NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)
Kumaracoil, Thuckalay

DEPARTMENT OF INFORMATION TECHNOLOGY

B.Sc. CYBER FORENSICS

CURRICULUM AND SYLLABI

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation: 2021

Curriculum and Syllabi

B.Sc Degree Programme

DEPARTMENT OF INFORMATION TECHNOLOGY

B.Sc. CYBER FORENSICS

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Information and Computer Engineering

Department of Information Technology

Vision of the Department

The Department envisions emerging as a world class center in creating and disseminating knowledge, and providing students a unique learning experience in Maths, Science, Technology and other areas so as to serve the world and the betterment of mankind.

Mission of the Department

- To provide our students with a rich educational and practical approach to forensic education that will enable them to achieve intellectual and personal growth.
- To enable students to enhance their academic excellence and knowledge through a balanced emphasis on teaching, learning, research and service to the society.
- To inculcate innovative thinking and public awareness among the students to meet the global changes and the challenges arising from the cyber security threats.
- To empower our students to unleash their abilities for the substantial development of the society and to enjoy a safe and secure cyber environment.

Description of the programme

This innovative programme is designed to create graduates specialized in Cyber Forensics having expert, technical and legal knowledge. Those who undergo this programme will be able to make a major contribution to information security and computer forensics investigation.

Programme Educational Objectives - PEO	
PEO-01	To provide a strong basic scientific knowledge in the areas of cyber security with focus on theoretical aspect and practical exposure.
PEO-02	Enable the student to develop expertise and skills to understand the challenges due to cyber security risk and threats.
PEO-03	Develop skills and knowledge to identify solution to counter the cyber security risks and threats.
PEO-04	Equip the students with the latest technology in cyber security solution to make them professionals in the areas of threat detection, threat mitigation, remediation and forensics.
PEO-05	Enable the student to practice ethical and legal practices and perspectives to make them true cyber security professionals.

Graduate Attributes-GA	
GA-1	Foundational Scientific Knowledge Acquire a deep understanding of fundamental principles across core scientific disciplines, including physics, chemistry, biology, and mathematics, providing a strong foundation for further learning and research.
GA-2	Practical Skills and Laboratory Competence Develop hands-on laboratory skills and the ability to conduct experiments, analyze data, and apply scientific methods to real-world problems in various scientific domains.

GA-3	Research and Analytical Thinking Foster research capabilities and critical thinking skills, enabling the design and execution of scientific investigations, interpretation of experimental results, and formulation of evidence-based conclusions.
GA-4	Data Analysis and Statistical Techniques Utilize modern data analysis techniques and statistical tools to interpret experimental data, draw meaningful conclusions, and solve complex scientific and mathematical problems.
GA-5	Interdisciplinary Knowledge and Applications Integrate knowledge from multiple scientific disciplines to approach problems holistically, understanding how different scientific fields contribute to innovation and real-world applications.
GA-6	Environmental Awareness and Sustainability Demonstrate an understanding of environmental issues and the impact of scientific practices on the environment, promoting sustainability and responsible use of natural resources in all scientific endeavors.
GA-7	Ethical Conduct and Scientific Integrity Uphold ethical standards and integrity in scientific research and practice, ensuring honesty, accuracy, and responsibility in data handling, experimentation, and reporting.
GA-8	Communication and Presentation Skills Develop effective communication skills to articulate scientific concepts, research findings, and technical information clearly and concisely to both scientific and non-scientific audiences.
GA-9	Technology Integration and Innovation Apply cutting-edge technologies and tools in scientific experimentation and research, leveraging innovation to drive progress and stay at the forefront of scientific discovery.
GA-10	Lifelong Learning and Adaptability Cultivate a mindset of continuous learning, staying informed about scientific advancements and adapting to new tools, methods, and technologies to remain competitive in a rapidly evolving scientific landscape.

Programme Outcome – POs

Programme Outcomes - PO	
PO-A	Apply the knowledge of maths, science and programming concepts to the problems related with the cyber environment.
PO-B	Ability to identify, formulate and develop solutions to computational challenges.
PO-C	Identify and examine the current and emerging concepts, practices and tools in the forensics field.
P0-D	Gain knowledge to assess the various threats and security issues relevant to the cyber environment.

PO-E	Demonstrate critical thinking by analyzing situations and by constructing and selecting solutions to complex problems.
PO-F	Understand and appreciate the legal and ethical environment impacting individuals and have an understanding of the ethical implications of IT legal decisions.
PO-G	Work effectively as an individual and also a member/leader in multidisciplinary teams.
PO-H	Apply the techniques, skills and modern tools necessary for their projects.
PO-I	Recognize the need for specialized advancement by engaging in lifelong learning.
PO-J	Impart knowledge of contemporary issues about society and environment.

Mapping of Graduate Attributes and Programme Educational Objectives (PEO)

GAs / PEOs	**GA-01**	**GA-02**	**GA-03**	**GA-04**	**GA-05**	**GA-06**	**GA-07**	**GA-08**	**GA-09**	**GA-10**
PEO-01	H	H	H	H	H	H	H	H	H	H
PEO-02	A	A	H	A	A	A	A	H	A	H
PEO-03	A	A	H	A	A	A	A	H	A	H
PE0-04	H	H	H	H	H	A	H	H	H	H
PEO-05	A	A	A	A	A	A	H	A	A	A

H- Highly Associated A- Associated Not – Not Associated

Mapping of Graduate Attributes and Programme Outcomes (PO)

GAs / POs	**GA-01**	**GA-02**	**GA-03**	**GA-04**	**GA-05**	**GA-06**	**GA-07**	**GA-08**	**GA-09**	**GA-10**
PO-A	H	H	H	H	H	H	H	H	H	H
PO-B	H	H	H	H	H	A	A	H	H	H

PO-C	H	H	H	H	H	A	A	H	H	H
P0-D	H	H	H	H	H	A	A	H	H	H
PO-E	H	H	H	H	H	A	A	H	H	H
PO-F	A	A	A	A	A	A	H	A	A	A
PO-G	H	H	H	H	H	A	A	H	H	H
PO-H	H	H	H	H	H	A	A	H	H	H
PO-I	H	H	H	H	H	A	A	H	H	H
PO-J	H	H	H	H	H	H	A	H	H	H

H- Highly Associated A- Associated Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes (POs)

PEO / PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-A	H	H	H	H	H
PO-B	H	H	H	H	H
PO-C	H	H	H	H	H
P0-D	H	H	H	H	H
PO-E	H	H	H	H	H
PO-F	A	A	A	A	H
PO-G	H	H	H	H	H
PO-H	H	H	H	H	H

PO-I	H	H	H	H	H
PO-J	H	H	H	H	H

H- Highly Associated A- Associated Not – Not Associated

Duration of the program: 3 Years/6 Semesters

Total credits : 122

CURRICULUM & SYLLABI

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3601	English I	3	1	0	4
2.	MA3605	Discrete Mathematics	3	1	0	4
3.	CF3601	Introduction to Computer Software and Hardware	3	0	0	3
4.	CF3602	Data structures using C++	3	1	0	4
5.	CF3603	Python Programming	3	1	0	4
PRACTICAL						
6.	CF3671	Data structures using C++ Lab	0	0	4	2
7.	CF3672	Python Lab	0	0	4	2
TOTAL			**15**	**4**	**8**	**23**

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3602	English II	3	1	0	4
2.	MA3606	Mathematical Foundations of Computer Science	3	1	0	4
3.	CF3604	Operating Systems and System Software	3	1	0	4
4.	CF3605	Foundations of Data communication	3	0	0	3
5.	CF3606	Fundamentals of Java Programming	3	1	0	4
PRACTICAL						
6.	CF3673	Operating System and Networks Lab	0	0	4	2
7.	CF3674	Fundamentals of Java Programming Lab	0	0	4	2
TOTAL			**15**	**4**	**8**	**23**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	MA3607	Fundamentals of Statistics	3	1	0	4
2	CF3607	Software Engineering	3	0	0	3
3	CF3608	PHP Programming	3	1	0	4
4	CF3609	Cyber Forensics Basics	3	0	0	3
5	GE3602	Environmental Studies	2	0	0	2

PRACTICAL						
6	CF3675	Cyber Forensics Laboratory	0	0	4	2
7	CF3676	PHP Programming Laboratory	0	0	4	2
TOTAL			14	2	8	20

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1	CF3610	Networks and Information Security	3	0	0	3
2	CF3611	File System Forensic Analysis	3	0	0	3
3	CF3612	Ethical Hacking	3	1	0	4
4	CF3613	OS Forensics	3	1	0	4
5	CF3614	Web Technology	3	0	0	3
PRACTICAL						
6	CF3677	Computer Security Laboratory	0	0	4	2
7	CF3678	Web Technology Laboratory	0	0	4	2
TOTAL			15	2	8	21

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CF3615	Recovery and Preservation of Digital Evidence	3	0	0	3
2.	CF3616	Database Security	3	1	0	4
3.	CF3617	Cyber Forensics and Incident Response	3	0	0	3

4.	CF3618	Cyber Law, Security policies and Ethics	3	0	0	3
5.	*****	Elective I	3	0	0	3
PRACTICAL						
6.	CF3679	Ethical Hacking Lab	0	0	4	2
7.	CF3680	Database security Lab	0	0	4	2
TOTAL			15	2	8	20

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CF3619	Fundamentals of Cloud Computing	3	0	0	3
2.	CF3620	Mobile and Wireless Technology and Security	3	0	0	3
3.	*****	Elective II	3	0	0	3
PRACTICAL						
4.	CF36P1	Project	0	0	12	6
TOTAL			9	0	12	15

ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CF36A1	Vulnerability Assessment and Penetration Testing	3	0	0	3
2.	CF36A2	Cyber Security and Forensic Tools	3	0	0	3
3.	CF36A4	Biometric Security				

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3601	English I	3	1	0	4
2.	MA3605	Discrete Mathematics	3	1	0	4
3.	CF3601	Introduction to Computer Software and Hardware	3	0	0	3
4.	CF3602	Data structures using C++	3	1	0	4
5.	CF3603	Python Programming	3	1	0	4
PRACTICAL						
6.	CF3671	Data structures using C++ Lab	0	0	4	2
7.	CF3672	Python Lab	0	0	4	2
TOTAL			**15**	**4**	**8**	**23**

EG3601	ENGLISH-I	L	T	P	C
		3	**1**	**0**	**4**

OBJECTIVES

- To make the students acquire basic knowledge in English with communicative competence
- To enable them to develop their communication skills effectively
- To make them get exposure to English prose, poetry, short story and grammar

Course Outcomes		Cognitive Skill
CO-01	The students will be able to learn the various themes, styles and the nuances of modern English prose written by great masters of prose writing in the 20th century.	R
CO-02	The students will be able to grasp the poetic language, the rhythm and cadence of poetry, and the themes and styles of different masters of English poetry.	U

CO-03	The students will be able to understand the elements of short story, narrative techniques employed and its brevity and wisdom from the great masters of story-telling.	An
CO-04	The students will learn basic grammar and vocabulary that will enrich their communicative competence.	R
CO-05	The students will learn the format, the basics and the requirements of Letter Writing, understand the different types of letters, their characteristics and the formalities involved in writing, and also learn how to skim and scan passages for comprehension.	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	M	S	M	M	S	S	S	M
CO-02	M	S	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	S	M
CO-04	S	M	S	M	S	S	M	S
CO-05	S	S	M	M	S	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Prose: A Galaxy of Precious Prose: (Detailed) 12

1. Spoken English and Broken English – George Bernard Shaw
2. Reading for Pleasure – L. A. G. Strong
3. University Days – James Thurber
4. The Model Millionaire – Oscar Wilde
5. On Forgetting – Robert Lynd

Unit II: Poetry: Harmony (Detailed) 12

1. The Solitary Reaper – William Wordsworth
2. Stopping by Woods on a Snowy Evening – Robert Frost
3. Enterprise – Nissim Ezekiel
4. Lead, Kindly Light – Cardinal Newman
5. Where the mind is without fear – Rabindranath Tagore

Unit III: Short Story: Popular Short Stories (Non–Detailed) 6

1. The Gift of the Magi – O. Henry
2. The Ant and the Grasshopper – W. Somerset Maugham
3. The Mark of Vishnu – Kushwant Singh

Unit IV: Grammar **6**

1. **FUNCTIONAL ENGLISH** – Parts of Speech, Articles, Prepositions, Auxiliaries and Modals, Agreement of Subject with Verb

2. **VOCABULARY** – Antonyms, Synonyms, Suffixes, Prefixes, One Word Substitutes, Odd Words Out

Unit V **9**

Basics of Letter Writing – Reading Comprehension

T: 15 + L: 45 = TOTAL: 60 HOURS

BOOKS RECOMMENDED

1. Galaxy of English Prose, Ed. Dr. B. Symala Rao, Blackie Books, Madras.
2. An Anthology of Poems, Harmony, Ed. Biyot K. Tripathy.

