource/ethical-hacking-systems-defense-nationalcyberwatch-center-edition/

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Cryptography and Information Security

Credits-2T+2P

Course Code – FYCYS 403(Theory), FYCYS 493(Practical)

Course Objective: The course is designed to provide an elaborate idea about thedifferent cryptography techniques, development of key generation algorithms for information protection.

Sl. No.	Course Outcome
1.	Apply the concept of cryptography.
2.	Apply One time pad and stream ciphers.
3.	Apply Block ciphers
4.	Apply message integrity
5.	Apply public key cryptography.
6.	Make use of digital signature and protocols

Theory

Module Number	Headline	Total Hours	%age of questions	Blooms Level
M1	Overview of cryptography, numbersystem	10	20	2,3,4
M2	One time pad andstream ciphers	10	20	2,3,4

M3	Block ciphers, message integrity	14	30	2,3,4
M4	Public key cryptography, digital signature	14	30	2,3,4
		48	100	

Practical

Module Number	Headline	Total Hours	%age of questions	Blooms Level
M5	Arithmetic modulo, programming	28	40	2,3,4
M6	Cryptography algorithm design and programming	30	60	2,3,4
		58	100	

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Theory (Course Code – FYCYS 403) and Practical (Course Code – FYCYS 493)

MODULE 1: Overview of cryptography, number system:

Arithmetic modulo operations, Abstract algebra, modular inverse, mathematicsof SecureCommunications; Classical Cryptosystems etc.

MODULE 2: Classical cryptosystem, one time pad and stream ciphers: Classical Cryptosystems, Substitution Cipher, Play Fair Cipher, Vignere cipher,Introduction tostream cipher, RC4, ARC4 algorithms.

MODULE 3: Block ciphers, message integrity:

Symmetric key encryption, block cipher mode of operations, Fiestel Cipher, DES,AES, 3-DES, useof block cipher,

MODULE 4: Public key cryptography, digital signature:

Public key Cryptosystems Diffie-Hellman key exchange, semantically secure El-Gamal encryption,RSA and other Cryptosystems, Key Exchange Protocols, Hash Functions, Digital signature.

MODULE 5: Arithmetic modulo, programming:

Euclidean Algorithm, Extended Euclidean Algorithm, random number generation andprogramming.

MODULE 6: Cryptography algorithm design and programming:

Polynomial arithmetic, implementation of symmetric and asymmetric keyalgorithms, design ofcryptography algorithms.

Suggested Readings:

William Stallings: Cryptography and Network security, Pearson Education
V.K. Jain: Cryptography and Network security, Khanna Publishing House
Alfred Menezes: Handbook of Applied Cryptography.