MA3605	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVES

- To extend student's Logical and Mathematical maturity
- Ability to deal with abstraction
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

Course Outcome		Cognitive Skill
CO-01	Recognize graph models and its application in technical sectors	R
CO-02	Know about the shortest path algorithm for solving real life situation	U
CO-03	Gain knowledge about various Cryptosystem for securing data	A
CO-04	Know about Product of two Posets and its applications	U
CO-05	Understand the Minimal spanning tree and algorithms	R

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-J
CO-01	S	M	M	L	S	S	L	S	S
CO-02	S	S	M	S	M	S	M	M	M
CO-03	S	S	S	S	M	M	M	M	S
CO-04	S	S	L	S	M	M	M	M	S
CO-05	S	S	M	L	S	M	L	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Graph Theory **9**

An introduction to graph, Definition of a Graph, Graphs as models, More definitions, Vertex Degrees, Sub graphs, Paths and cycles The matrix representation of graphs (definition and example only) Trees, Binary trees, Binary search trees and traversals.

Unit II: Euler Tours and Hamiltonian Cycles **9**

Euler's paths and cycles, Hamiltonian paths and cycles, Minima's Path Application (Flow charts and state transition Graphs, Algorithm for determining cycle and minimal paths.

Unit III: Introduction to Cryptography **9**

From Caesar Cipher to Public key Cryptography, the Knapsack Cryptosystem.

Unit IV: Poset and Lattices **9**

Diagrammatical Representation of a Poset , Isomorphism, Duality, Product of two Posets, Lattices, Semi lattices, Complete Lattices, Sub lattices.

Unit V: Network Models **9**

Shortest Route Algorithm-Minimal Spanning tree- Prim's Algorithm and Kruskal's algorithm - Maximal Flow Models-Ford Fulkurson's Algonthm

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers
2. David M Burton - Elementary Number Theory 6th Edition TMH
3. VijayK.Khanna-LatticesandBooleanAlgebras-FirstConcepts,VikasPublishingHouse Pvt. Ltd
4. Kenneth H.Rosan,"Discrete Matematics and its apllicatuions",fifth edition,TataMcgrawHill,2003(UNITV)

REFERENCES

1. Douglas B West Peter Grossman - Introduction to Graph Theory
2. W.D.Wallis - A Biginner's Guide to Discrete Mathematics, Springer
3. R. Balakrishnan, K. Ranganathan - A textbook of Graph Theory, Springer International Edition
4. S.Arumugham, S. Ramachandran - Invitation to Graph Theory, Scitech. Peter Grossman,
5. J.K Sharma - : Discrete Mathematics (2nd edition),(Macmillion)
6. S. A. Choudam –A First Course in Graph Theory (Macmillian)Theory (Macmillian)

CF3601	INTRODUCTION TO COMPUTER SOFTWARE AND HARDWARE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give students an in-depth understanding of why computers are essential components in business, education and society.
- To introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
- To provide hands-on use of Microsoft Office applications Word, Excel, Access and Power-Point.
- To Provide foundational or "computer literacy" curriculum that prepares students for life- long learning of computer concepts and skills.

Course Outcome		Cognitive Skill
CO-01	The students will be able to describe the usage of computers and why computers are essential components in business and society.	R
CO-02	The students will be familiarized with the interfacing of the computers by using different input and output devices	U
CO-03	The students will be able to understand the concepts of data processing and the measures which influence the processing speed of the computer.	U
CO-04	The students will be able to understand the various storage devices for the storage of information in a computer system	U
CO-05	The students will be able to describe the types of PC-operating systems and various types of networks and also to familiar with the use of web resources to evaluate on line e- business system.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	S	M	L	L	S	S	S	S
CO-02	S	M	S	L	M	L	S	M	S	S
CO-03	S	M	S	L	M	L	S	M	S	M
CO-04	S	M	S	L	M	L	S	M	S	S
CO-05	S	S	S	N	M	M	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I **9**

Introduction: Parts of Computer System- Hardware, Software, Data, Users, Different types of computers, Characteristics of computers, Computer Languages-Machine, Assembly Language and Higher Level languages - 3GL, 4GL,5GL

Unit II **9**

Interacting with Computers:-Input Devices - Key Board, Mouse, Variants of Mouse, Hand held devices, Optical Input devices. Output Devices: Monitors, Sound Systems, and Printers.

Unit III **9**

Data Processing: Representation of data, processing of data - The CPU, Memory-different types of RAM and ROM, Factors affecting speed

Unit IV **9**

Storing Information in a Computer: Types of Storage Devices - Magnetic Storage Devices, Data storage and organization on a Magnetic Disk, Finding data on a disk -Diskettes - Hard Disks- Tape drives- Optical Storage devices, Solid state storage devices

Unit V **9**

Operating Systems and Networking: Definition of an Operating System - Different types of PC Operating Systems. Computer Networks uses - categories of networks - LAN, WAN, PC Components and assembling, different cards in the PC, The Internet - Working of Internet - Major Features of Internet-Brief idea of multimedia.

TOTAL: 45 HOURS

TEXT BOOK

1. Peter Nortons, Introduction to Computers, Sixth Edition, Published by Tata McGraw Hill

REFERENCES

1. P K Sinha and Priti Sinha, Computer Fundamentals, Fourth Edition.
2. Introduction to Computer Science, ITL Education Solutions limited.
3. CraigZackerandJohnrourke, TheCompleteReference–PCHardware, Edition2001, Tata McGrawHill

CF3602	DATA STRUCTURES USING C++	L	T	P	C
		3	1	0	4

OBJECTIVES

- To learn the systematic way of solving problems
- To understand the different methods of organizing large amounts of data
- To learn to program in C++
- To efficiently implement the different data structures
- To efficiently implement solutions for specific problems

Course Outcome		Cognitive Skill
CO-01	Students develop ability to understand the basic concepts of OOP's, basics of C++ programming and generate the skill in writing simple C++ programs	U
CO-02	Students develop knowledge about operation and function overloading, inheritance pointers and file handling	U
CO-03	Students understand the behavior of basic data structures, learn to formulate new solutions for programming problems and improve existing code using learned algorithms and data structures.	A

CO-04	Students develop ability to understand and apply the concepts of stacks ,queues and linked list in solving computer problems	A
CO-05	Students develop knowledge in nonlinear data structures, sorting and searching and learn to utilize it against different data types and records and design algorithms for solving real life problems	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO- J
CO-01	S	S	S	S	S	L	S	S	S	M
CO-02	S	S	S	L	M	L	S	S	S	M
CO-03	S	S	M	M	M	L	S	S	S	M
CO-04	S	S	M	M	M	L	S	S	S	M
CO-05	S	S	M	M	M	L	S	S	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I **9**

Introduction to object oriented concepts, features of object oriented programming, C++ programming basics, Data types, operators, precedence of operators, control flow, functions, arrays. Classes and objects, constructors, destructors, objects as function arguments, inline functions, friend functions, friend classes, array of objects.

Unit II **9**

Overloading, operator overloading, function overloading, Inheritance, forms of inheritance, Virtual functions, pointers, new and delete, pointers with in a class, pointers to objects, array of pointers to objects, polymorphism, virtual function, pure virtual function, abstract classes , late binding, early binding, the this pointer, Files and streams, file modes, file pointers, file input/output ,command line arguments, templates, exception handling.

Unit III **9**

Introduction to Data Structure, Basic Terminology, Data Structure Operations; Algorithm: Definition, Algorithm Analysis, Complexity, Asymptotic Notation, Recursion. Array: Introduction, Linear Arrays, Representation of Linear Arrays in Memory, operations; Multidimensional Arrays.

Unit IV **9**

Stack: Introduction, Array Representation and Basic Operations; Implementation of Stacks. Application of Stacks-Evaluating Arithmetic Expression using Stacks -Infix to Postfix Notation.- Evaluating a Postfix Notation- Queue: Introduction, Implementation of Queue, Priority Queue, Dequeue , Linked List: Introduction, Representation of Linked List, operations in Linked List, Doubly and Circular Linked List.

Unit V **9**

Non Linear Data Structures and Algorithms: Trees - Introduction, Binary Trees, Representation, Traversing and its Algorithms, Sorting: Bubble sort, Insertion sort, Selection

sort, Heap sort, Quicksort, Mergesort; Comparison of sorting algorithms-Searching: Linear Search, Binary Search; Comparison of searching algorithms.

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. E. Balaguruswamy, Object Oriented Programming in C++
2. Seymour Lipschutz , Schaum's Outline Series: Theory and Problems of Data Structures.

REFERENCES

1. Jean-Paul Tremblay and G.Sorenson, Introduction to data structures with application.
2. Data structures using C and C++, Tanenbaum, Schaums Outline series, Programming in C++
3. Stroustrup, Bjarne, The C++ Programming Language , Addison Wesley

CF3603	PYTHON PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVES

- To know the basics of algorithmic problem solving
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python

Course Outcome		Cognitive Skill
CO-01	Develop algorithmic solutions to simple computational problem.	An
CO-02	Structure simple Python programs for solving problems.	A
CO-03	Decompose a Python program into functions.	E
CO-04	Represent compound data using Python lists, tuples, and dictionaries.	An
CO-05	Read and write data from/to files in Python Programs.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO- J
CO-01	S	S	M	M	L	M	S	M	M	S
CO-02	S	M	S	S	N	L	L	M	S	S
CO-03	S	S	M	M	M	S	L	M	M	M
CO-04	S	S	S	S	S	L	S	S	S	M
CO-05	M	M	S	M	S	S	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Algorithmic Problem Solving **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flowchart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Unit II: Data, Expressions, Statements **9**

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Unit III: Control Flow, Functions **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if- else-if); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, mutability, string functions and methods, string module; Lists as arrays, Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Unit IV: Lists, Tuples, Dictionaries **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing-list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

Unit V: Files, Modules, Packages **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition,UpdatedforPython3,Shroff/O'ReillyPublishers,2016(http://greenteapress.com/wp/think- python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,2011.

REFERENCES

1. John V Guttag, —Introduction to Computation and Programming Using Python",Revised and expanded Edition, MIT Press ,2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python:AnInter-disciplinaryApproach,PearsonIndiaEducationServicesPvt.Ltd.,2016.
3. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,,2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning,

2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition,2013.
6. PaulGries,JenniferCampbellandJasonMontojo,—PracticalProgramming:AnIntroduc- tion to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

CF3671	DATA STRUCTURES USING C++ LAB	L	T	P	C
		0	0	4	2

OBJECTIVES

- To teach the students to write programs in C++
- To implement the various data structures as Abstract Data Types
- To write programs to solve problems using the ADTs

Course Outcome		Cognitive Skill
CO-01	The student should be able to implement the basic OOPs like inheritance, abstraction, encapsulation, dynamic binding and polymorphism.	A
CO-02	The student should be able implement stack operations using PUSH and POP operations and the operations of queue.	A
CO-03	The student should be able to implement linked list.	A
CO-04	The student should be able to implement binary search traversals.	A
CO-05	The student should be able to implement searching and sorting techniques	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO-J
CO-01	S	M	M	S	S	L	S	S	S	S
CO-02	S	M	M	S	S	L	S	S	S	S
CO-03	S	M	M	M	S	L	S	S	S	S
CO-04	S	M	M	M	S	M	S	S	S	S
CO-05	S	S	S	S	M	M	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. C++ Programs to implement member functions, overloading, inheritance
2. Implement PUSH, POP operations of stack using Arrays.
3. Implement add, delete operations of a queue using Arrays.
4. Creation, insertion, and deletion in singly linked list.
5. Binary Search tree traversals (in-order, pre-order, and post-order).

6. Searching techniques - Linear search , Binary search
7. Sorting techniques - Selection, Bubble, Insertion, Quick, Heap, Merge.

TOTAL: 45 HOURS

CF3672	PYTHON LAB	L	T	P	C
		0	0	4	2

OBJECTIVES

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python.

Course Outcome		Cognitive Skill
CO-01	Student should able to write basic computational program and execute it	A
CO-02	Students should able to do basic searching algorithm	A
CO-03	Student should able to develop searching and sorting algorithm	An
CO-04	Student should able to do matrix multiplication and word count programming	An
CO-05	Student should able to do with file and game programming	E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	N	S	N	M	M	L	L
CO-02	S	S	S	N	S	N	M	M	L	L
CO-03	S	S	S	N	S	N	M	M	L	L
CO-04	S	S	S	N	S	N	M	M	L	L
CO-05	S	S	S	N	S	N	M	M	L	L

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Compute addition/subtraction of numbers.
2. Find the square root of a number
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. A simple sorting program
7. First n prime numbers
8. Multiply matrices
9. Programs that take command line arguments (word count).
10. Find the most frequent words in a text read from a file.
11. A game program using Pygame.

TOTAL: 45 HOURS

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3602	English II	3	1	0	4
2.	MA3606	Mathematical Foundations of Computer Science	3	1	0	4
3.	CF3604	Operating Systems and System Software	3	1	0	4
4.	CF3605	Foundations of Data communication	3	0	0	3
5.	CF3606	Fundamentals of Java Programming	3	1	0	4
PRACTICAL						
6.	CF3673	Operating System and Networks Lab	0	0	4	2
7.	CF3674	Fundamentals of Java Programming Lab	0	0	4	2
TOTAL			**15**	**4**	**8**	**23**

EG3602	ENGLISH-II	L	T	P	C
		3	1	0	4

OBJECTIVES

1. To make the learners acquire basic knowledge in English with communicative competence
2. To enable them to communicate effectively in English
3. To make them understand and assimilate the genres of poetry , prose, and short story and grammar

Course Outcomes		Cognitive Skill
CO-01	The students will able to grasp the themes, styles and diverse subjects of the prose written by Indian and English Authors of the 20th century.	R
CO-02	The students will be able to understand the depth and variety of English Poetry from Shakespeare to Sarojini Naidu in different shades.	U
CO-03	The students will have an exposure to short stories with great themes by some of the great Indian and European masters of story telling.	U
CO-04	The students will be able to learn the different varieties of vocabulary such as homonyms, and the fundamentals of English grammar such as Tense, Voice etc.,, the one for vocabulary enrichment and the other for improvement of functional English.	E
CO-05	The students will be able to understand Non-verbal Communication and its important elements such as facial expression, gestures, postures etc. in all their details.	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	S	M	M	M	M	S	M
CO-02	M	S	M	M	S	M	M	M
CO-03	M	M	S	M	M	S	M	M
CO-04	S	M	M	S	M	M	M	M
CO-05	M	S	M	M	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Prose: A Galaxy of Precious Prose :(Detailed) **12**

1. On Saying Please – A. G. Gardiner
2. My visions for India – A. P. J. Abdul Kalam
3. Water the Elixir of Life – C. V. Raman
4. An Astrologer's Day – R. K. Narayan
5. Hazards of Sensual Drugs – Hardin B. Jones

Unit II: Poetry : Harmony (Detailed) **12**

1. La Belle Dame Sans Merci – John Keats
2. All the World's a Stage – William Shakespeare
3. Palanquin Bearers – Sarojini Naidu
4. Tithonus – Alfred Lord Tennyson
5. If – Rudyard Kipling

Unit III: Short Story :Popular Short Stories (Non–Detailed) **6**

1. The Necklace – Guy De Maupassant
2. The World Renowned Nose – Vaikkam Muhammad Basheer

3. The Selfish Giant – Oscar Wilde

Unit IV: Grammar **6**

1. FUNCTIONAL ENGLISH – Tense, Active Voice, Passive Voice, Conditional Clauses, Direct Speech, Indirect Speech

2. VOCABULARY – Homonyms, Homophones, Word Formation - Derivatives

Unit V: Non-Verbal Communication **9**

Facial Expressions – Eye Contact – Posture – Gestures – Paralanguage – Proxemics – Use of Body– Body Movements or Kinesics – Physiological Changes

T: 15 + L: 45 = TOTAL: 60 HOURS

BOOKS RECOMMENDED

1. Galaxy of English Prose, Ed. Dr. B. Symala Rao, Blackie Books, Madras.
2. An Anthology of Poems, Harmony, Ed. Biyot K. Tripathy.

MA3606	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES

- To familiarize symbolic logic concepts
- To learn set theory and its applications
- To learn differentiation and its applications
- To gain concepts of two dimensional geometry

	Course Outcome	Cognitive Skill
CO-01	Translate ordinary English language statements and arguments into symbolic form. Use formal methods of propositional and predicate logic for analyzing the logical structures of ordinary language statements, and for determining the validity of deductive arguments.	R,U,A,An,E
CO-02	Understand the basic principles of sets and operations in sets. Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion.. Demonstrate an understanding of relations and functions and be able to determine their properties. Determine when a function is 1-1 and "onto"	R,U,A,An,E
CO-03	Describe binary relations between two sets .Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations Apply counting principles to determine probabilities. Understand the concept of Boolean Algebra.	R,U,A,An,E
CO-04	Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point. Compare and contrast the ideas of continuity and differentiability. Finding maxima and minima, critical points and inflection points of functions and to determine the concavity of curves.	R,U,A,An,E
CO-05	Study of lines in 2dimension. Finding equation in various form of line, pair of straight lines and circle	R,U,A,An,E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	M	S	M	S	S	S	S	M
CO-02	M	S	M	M	S	M	M	S	M	M
CO-03	M	S	M	M	S	M	M	S	M	M
CO-04	M	M	M	M	M	M	M	M	M	M
CO-05	M	M	S	M	M	M	M	M	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Symbolic Logic **9**

Proposition, Logical operators, conjunction, disjunction, negation, conditional and bi-conditional operators, converse, Inverse, Contra Positive, logically equivalent, tautology and contradiction. Arguments and validity of arguments.

Unit II: Set Theory **9**

Sets, set operations, Venn diagram, Properties of sets, number of elements in a set, Cartesian product, relations and functions, Relations: Equivalence relation. Equivalence class, partially and totally Ordered sets, Functions: Types of Functions, Composition of Functions.

Unit III: Binary Operations **9**

Types of Binary Operations: Commutative, Associative, Distributive and identity, Boolean algebra: simple properties, Permutations and Combinations.

Unit IV: Differentiation **9**

Simple problems using standard limits, Differentiation, successive differentiation, Leibnitz theorem, partial differentiation, Applications of differentiation, Tangent and normal, angle between two curves, Maximum and Minimum values (Second derivative test), Curvature and radius of Curvature (Cartesian coordinates),Envelopes.

Unit V: Two Dimensional Analytical Geometry **9**

Straight Lines – Pair of Straight Lines – Circles.

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. B.S.Grewal,'Higher Engineering Mathematics, Khanna Publishers, 40th Edition.
2. Kenneth H.Rosan,"Discrete Matematics and its apllications",fifth edition,Tata Mcgraw–Hill,2003
3. Manicavachagom pillay and Natarajan. Analytical Geometry part I - Two Dimension - S.Viswanathan (printers and publication) Pvt Ltd.,1991.

REFERENCES

1. P.R.Vittal, Mathematical Foundations – Margham Publication, Chennai.
2. U. Rizwan, Mathematical Foundation - SciTech, Chennai

3. V.Sundaram and Others, Dircrete Mathematical Foundation - A.P.Publication, sirkali.
4. P.DuraipandianandOthers,AnalyticalGeometry2Dimension-Emeraldpublication1992 Reprint.

CF3604	OPERATING SYSTEMS AND SYSTEM SOFTWARE	L	T	P	C
		3	1	0	4

OBJECTIVES

- To introduce operating system as a resource manager, its evolutions and fundamentals.
- To help student understand concept of process and different process (linear and concurrent) Scheduling policies.
- To help student familiar with memory, file and I/O management policies.
- To be familiar with the various system software concepts.
- To help students to understand the linking, binding and compilers.

Course Outcome		Cognitive Skill
CO-01	Understand the role of an operating system, issues and analyze its functions as a resource and system manager.	U, An
CO-02	Able to understand how processes can communicate with each other and the various scheduling algorithms.	U, R
CO-03	Understand the memory and storage management and analyze how the file systems are mounted.	U, An
CO-04	Analyze the different types of software and how assemblers can be designed securely.	An, A
CO-05	Gain knowledge about linking, loading concepts and how these productivity enhancement tools can be utilized effectively to build a secure systems.	A,E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	L	L	S	N	N	L	M	S	S	M
CO-02	M	M	L	S	N	S	S	M	L	N
CO-03	S	N	M	L	M	L	L	L	N	L
CO-04	N	S	L	S	L	M	M	M	M	S
CO-05	L	L	N	M	S	N	N	N	N	N

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I **9**

Definition- Functions- OS as Resource Manager, Types – Structure- Concept of Batch Processing, multi-programming, multi-user Systems and Real-time system, POST Bootstrapping –Kernel.

Unit II **9**

Process management: process concept, process scheduling, operations on processes, cooperating processes, inter process communication, communication in client server systems, threads, overview, multithreading models, CPU scheduling, scheduling criteria, CPU scheduling algorithms, process synchronization, critical-section problem semaphores, deadlocks, prevention, avoidance and detection.

Unit III **9**

Storage Management: memory management, contiguous memory allocation, paging, segmentation, segmentation with paging, virtual memory, demand paging, page replacement. I/O hardware, I/O Software, Disks – Disk Scheduling-File organization, File system implementation, allocation methods, Security, Protection mechanism.

Unit IV **9**

General concepts - system software and application software, Assemblers- Design of assembler, Macros and Macro processor, Macro definitions and Instructions, Features of macro facility, Nested macros calls.

Unit V **9**

Loading, Linking and Relocating- Loading and Linking Schemes- Relocatablity of Programs, Concepts of Binders, Linking Loaders, Overlays, Dynamic Binders, Design of an absolute loader. Compilers – Different phases of compilers.

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts (Addison Wesley)
2. D.M. Dhammdhere, programming and Operating Systems(Tata McGrawHill)

REFERENCES

1. Manick and Donovan ,Operating System (Mc GrawHill)
2. H M Deitel, Operating system (Pearson Education)
3. John J Donovan, System Programming (Tata McGrawHill)

CF3605	FOUNDATIONS OF DATA COMMUNICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts of data communication.
- To explore the data communication devices.
- To study error detection and correction.
- To learn the different layers of communication.
- To know the cables and its configurations.

Course Outcome		Cognitive Skill
CO-01	The students will be able to understand and explain data communications system and its components.	R
CO-02	The students will be able to describe the different error correction and detection methods and also the transmission media.	A
CO-03	The students will be able to describe the functions of data link control and protocols.	U
CO-04	The students will be able to explain the various switching techniques and the aspects of flow control and traffic control.	A
CO-05	The students will be able to understand the functions of upper OSI layers.	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	S	S	S	S	S	S
CO-02	S	S	M	S	L	S	S	S	S	S
CO-03	S	M	L	S	S	S	M	S	S	L
CO-04	M	S	L	S	M	S	S	S	S	L
CO-05	M	S	L	S	L	M	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I : Communication Devices **9**

Digital Data Transmission- DTE- DCE- Interface- Other Interface Standards- Modem- Different Types – Hub – Repeaters – Switches – Routers – Comparison – NIC – Multilayer Devices.

Unit II : Error Detection and Correction **9**

Errors – Types – Detection - Redundancy Check – Vertical – Horizontal – Cyclic – Checksum – Correction - Humming Code - Burst. Wireless Devices and Wired Devices: - Cables for Communication - CAT 5 – UTP - BNC, Optic Transmission and Reception-Different Transmission Modes.

Unit III : Data Link Control **9**

-Line Discipline - ENQ/ACK - Poll/Select - Flow Control - Stop and Wait - Sliding Window - Error Control – ARQ - Different Types. Data Link Protocols - Asynchronous andSynchronousProtocols–Frames-CharacterOriented-BitOriented–HDLC-LinkAccess Procedures.

Unit IV : Switching **9**

Packet–Circuit–Message-Approaches-FrameRelay:-Introduction-Layers- Congestion Control -Traffic Control – Other Features.

Unit V : Upper OSI Layers **9**

Session - Session and Transport Interaction – Synchronization – SPDU – Presentation– Translation-EncryptionandDecryptions–Authentication-DataCompression– Application – MHS – FTAM – VT – DS -CMIP

TOTAL: 45 HOURS

TEXT BOOK

1. Behrouz A. Forouzan,"Data Communication and Networking ".

REFERENCES

1. William Stallings," Data and Computer Communications'
2. Kennedy and Davis," Electronic Communication Systems"
3. Tauband Schilling,"Principles of Communication Systems'

CF3606	FUNDAMENTALS OF JAVA PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVES

- To understand the principles and concepts of object oriented programming
- To learn multithreading concepts
- To Store and retrieve the information from Files.

Course Outcome		Cognitive Skill
CO-01	Describe the correct data types and control statements in program development.	U, R
CO-02	Able to develop program using appropriate classes and methods.	R, A
CO-03	Extend java classes with inheritance and handling exceptions in their program.	A,An
CO-04	Design applications with multi threading and build GUI's using Applets.	A,S
CO-05	Develop a real world programs with the help of java I/O and Strings.	R, A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	M	S	M	M	S	S	M
CO-02	S	S	S	M	S	M	M	S	S	M
CO-03	S	S	S	M	S	M	S	S	S	M
CO-04	S	S	S	M	S	M	S	S	S	S
CO-05	S	S	S	M	S	M	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction to Java **9**

Java History- Features of Java - Object oriented Concept- Data types, variables and arrays- Operators- Control Statements.

Unit II: Classes and Methods **9**

Introducing classes- Class fundamentals- The General form of a class- Declaring Objects- Assigning object reference variables- Introducing method– Constructors- The this Keyword- Garbage Collection- Finalize() method- Overloading methods- Overloading constructors- Using objects as parameters- Returning Objects- Recursion- Introducing access control- Introducing final.

Unit III: Inheritance and Exception Handling **9**

Inheritance: Basics- using Super- method Overriding- Abstract classes-Using final with Inheritance- Object class- Packages-Interfaces-Exception handling fundamentals- Exception types- Using try, catch, throw, throws and finally exceptions.

Unit IV: Multithreading and Applets **9**

Java thread model -Creating thread-Thread priorities-Synchronization-Inter-thread communication- Deadlock- Applet fundamentals- Applet Life Cycle- Creating an Executable Applet- Designing a web page.

Unit V: Java I/O and String Handling **9**

I/O Basics- Reading Console Input- writing Console Output- the Print Writer class- Reading and Writing Files-String constructors- String operations- Character Extraction- String comparison- Searching strings- Modifying a string.

T: 15 + L: 45 = TOTAL: 60 HOURS

TEXT BOOKS

1. Naughton and Schildt.H, ,"Java 2-The complete reference", Fifth Edition, McGraw Hill2002.
2. E.Balagurusamy, "Programming with Java –A Primer", McGraw Hill,2017

REFERENCES

1. Arnold and Gosling.J,(2000),"The Java programming language",Second edition, Addision Wesley.
2. Art Gittleman, (2002), "Ultimate Java Programming", First edition, Wiley Publications.

CF3673	OPERATING SYSTEM AND NETWORKS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES

The student should be made to:

- Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
- Implement memory management schemes and page replacement schemes.
- Simulate file allocation and organization techniques.
- Understand the concepts of deadlock in operating systems and implement them in multi- programming system.
- Understand the different networking concepts like Bit Stuffing, CRCcomputation, ARP/RARP and hamming code.

Course Outcome		Cognitive Skill
CO-01	Understand the process management policies and scheduling of processes by CPU.	U
CO-02	Able to describe and analyze the memory management and its allocation policies.	An
CO-03	Understand to stimulate algorithms for deadlock detection and avoidance	S
CO-04	Able to describe the functions of data link layer.	A
CO-05	Understand the different networking concepts like Bit Stuffing, CRC computation, ARP/RARP and hamming code.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	M	M	M	S	S	M	M
CO-02	S	S	S	M	M	M	S	S	M	M
CO-03	S	S	S	S	S	L	S	S	S	L
CO-04	S	S	S	S	S	M	M	S	S	M
CO-05	S	S	S	S	S	M	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Basics of UNIX commands.
2. Write a C program to simulate all the CPU scheduling algorithms and find the turnaround time and waiting time.
3. Write a C program to simulate the following file allocation strategies.
4. Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
5. Write a C program to simulate all the contiguous memory allocation techniques
6. Write a C program to simulate paging technique of memory management.
7. Write a C program to simulate disk scheduling algorithms
8. Write a C program to simulate page replacement algorithms
9. Write a C program to implement Client-Server model.
10. Write a C program to implement the Bit Stuffing.

11. Write a C program to implement CRC computation.
12. Write a C code for simulating ARP/RARP.
13. Write a C program that takes a binary file as input and performs hamming code.

TOTAL: 45 HOURS

CF3674	FUNDAMENTALS OF JAVA PROGRAMMING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES

- To be familiar with the basic concepts of Java Programming.
- To work on inheritance, interfaces and arrays.
- To get exposed to work with threads, packages.

Course Outcome		Cognitive Skill
CO-01	Able to develop program using appropriate classes and methods, and differentiate overloading and overriding concept.	U,A
CO-02	Develop program using classes, objects and constructors.	R, A
CO-03	Demonstrate problem solving skills using object oriented programming concepts.	A, E
CO-04	Illustrate the programming concepts with the help of exception handling and threading.	A
CO-05	Build GUI's using Java Applets and able to Store and retrieve the information from Files, and perform string operations.	S, A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	M	M	M	M	M	M	L
CO-02	S	S	S	M	M	M	M	S	S	L
CO-03	S	S	S	S	S	M	M	S	S	M
CO-04	S	S	S	S	S	M	M	S	S	M
CO-05	S	S	S	S	S	M	M	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Programs using Java Classes and Objects
2. Programs involving method overloading and method overriding
3. Programs using arrays in Java
4. Programs using constructor

5. Programs involving various kinds of inheritance
6. Program to implement interfaces.
7. Programs involving a variety of exception handling situations.
8. Threads (Synchronization, communication, critical section)
9. Programs to demonstrate creation and handling of packages, their imports and class path.
10. Java Applets
11. Programs involving I/O streams
12. Programs to demonstrate string handling.

TOTAL: 45 HOURS

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	MA3607	Fundamentals of Statistics	3	1	0	4
2	CF3607	Software Engineering	3	0	0	3
3	CF3608	PHP Programming	3	1	0	4
4	CF3609	Cyber Forensics Basics	3	0	0	3
5	GE3602	Environmental Studies	2	0	0	2
PRACTICAL						
6	CF3675	Cyber Forensics Laboratory	0	0	4	2
7	CF3676	PHP Programming Laboratory	0	0	4	2
TOTAL			14	2	8	20

MA3607	FUNDAMENTALS OF STSTISTICS	L	T	P	C
		3	1	0	4

AIM

The probabilistic models are applicable in all areas of science and technology. This course provides necessary mathematical support to solve real life problems

OBJECTIVES

To have the fundamental knowledge of basic statistical and probability concepts, the standard distributions and equip the students with different statistical techniques which are essential to solve practical problems.

UNIT 1 DESCRIPTIVE STATISTICS 9

Introduction to Statistics, Basic concepts, population and sample, Collection of data, census and sampling .Methods of sampling-Random and Non-random sampling methods. Frequency distributions-Measures of central tendency, measures of dispersion, moments, skewness and kurtosis.

UNIT II PROBABILITY AND RANDOM VARIABLES 9

Axioms of probability - Conditional probability – Independent Events - Total probability – Baye's theorem- Random variables - Probability mass functions - Probability density functions - Properties – Expectation

UNIT III STANDARD DISTRIBUTIONS 9

Moments and Moment generating function- Binomial, Poisson, Uniform, Exponential and Normal distributions (simple problems only)

UNIT IV CORRELATION AND REGRESSION ANALYSIS 9

Scatter diagram -Types of correlation, Karl Pearson's correlation coefficient, properties of correlation coefficient. Rank correlation. Linear regression

UNIT V TESTING OF HYPOTHESIS 9

Sampling distribution – Standard error – Sample size –Type I error and Type II error - One tailed and two tailed tests – Proportions – means – Small sample tests – Student's t-test – Single mean, difference of means – F- test for variances

TOTAL: 45 HOURS

Text Book

Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition , New Delhi ,1996.

Unit 1 : Chapter 1: Sections 1.1, 1.2, Chapter 14: Section 14.2,

Chapter 2: Sections 2.4,2.5, 2.6, 2.7, 2.8, 2.9, 2.13, 2.15, 2.16, 2.17

Unit 2 : Chapter 3: Sections 3.8,3.10, 3.12, Chapter 4: Section 4.2,

Chapter 5: Sections 5.1, 5.2, 5.3, 5.4.1, Chapter 6: Sections 6.1, 6.2.

Unit 3 :Chapter 2: Sections 2.15, Chapter 7: Section 7.1,

Chapter 8: Sections 8.4, 8.5, Chapter 9: Sections 9.2, 9.3, 9.8.

Unit 4 :Chapter 10: Sections 10.1, 10.2, 10.3, 10.4, 10.7 Chapter 11: Section 11.1, 11.2

Unit 5 :Chapter 14: Sections 14.3, 14.4, 14.5, 14.7, 14.8, Chapter 16: Section 16.5, 16.6.1,

Chapter 8: Sections 8.4, 8.5, Chapter 9: Sections 9.2, 9.3, 9.8

REFERENCES

1. Hogg R.V.&Craig A.L. Introduction to Mathematical Statistics, American publishing Co Pvt Ltd.
2. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi , 2002.
3. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.

CF3607	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

AIM

To understand the methods and procedures for software development that can scale up for large systems and can be used consistently to produce high-quality software.

OBJECTIVES

- To understand the phases in a software project.
- To learn the concept of Agile software development.
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies.
- To learn various testing and maintenance measures.

Course Outcome - COs		Cognitive Skill
CO-01	Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	U
CO-02	Be agile software developers with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.	U
CO-03	Analyze the concepts of requirements engineering and analysis modeling.	An
CO-04	Apply systematic procedure for software design and deployment.	A
CO-05	Compare and contrast the various testing mechanisms.	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO- J
CO-01	S	S	S	S	M	M	S	S	S	S
CO-02	S	S	S	L	L	M	M	S	S	S
CO-03	M	S	S	S	M	N	L	M	M	M
CO-04	M	M	L	M	L	N	S	M	S	S
CO-05	S	S	M	S	S	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Introduction to Software – Evolving nature of Software – Software Engineering – Software Process – Personal and Team process models – Life Cycle Models – Waterfall Model – Incremental Process Models – Evolutionary Process Models – Prototyping – The Spiral model – Object Oriented Model.

UNIT –II AGILE DEVELOPMENT 9

Agility – Agile Process – Agile Process Models – Extreme Programming – Adaptive Software Development – Dynamic Systems Development Method – Scrum – Crystal – Feature Driven Development – Agile Modeling – System Engineering Hierarchy – System Modeling.

UNIT-III REQUIREMENTS ENGINEERING AND ANALYSIS 9

Functional and non-functional Requirements - Requirement engineering process - Feasibility studies – Requirements Elicitation – Requirements Validation – Requirements Management - Software prototyping - Prototyping in the software process - Rapid prototyping techniques - Software document.

UNIT-IV DESIGN ENGINEERING 9

Design process and concepts - Data design - Architectural design - Transform mapping - Transaction mapping - User interface design - Real time systems - Real time software design - System design - Real time executives - Data acquisition system - Monitoring and control system.

UNIT-V TESTING 9

Taxonomy of software testing - Levels of Testing - Test activities - Types of software test - Black box testing - Structural testing - Regression testing - Unit testing - Integration testing - Validation testing - System testing.

TOTAL: 45 HOURS

TEXT BOOKS

1. Roger S. Pressman, Bruce R. Maxim, Software Engineering- A practitioner's Approach, McGraw-Hill International Edition, 8th Edition, 2019.
2. Ian Sommerville, Software Engineering, Pearson education Asia, 10th Edition, 2017.

REFERENCES

1. Rajib Mall, Fundamentals of Software Engineering, PHI Learning private Ltd., Fourth Edition, 2015.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, Third Edition, 2010.
3. Julia H. Allen, Sean Barnum, Robert J. Ellison, "Software Security Engineering: A Guide for Project Managers", Pearson Education, 2009.

CF3608	PHP PROGRAMMING	L	T	P	C
		3	1	0	4

AIM

The aim of this course is to provide the necessary knowledge to design and develop basic PHP programming.

OBJECTIVES

- Implement the basic of procedural oriented PHP programming
- Implement the basic of object oriented PHP programming

Course Outcome - COs		Cognitive Skill
CO-01	Analysis the essentials of PHP	U
CO-02	Enable programmers to break down or decompose a problem into smaller chunks for a particular task	A
CO-03	Analyze and solve common tasks by writing PHP programs using object oriented concepts.	S
CO-04	Analyze and solve various file handling parameters using the PHP language.	An
CO-05	Analyze and create technique for creating fast and dynamic web pages	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

MAPPING OF COURSE OUTCOME WITH PROGRAMME OUTCOME

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	S	M	S	M	M	S	S	L
CO-02	S	S	M	M	S	S	M	S	S	M
CO-03	S	S	M	M	S	S	M	S	S	M
CO-04	S	S	S	M	S	S	M	S	S	S
CO-05	S	S	S	M	S	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ESSENTIALS OF PHP **9**

Essentials of PHP - Operators and Flow Control - Strings and Arrays.

UNIT II FUNCTIONS **9**

Creating Functions - Reading Data in Web Pages - PHP Browser - Handling Power.

UNIT III OBJECT-ORIENTED PROGRAMMING **9**

Object-Oriented Programming –Advanced Object-Oriented Programming.

UNIT IV FILE HANDLING **9**

File Handling –Working with Databases – Sessions, Cookies, and FTP

UNIT V AJAX **9**

Ajax – Advanced Ajax – Drawing Images on the Server.

TOTAL: 45 HOURS

TEXT BOOK

1. The PHP Complete Reference, Steven Holzner, McGraw Hill Education, July 2017

REFERENCE

1. PHP: A Beginner's Guide, Vikram Vaswani, McGraw Hill Education, 2009

CF3609	CYBER FORENSICS BASICS	L	T	P	C
		3	0	0	3

AIM

To develop knowledge and skills in the field of cyber forensics.

OBJECTIVES

- Gain a comprehensive understanding of the field of computer forensics, including its history, legal aspects, and professional conduct, as well as the process of conducting computer investigations and establishing a forensic lab.
- Develop skills in data acquisition
- Acquire knowledge and proficiency in working with Windows and DOS systems

Course Outcome – Cos		Cognitive Skill
CO-01	Students will be able to effectively conduct computer investigations by applying a systematic approach.	U, A
CO-2	Students will able to process crime and incident scene effectively.	U, An

CO-03	Students will be able to effectively acquire and process digital evidence by applying appropriate storage formats, selecting and utilizing acquisition methods and tools	R, A
CO-04	Students will be able to effectively work with Windows and Linux systems	U, A
CO-05	Students will be able to effectively analyse and validate forensic data by generating report.	U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	M	L	L	M	L	L	L	M	M	S
CO-02	S	M	M	M	M	M	M	M	S	S
CO-03	M	M	L	M	M	L	M	M	S	S
CO-04	L	N	N	M	L	M	L	L	S	S
CO-05	S	M	S	S	M	M	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION 9

An Overview of Digital Forensics - Preparing for Digital Investigations, preparing a Digital Forensics investigation- Procedures for Private-Sector High-Tech Investigations - Understanding Data Recovery Workstations and Software - Conducting an Investigation- Requirements for Forensic Lab certification, determining the physical requirements for a CF lab, selecting a basic forensic workstation

UNIT II PROCESSING CRIME AND INCIDENT SCENE 8

Processing Crime and Incident Scene - Identifying digital evidence, collecting evidence in private sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene. Seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash

UNIT III DATA ACQUISITION 8

Data Acquisition - storage formats for digital evidence, determining the best acquisition method, contingency planning for image acquisitions, using acquisition tools, validating data acquisitions, performing RAID data acquisitions, using remote network acquisition tools, using other forensic acquisition tools

UNIT IV WINDOWS AND LINUX SYSTEMS 10

Working with windows and DOS systems- file systems- Boot Sequence, Disk Drives, Solid State Storage Devices- exploring Microsoft file structures- Disk Partitions- Examining FAT Disks - examining NTFS disks, virtual machines, Examining Linux File Structures- Understanding Macintosh File Structures- Using Linux Forensics Tools

UNIT V ANALYSIS AND REOPORTING 10

Analysis and validation -determining what data to collect and analyze, validating forensic data, addressing data -hiding techniques, performing remote acquisitions. Report Writing for High-Tech Investigations - Understanding the Importance of Reports- Limiting a Report to Specifics, Types of Reports- Guidelines for Writing Reports- Report Structure, Designing the Layout and Presentation of Reports- Generating Report Findings with Forensics Software Tools

TOTAL: 45 HOURS

TEXT BOOKS

1. Guide to Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Chris Steuart, Sixth edition, 2018
2. Digital Evidence and Computer Crime – Eoghan Casey, Edition 3, Academic Press,2011
3. Computer Forensics and Cyber Crime : An Introduction – MarjieBritz, Edition 2, Prentice Hall, 2008

REFERENCES

1. Practical guide to Computer Forensics- David Benton and Frank Grindstaff , BookSurge Publishing,2006
2. Computer Evidence: Collection & Preservation- Christopher L.T Brown Charles River Media publishing, Edition 1, 2005
3. Computer Investigation (Forensics, the Science of crime-solving) – Elizabeth Bauchner, Mason Crest Publishers, 2005
4. Real Digital Forensics- Keith J. Jones, Richard Bejtlich and Curtis W. Rose, Addison-Wesley publishers, 2005
5. Forensic Computer Crime Investigation (International Forensic Science and Investigation)-Thomas A. Johnson, CRC Press, 2005 Publishing Co. Beijing, 1999.
6. S. K. Basu, “Design Methods and Analysis of Algorithms”, Prentice Hall India, 2005.

GE3602	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES

- To understand the complexity of ecosystems and possibly how to sustain them
- To understand the relationships between humans and the environment.
- To understand major environmental problems including their causes and consequences.

UNIT-I (6)

Environmental Sciences - Relevance - Significance - Public awareness - Forest resources - Water resources - Mineral resources - Food resources - conflicts over resource sharing - Exploitation - Land use pattern - Environmental impact - fertilizer - Pesticide Problems - case studies.

UNIT-II **(6)**

Ecosystem - concept - structure and function - producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow - Forest, Grassland, desert and aquatic ecosystem. Biodiversity - Definition - genetic, species and ecosystem diversity - Values and uses of biodiversity - biodiversity at global, national (India) and local levels - Hotspots, threats to biodiversity - conservation of biodiversity.

UNIT-III **(6)**

Environmental Pollution - Causes - Effects and control measures of Air, Water, Marine, soil, solid waste, Thermal, Nuclear pollution and Disaster Management - Floods, Earth quake, Cyclone and Land slides. Role of individuals in prevention of pollution - pollution case studies.

UNIT-IV **(6)**

Urban issues - Energy - water conservation - Environmental Ethics - Global warming - Resettlement and Rehabilitation issues - Environmental legislations - Environmental production Act. 1986 - Air, Water, Wildlife and forest conservation Act

UNIT-V **(6)**

Population growth and Explosion - Human rights and Value Education - Environmental Health - HIV/AIDS - Role of IT in Environment and Human Health - Women and child welfare - Public awareness - Case studies.

TOTAL: 30 HOURS

TEXT BOOKS

1. Gupta N.C.; Social Auditing of Environmental Law in India, edited book, New Century Publications, Delhi-2003.
2. Divan, Shyam and RosenCeranz; Armin. Environmental Law and Policy in India, Cases, materials and statutes, second edition, Oxford University Press, 2001.
3. Uberoi, N.K.; Environmental Management, Excel Books, New Delhi, 2000.
4. Agarwal, A, Narain; S. State of India's Environment, Published by Centre for Science and Environment, New Delhi, 1999.
5. Joseph, Casio, Woodside, Gayle and Mitchell, Philip.; ISO 14000 guide- The new Environmental Management Standards, McGraw Hill, New York, 1996.

CF3675	CYBER FORENSICS LABORATORY	L	T	P	C
		0	0	4	2

AIM

To learn about the various cyber tools and techniques and make the students industry ready.

OBJECTIVES

- To understand the open ports which enable the hackers to connect to the system.
- To scan different IP address simultaneously for scanning the network.
- To exploit evidences from windows, hard drives and smart phones using the cyber tools and analyses its usage.

- To be familiar with the password cracking tool and discover how to protect the system from intruders.
- To identify the malicious activities in a network by using the network sniffer tool.

Course Outcome – Cos		Cognitive Skill
CO-01	Enable students to acquire knowledge about the different cyber forensics tools.	U, An
CO-02	Enable students to be familiar with the forensics tools to collect evidences from devices such as hard drives and smart phones.	U,A
CO-03	Facilitate students to be aware of the packet sniffer tool and identify for malicious activity if any.	An
CO-04	Students should be made to be knowledgeable in the file carving techniques.	An
CO-05	Mould students to implement the different crypt tools for various applications such as password cracking .	U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	M	S	S	N	L	S	M	S
CO-02	S	S	S	M	M	N	M	S	S	S
CO-03	M	S	S	S	M	M	L	M	S	S
CO-04	S	S	S	S	S	N	L	M	S	M
CO-05	M	S	S	M	M	L	M	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Create a Forensic Image Using Autopsy.
2. Analyze the given forensic image using Autopsy.
3. Break the password of the mobile phone and Create its forensic image using Mobile check.
4. Analyze forensic image using Mobile Check and recover the deleted data.
5. Show how evidences can be collected from windows.
6. Live Analysis using Win-LiFT Analyzer
7. Live Forensics Case Investigation using Autopsy
8. Familiarization of NeSA (Network Packet Analysis) Tool
9. Examine the email messages and analyse it in detail.
10. Perform advanced scanning using Nmap tool.
11. Perform various administrative tasks using PSTools.
12. Capture and Analyze network traffic using Wireshark
13. Hide and extract any text file behind an image file/ Audio file.
14. To create a Virtual Machine and Install Kali Linux OS

TOTAL: 45 HOURS

CF3676	PHP PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

AIM

To learn the basic of PHP programming

OBJECTIVES

- To acquire the programming experience in PHP
- To apply variables, strings, and constants to a PHP a script and test it with a program.
- To design an authentication web page in PHP with MySQL.

Course Outcome – Cos		Cognitive Skill
CO-01	Learn PHP programming on handling strings and arrays.	R
CO-02	Design web pages for different applications with MYSQL	S
CO-03	Handle files, sessions and cookies by downloading a file from the server	A
CO-04	Develop real-time applications.	S
CO-05	Gain experience in drawing images using Ajax	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

MAPPING OF COURSE OUTCOME WITH PROGRAMME OUTCOME

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	S	M	S	M	M	S	S	L
CO-02	S	S	M	M	S	S	M	S	S	M
CO-03	S	S	M	M	S	S	M	S	S	M
CO-04	S	S	S	M	S	S	M	S	S	S
CO-05	S	S	S	M	S	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Write a program to find the factorial of a number.
2. Write a program using Conditional Statements need a number N and check whether it is divisible by M.
3. Write a program to find the maximum value in a given multi-dimensional array.
4. Write a program to find the GCD of two numbers using user-defined functions.
5. Design a simple web page to generate multiplication table for a given number.
6. Write a program to download a file from the server.
7. Write a program to store the current date and time in a COOKIE and display the ‘Last Visited’ date and time on the web page.

8. Write a program to store page views count in SESSION, to increment the count on each refresh and to show the count on web page.
9. Write a program to design a simple calculator.
10. Design an authentication web page in PHP with MySQL to check username and password.

TOTAL: 45 HOURS

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1	CF3610	Networks and Information Security	3	0	0	3
2	CF3611	File System Forensic Analysis	3	0	0	3
3	CF3612	Ethical Hacking	3	1	0	4
4	CF3613	OS Forensics	3	1	0	4
5	CF3614	Web Technology	3	0	0	3
PRACTICAL						
6	CF3677	Computer Security Laboratory	0	0	4	2
7	CF3678	Web Technology Laboratory	0	0	4	2
TOTAL			15	2	8	21

CF3610	NETWORKS AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

AIM

To enable the students to understand the need to protect data and resources from disclosure, to guarantee the authenticity of data and messages, and to protect systems from network-based attacks.

OBJECTIVES

- To understand the basics of Network and Information Security.
- To discuss the role of access control in information systems and technologies used in access control systems.

- To understand the symmetric and asymmetric key cryptography principles and algorithms.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.

Course Outcome – Cos		Cognitive Skill
CO-01	Understand the concepts of information security, policies, standards and practices.	R, U
CO-02	Gets a deeper insight on the security models for securing information.	U
CO-03	Demonstrate symmetric and asymmetric cryptographic algorithm for communication	A
CO-04	Able to use the security applications and analyze them.	A, An
CO-05	Gets a thorough knowledge on E-mail and IP Security.	U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	S	S	S	L	M	S	M	M
CO-02	S	S	S	S	S	L	M	S	M	S
CO-03	S	S	S	S	S	L	M	S	M	S
CO-04	S	S	S	S	S	L	M	S	S	S
CO-05	S	S	S	S	S	L	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION 9

Information Security Concepts-Components of Information Security-Introduction to the need for Information Security Information Security threats and Attacks-Law and Ethics in Information Security-Information Security Policy Standards and Practices- The Information Security Blue Print- Contingency plan and a model for contingency plan.

UNIT II SECURITY MODELS 9

Access Controls - Firewalls, Intrusion Detection and Prevention System – Honeypots – Honeynets - Padded Cell Systems-Scanning and Analysis Tools.

UNIT III CRYPTOGRAPHY 9

Substitution and Transposition Cipher - Symmetric Encryption Principles- Symmetric block encryption algorithms: DES, Triple DES, AES – Stream Ciphers - Public key cryptography principles – Public key cryptography algorithms: RSA algorithm, Diffie Hellman key exchange algorithm.

UNIT IV SECURITY APPLICATIONS 9

Message Authentication - MAC, SHA, HMAC - Digital Signatures, Kerberos, Federated Identity Management.

UNIT V E-MAIL, IP AND WEB SECURITY 9

Pretty Good Privacy (PGP)-S/MIME- IP Security Architecture-Authentication Header-Encapsulating Security Payload-Web security requirements-Secure Socket layer (SSL) and Transport layer Security (TLS)

TOATL: 45 HOURS

TEXT BOOKS

1. Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, Seventh Edition, cenage Learning, 2021.
2. William Stallings, "Network Security Essentials: Applications and Standards", Sixth Edition, 2017.

REFERENCES

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Prentice Hall, 2019.
2. Mark Rhodes- Ousley, "The Complete Reference - Information Security ", 2nd Edition, McGraw Hill Education, 2013.

CF3611	FILE SYSTEM FORENSIC ANALYSIS	L	T	P	C
		3	0	0	3

AIM

To provide students with a comprehensive understanding of file systems, their structures, and the methodologies used to analyze digital evidence stored within them.

OBJECTIVES

- To understand foundation of digital investigation and methods of data analysis
- To understand the file system and how to analyze a file system

Course Outcome – Cos		Cognitive Skill
CO-01	Students will be able to conduct digital investigations, handle digital evidence, analyse data	A, U
CO-02	Students will be able to perform volume analysis, including analyzing various types of partitions	A, R, S
CO-03	Students will develop the skills and knowledge required to perform file system analysis	U, S, A
CO-04	Students will be able to perform effective NTFS analysis,	R, U, E
CO-05	Students will be able to analyse Ext2 and Ext3 file systems	An, E, U

S- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

S- Strong, M- Medium, L-Low, N- Not Relevant

PO / CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	S	M	M	S	M	L	M	L	S
CO-02	M	S	M	S	S	M	M	M	L	S
CO-03	S	M	S	S	S	L	M	M	L	S
CO-04	S	M	M	S	S	L	M	M	L	S
CO-05	S	M	M	M	S	M	M	M	M	S

UNIT I DIGITAL INVESTIGATION FOUNDATIONS 9

Digital investigation foundation- Digital investigations and evidence, Digital crime scene investigation process, Data analysis, overview of toolkits. Computer foundations- Data organizations, booting process, Hard disk technology, Hard disk data acquisition- introduction, reading the source data, writing the output data, a case study.

UNIT II VOLUME ANALYSIS 9

Volume Analysis- introduction, background, analysis basics, PC based partitions- DOS partitions, Analysis considerations, Apple partitions, removable media, Server based partitions- BSD partitions, Sun Solaris slices, GPT partitions, Multiple disk volumes- RAID, Disk Spanning

UNIT III FILE SYSTEM ANALYSIS 9

File system analysis- What is a file system- Essential and Non-Essential Data- Data Categories: File system category- Analysis Techniques- Addressing Data Units- Allocation Strategies- Damaged Data Units, Content Category-Analysis, Metadata category-analysis, File name category, Application category

UNIT IV FAT CONCEPTS AND ANALYSIS 9

FAT concepts and analysis- Introduction, File system category, Content category, Metadata category, File name category, File recovery, determining type, Consistency check. FAT data structure -Boot sector, FAT 32 FS info, directory entries, Long file name directory entries

UNIT V NTFS CONCEPTS 9

NTFS concepts- Introduction, Everything is a file, MFT concepts, MFT entry attribute concepts, NTFS Analysis- File system category, Content category, Metadata category, File name category, File recovery, determining the type, Consistency check. NTFS data structure- File system metadata files

TOTAL: 45 HOURS

TEXT BOOKS

1. File System Forensic Analysis – Brian Carrier, Addison Wesley, 2005
2. Digital Evidence and Computer Crime- Casey, Eoghan , edition 2, Academic Press, 2004.
3. Computer Forensics- Kruse, Warren and Jay Heiser, Addison Wesley, 2002.

REFERENCES

1. Guide to Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Frank Enfinger, Chris Steuart, Thomson Course Technology, 2004.
2. Forensic Discovery – Dan Farmer &WietseVenema, Addison Wesley, 2005
3. Incident Response and Computer Forensics- Mandia, Kevin, Chris Prosise, Matt Pepe, McGraw Hill/Osborne, 2003.
4. A Fast File System for UNIX-McKusick, William N. Joy, Samuel J. Leffler, Robert S.
5. Fabry, ACM Transactions on Computer Systems, August 1984, pp 181-197. http://docs.freebsd.org/44doc/smm/05.fastfs/paper.pdf
6. The Common Vulnerabilities and Exposures database, entry CVE-2000-0666.http://cve.mitre.org/

CF3612	ETHICAL HACKING	L	T	P	C
		3	1	0	4

AIM

To learn the ethical hacking concepts and different hacking methodologies.

OBJECTIVES

- To know the basics of ethical hacking along with the hacking process and plan.
- To learn about foot printing and social engineering concepts.
- To understand service scanning techniques.
- To know hacking of web servers and wireless sensor networks.
- To acquire knowledge about hacking different operating systems.

Course Outcome – Cos		Cognitive Skill
CO-01	Students will be able to understand the basics of ethical hacking and the different hacking methodologies.	U, R
CO-02	Students gain knowledge about the different hacking tools such as footprinting, social engineering and to be aware with the social engineering attacks and its countermeasures.	U,An
CO-03	Students will be able to understand and analyze the port scanning techniques, its types and enumeration concepts and apply these techniques to enumerate windows and NetWare operating systems.	U, An, A
CO-04	Students will get exposed to hacking the wired and wireless networks, its vulnerabilities, the tools and the methods of protecting the networks with security devices.	An,A
CO-05	Students will be able to understand the techniques in hacking the operating system.	U,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO- J
CO-01	S	S	N	M	S	S	N	M	S	S
CO-02	M	M	M	L	N	L	N	N	M	N
CO-03	L	S	L	M	L	M	N	M	N	M
CO-04	M	L	N	S	S	S	M	L	L	S
CO-05	S	N	L	M	L	N	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I ETHICAL HACKING OVERVIEW 9

Introduction-Hacking Concepts, Types and Phases - Ethical Hacking Concepts and Scope-Certified Ethical Hackers-Network and Computer Attacks-Ethical Hacking Plan -Hacking Methodology-Vulnerability testing-Developing Security Testing Plan

UNIT-II FOOTPRINTING AND SOCIAL ENGINEERING 9

Footprinting Concepts - Footprinting Methodology - Conducting Competitive Intelligence - DNS Zone Transfers - Introduction to Social Engineering - Performing Social Engineering Attacks - Social Engineering Counter measures.

UNIT-III SERVICE SCANNING 9

Introduction to Port Scanning - Types of Port Scan - Port Scanning Tools - Conducting Ping Sweeps - Shell Scripting. Enumeration: Introduction - Enumerating Windows Operating Systems-Penetration testing.

UNIT-IV HACKING NETWORKS 9

Hacking Web Servers: Web Application - Web Application Vulnerabilities - Tools for Web Attackers and Security Testers. Hacking Wireless Network: Wireless Technology – Wireless Network Standards-Authentication-Wardriving-Wireless Hacking-Protecting Networks with Security Devices.

UNIT-V HACKING OPERATING SYSTEMS 9

Hacking Windows- Overview- Unauthenticated Attacks- Authenticated Attacks- Windows Security Features- Hacking UNIX- The Quest for Root- Remote Access- Local Access- Rootkit Recovery

TOTAL: 45 HOURS

TEXT BOOKS

1. Michael T. Simpson, "Ethical Hacking and Network Defense", Cengage Learning, New Delhi,2010.
2. Stuart McClure, Joel Scambray, George Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions ", McGraw-Hill publishing, 7th Edition, July 2012
3. The Certified Ethical Hacker CEH V10, Complete Hacking Guide

REFERENCES

1. Kevin Beaver, "Hacking for Dummies", Wiley Publication, India, **5th Edition**, 2016.
2. AnkitFadia, "Unofficial Guide to Ethical Hacking", Macmillan Company, New Delhi,2006.

CF3613	**OS FORENSICS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

AIM

To provide comprehensive coverage of the fundamental concepts Windows and Linux incidence response and Forensic analysis.

OBJECTIVE

- To understand how data acquisition is done from a Windows and Linux System

Course Outcome – Cos		**Cognitive Skill**
CO-01	Students will acquire the necessary skills to perform live response investigations in Windows environments	U, A
CO-02	Students will gain proficiency in conducting in-depth analysis of Windows systems by effectively analyzing memory dumps	R, A
CO-03	Students will able to perform Linux forensic analysis, including live response data collection, data analysis techniques	U, An
CO-04	Students will acquire advanced skills in Linux file analysis	U, A
CO-05	Students will acquire advanced skills in iOS Forensics Analysis	U, A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	**PO-A**	**PO-B**	**PO- C**	**PO-D**	**PO- E**	**PO- F**	**PO-G**	**PO-H**	**PO - I**	**PO- J**
CO-01	M	L	L	M	L	L	L	M	M	S

CO-02	S	M	M	M	M	M	M	M	S	S
CO-03	M	M	L	M	M	L	M	M	S	S
CO-04	L	N	N	M	L	M	L	L	S	S
CO-05	S	M	S	S	M	M	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I WINDOWS FORENSIC ANALYSIS 9

Windows Forensic Analysis- Live Response: Data Collection- Introduction, Locard's Exchange Principle, Order of Volatility, when to Perform Live Response, What Data to Collect- System Time, Logged-on Users, Open Files, Network Information, Process Memory, Network Status, Nonvolatile Informations. Live-Response Methodologies: Data Analysis- Agile Analysis.

UNIT II WINDOWS FILE ANALYSIS 9

Windows Memory Analysis-Collecting Process Memory, Dumping Physical Memory. Registry Analysis, RegRipper, System Information, USB Removable Storage Devices, Deleted Registry Keys. Windows File Analysis-Log Files, Event Logs, Recycle Bin, Vista Volume Shadow Copy Service, File Metadata, File Signature Analysis, NTFS Alternate Data Streams, Executable File Analysis.

UNIT III LINUX FORENSIC ANALYSIS 9

Linux Forensic Analysis- Live Response Data Collection- Prepare the Target Media, Format the Drive, Gather Volatile Information, Acquiring the Image. Initial Triage and Live Response: Data Analysis- Log Analysis, Running Processes, Open File Handlers, The /Proc File System- Introduction, Process IDs.

UNIT IV LINUX FILE ANALYSIS 9

File Analysis- The Linux Boot Process, System and Security Configuration Files- Users, Groups, and Privileges, Cron Jobs, Log Files. Identifying Other Files of Interest- SUID and SGID Root Files, Recently Modified/Accessed/Created Files, Modified System Files, Hidden Files and Hiding Places.

UNIT V iOS FORENSIC ANALYSIS 9

History of Apple Mobile Devices, iOS Operating and File System Analysis - The iOS File System, HFS+ File System, HFSX, iPhone Partition and Volume Information, OS Partition, iOS System Partition, iOS Data Partition, SQLite Databases - iPhone Logical Acquisition, Logical Data Analysis

TOTAL: 45 HOURS

TEXT BOOKS

1. Unix and Linux Forensic Analysis DVD ToolKit - Chris Pogue, Cory Altheide, Todd Haverkos, Syngress Inc., 2008
3. Windows Forensic Analysis DVD Toolkit- Harlan Carvey, Edition 2, Syngress Inc., 2009
3. Windows Registry Forensics: Advanced Digital Forensic Analysis of the Windows

Registry - Harlan Carvey, Syngress Inc, Feb 2011

4."iOS Forensic Analysis: for iPhone, iPad, and iPod Touch" - Sean Morrissey, 2010

REFERENCES

1. File System Forensic Analysis- Brian Carrier, Addison Wesley, Edition 1, 2005
2. Handbook of Digital Forensics and Investigation- Eoghan Casey, Academic Press, 2009
3. Digital Forensics with Open Source Tools- Cory Altheide, Harlan Carvey, Syngress Inc, Edition 1,April 2011
4. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=6766b849a7a0c71accc8f5e02bc7106d2a88ebcc

CF3614	WEB TECHNOLOGY	L	T	P	C
		3	1	0	4

AIM

To highlight the features of different technologies involved in Web Technology and various scripting languages.

OBJECTIVES

- To understand the basics of Internetworking concepts.
- To learn the basics of various markup and scripting languages.
- To design interactive web pages using Dynamic HTML.
- To build knowledge on servlets and JSP.
- To know the concepts of XML and database.

Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basics of Internetworking concepts	U
CO-02	Create web pages using HTML, Cascading Style Sheets and Javascript	A
CO-03	Design interactive web pages using Dynamic HTML	A
CO-04	Evaluate the concept of server side programming using servlets and JSP	A
CO-05	Develop web pages using XML and database	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO- J
CO-01	S	S	S	S	M	M	S	S	S	M
CO-02	S	S	S	S	M	M	S	S	S	M
CO-03	S	S	S	S	M	M	S	S	S	M
CO-04	S	S	S	S	M	M	S	S	S	M

CO-05	S	S	S	S	M	M	S	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTERNET AND HTML 9

Evolution of Internet and World Wide Web – Web basics – multitier application architecture – client side scripting – server side scripting – W3C – HTML-Images – Tables- Forms – Links – Cascading Style Sheets

UNIT II JAVASCRIPT 9

JavaScript-Prompt dialogs – Decision making- Control statements- Nested Control statements – Operators – Counter controlled repetition statements – functions – arrays –objects

UNIT III DYNAMIC HTML 9

Introduction –Object model and collection - Event Model – Form processing – Event Bubbling – Filters and transitions– Data Binding – Binding to an Image and Table – DOM: Objects and collections.

UNIT IV SERVLETS AND JSP 9

Introduction – Servlet Overview Architecture – Handling HTTP Request – Get and Post request – Redirecting request– Session Management - JSP – Overview – Objects – Scripting – Standard Actions – Directives.

UNIT V XML AND DATABASE ACCESS 9

XML Basics – X-Path, XSLT, JSON, Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from a JSP Page, Application-specific Database Actions–Multi-tier applications.

L: 45 + T: 15 = TOTAL: 60 HOURS

TEXT BOOK

1. Deitel & Deitel, Goldberg, "Internet and world wide web – How to Program", Pearson Education Asia, Fifth edition, 2012.

REFERENCES

1. Jeffrey C. Jackson, "Web Technologies- A computer science perspective", Pearson Education, 2007.
2. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India QUE, 1999.
3. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
4. Rajkamal, "Web Technology", Tata McGraw-Hill, 2002.

CF3677	**COMPUTER SECURITY LAB**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

AIM

To make practice certain security settings, learn to use certain network security tools and implement various cryptographic algorithms.

OBJECTIVES

- Learn to implement certain security techniques.
- Learn to implement the basic cryptographic algorithms.

Course Outcome – Cos		Cognitive Skill
CO-01	Practice setting up certain security options.	U, An
CO-02	Learn to use network security tools.	An
CO-03	Implement cipher techniques.	A
CO-04	Implement the basic cryptographic algorithms.	A
CO-05	Implement various cryptographic data integrity algorithms.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO\	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	M	S	M	S	S	S	M
CO-02	S	S	S	S	S	M	S	S	S	M
CO-03	S	S	S	S	S	M	S	S	S	M
CO-04	S	S	S	S	S	M	S	S	S	M
CO-05	S	S	S	S	S	M	M	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Installation of rootkits and study about the variety of options.
2. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
3. Experiment with Sniff Traffic using ARP Poisoning
4. Explore network monitoring tools
5. Experiment Dictionary attacks, Brute force attacks.
6. Study of:
   a. the features of firewall in providing network security and to set Firewall Security in windows.
   b. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
7. Write a C program that contains a string with a value 'HelloWorld'. The program should AND, or and XOR each character in this string with 127 and display the result.
8. i. Implement the following substitution techniques:
   a) Caesar Cipher
   b) Playfair Cipher
   ii**.** Implement the following transposition technique:
   a) Rail fence – row & Column Transformation
9. Implement the Data Encryption Standard (DES) algorithm for both Encryption and Decryption.
10. Implement the public-key cryptographic algorithm-RSA.
11. Calculate the message digest of a text using Secure Hash Algorithm (SHA).
12. Implement the Signature Scheme - Digital Signature Standard.

TOTAL: 45 HOURS

CF3678	WEB TECHNOLOGY LAB	L	T	P	C
		0	0	4	2

AIM

To develop programming skills in creating web pages.

OBJECTIVES

- To learn the basics and design concepts of HTML.
- To develop web pages using HTML.
- To create web pages using Cascading Style Sheets.
- To design interactive web pages using scripting language Java Script.
- To learn server side programming using Servlets and JSP
- To work with JDBC

Course Outcome – Cos		Cognitive Skill
CO-01	Apply the basic design concepts of HTML and develop web pages using HTML.	A
CO-02	Create web pages using Cascading Style Sheets.	A
CO-03	Design interactive web pages using Scripting language Java Script.	A
CO-04	Ability to work with Servlets	A
CO-05	Ability to work with JSP and JDBC	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	S	S	S	M
CO-02	S	S	S	S	M	M	S	S	S	M
CO-03	S	S	S	S	M	M	S	S	S	M
CO-04	S	S	S	S	M	M	S	S	S	M
CO-05	S	S	S	S	M	M	S	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Create a web page illustrating text formatting tags using HTML
2. Create a web page using HTML to demonstrate font variations.
3. Prepare a sample code to illustrate three types of lists in HTML.

4. Using HTML tables create your Curriculum Vitae.
5. Create a web page with all types of Cascading style sheets.
6. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
7. Write a Java Script program to validate name, password, mobile number, email id and address of a user in the course registration page.
8. Create a Servlet program to retrieve the values entered in the HTML file.
9. Develop a Servlet program for session management.
10. Write programs in Java to create 3 tier applications using JSP and databases.
11. Write JSP program to store student information sent from registration page to database table.
12. Write a program to validate username and password that are stored in database using JSP.

TOTAL: 45 HOURS

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CF3615	Recovery and Preservation of Digital Evidence	3	0	0	3
2.	CF3616	Database Security	3	1	0	4
3.	CF3617	Cyber Forensics and Incident Response	3	0	0	3
4.	CF3618	Cyber Law, Security policies and Ethics	3	0	0	3
5.	*****	Elective I	3	0	0	3
PRACTICAL						
6.	CF3679	Ethical Hacking Lab	0	0	4	2
7.	CF3680	Database security Lab	0	0	4	2
TOTAL			15	2	8	20

CF3615	RECOVERY AND PRESERVATION OF DIGITAL EVIDENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the foundations and principles for digital evidence
- To enable the students to understand digital evidence on different platforms
- To study the recovery mechanism of evidence
- To preserve the evidences procured
- To practice recovering evidence from mobile devices

Course Outcome		Cognitive Skill
CO-01	Enable students to understand digital evidence basics and evidence on different platforms	U
CO-02	Students are made to understand about the evidence in different platforms.	An
CO-03	Students should be able to recover digital evidence.	U, E
CO-04	Make students to be familiar about the preservation of digital evidence.	An, E
CO-05	Enable students to recover evidence from mobile devices.	A, An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	M	S	L	L	M	S	M
CO-02	S	L	S	M	S	L	L	L	S	S
CO-03	S	M	S	M	S	L	L	S	S	S
CO-04	S	S	S	M	M	L	L	S	S	S
CO-05	M	S	S	M	S	L	M	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION **9**

Digital Evidence, Increasing Awareness of Digital Evidence, Digital forensics: Past, Present, and Future, Principles of Digital Forensics, Challenging Aspects of Digital Evidence, Language of Computer Crime Investigation, Digital Evidence in the Courtroom.

UNIT II: DIGITAL EVIDENCE ON COMPUTERS **9**

Computer basics for Digital Investigators: Applying Forensic Science to Computers, Digital Evidence on Windows Systems, Digital Evidence on Unix Systems, Digital Evidence on the Internet.

UNIT III: IMAGING AND RECOVERING DIGITAL EVIDENCE **9**

Recovering Digital Evidence, Understanding the Chain of Custody, Physical Acquisition, Safekeeping of Digital Evidence, Forensic Imaging Process, Live Recovery Process, Efficacy of Tools, Linking the user to Evidence.

UNIT IV: PRESERVING DIGITAL EVIDENCE **9**

Preservation in the Digital Age: What to Preserve-How Long to Preserve-Modes of Digital Death-Digital Storage Media-Preservation Storage-Cloud Storage

UNIT V: MOBILE EVIDENCE RECOVERY **9**

Mobile phone evidence extraction process, Data acquisition from iOS devices- iOS Data Analysis and Recovery, Time stamps, SQLite Databases, Key artifacts, Property lists, Other important files, Recovering deleted SQLite records, Android data extraction techniques, Analysis and recovery.

TOTAL: 45 HOURS

TEXT BOOKS

1. Eoghan Casey Digital, “Evidence and Computer Crime Forensic science, Computers and Internet”, Elsevier Academic Press, Second Edition,2011
2. Richard Boddington, “Practical Digital Forensics”, Packt Publishing,2016
3. RohitTamma, Oleg Skulkin, Heather Mahalik, Satish Bommisetty, “Practical Mobile Forensics”, Third Edition, Packt Publishing, 2018
4. Ross Harvey and Jaye Weatherburn, “Preserving Digital Materials”, Rowman and Littlefield Publishing Group,2018

REFERENCES

1. Shira A scheindlin, Daniel J Capra,A, ”Electronic Discovery and Digital Evidence in a Nut Shell“, The Sedona Conference, Academic Press, Third Edition, 2015.
2. Terrence V.Lillard, Glint P.Garrison, Craig A..Schiller, James Steele , “Digital Forensic for Network, Internet, and Cloud Computing A forensic evidence guide for moving Targets and Data:, ,Syngress.,2010
3. Jack Wiles, Anthony Reyes, Jesse Varsalone,”The Best Damn Cybercrime and Digital Forensics Book Period”,Syngress 2007.

CF3616	DATABASE SECURITY	L	T	P	C
		3	1	0	4

OBJECTIVES

- To understand the fundamentals of database security
- To explore on the security models
- To design secure databases
- To learn the statistical database security
- To secure the new generation databases

Course Outcome		Cognitive Skill
CO-01	Students are enabled to understand the purpose and importance of Database systems.	R,U
CO-02	Students are enabled to understand and use the core concepts of database systems.	U,A
CO-03	Students are made strong in the fundamentals of database security.	U,A
CO-04	Students are enabled to design secure database systems.	An,A
CO-05	Students are enabled to know the in depth concepts of database auditing.	U, A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	M	S	S	M
CO-02	S	S	S	S	S	M	M	S	S	M
CO-03	S	S	S	S	S	S	S	S	S	M
CO-04	S	S	S	S	S	M	S	S	S	M
CO-05	S	S	S	S	S	M	S	S	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO DATABASES **9**

Databases – purpose, Views of Data, Components of DBMS, Data models, Database languages, Database users and administrators, Applications of DBMS.

UNIT II: DATABASE DESIGN **9**

Relational database, Database languages SQL, Queries in SQL, Views, Integrity and Security, Relational database design, Concepts of functional dependency and normalization.

UNIT III: DATABASE SECURITY **9**

Introduction to Database security – Security requirements of database – Reliability and Integrity – Database disclosure- Security architecture – Security policies - Security Problems in Databases, SQL injection.

UNIT IV: SECURITY MECHANISMS **9**

Profiles, Password policies, Privileges, Roles, Access control, Access control mechanisms, Discretionary Access Control, Mandatory Access Control, Role Based Access Control,

UNIT V: DATABASE AUDITING **9**

Security Auditing, Auditing objectives, audit classifications, Goal of audit, Auditing process, planning for database security audit, Database audit, Reporting database security audit, Vendor specific auditing information, Auditing models.

TOTAL: 60 HOURS

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2011.
2. Hassan A. Afyouni, "Database Security and Auditing", Course Technology – Cengage Learning, NewDelhi, 2009.
3. Alfred Basta, Melissa Zgola, Dana Bullaboy et al, "Database Security", Cengage Learning, 2012
4. Charles P. Pfleeger, Shari Lawrence Pfleeger et al,"Security in Computing", Prentice Hall, 2015

REFERENCES

1. David Litchfield, Chris Anley, John Heasman, and Bill Grindlay, "The Database Hacker's Handbook: Defending Database Servers", Wiley Publishing, Inc., 2005.
2. Silvana Castano, "Database Security", Second edition, Pearson Education, 1995
3. Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier publications, 2005.

CF3617	CYBER FORENSICS AND INCIDENT RESPONSE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the real-world incidents
- To make a pre-incident preparation
- To understand about incident detection and characterization

Course Outcome		Cognitive Skill
CO-01	Students will gain knowledge about the cyber security threats and the emerging threat landscape.	U
CO-02	Students will learn about the different types of cyber security threats, and also about the vulnerabilities in the cyber resources that are exploited by the adversaries.	U
CO-03	Students will learn about the network threats, causes thereof and attacks which affect the working of the networks.	U
CO-04	Students will learn about the security requirements and security infrastructure to be put in place to secure a cyber-system.	U
CO-05	Students will learn about the procedure in identifying the risks/vulnerabilities in the cyber resources and the nature and extent of the impact of attacks, to enable them study proper threat identification; will also learn about the critical infrastructure protection.	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

S-

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	M	L	L	S
CO-02	S	S	S	S	M	M	M	L	L	S
CO-03	S	S	S	S	M	M	M	L	M	L
CO-04	S	S	S	S	M	M	M	L	L	M
CO-05	S	S	S	S	M	M	M	L	L	L

S-Strong, M-Medium,L-Low,N-Not relevant

Incident Response Overview - Attack Life cycle Concepts- Incident Response Team Composition and Responsibilities - Incident Response Goals and Process - Roles and Responsibilities of CERT-In

Unit II: Pre-Incident Preparation and Incident Response **15**

Organizational Preparation for Incident Response - Risk Identification - Global Infrastructure Considerations - User Education on Host-Based Security - IR Team Preparation - Infrastructure Readiness for Incident Response - Initial Facts Collection - Attack Timeline Construction - Investigative Priorities and Proof Elements - Management Expectation Setting - Leads Development and Management

Unit III: Cyber Forensics and Data Duplication **9**

Cellular Crimes and Evidences - Forensic Procedures Overview - SIM Card and Device Data Analysis - Memory Card Evidences - Android Forensics Procedures - Forensic Image Formats and Duplication Techniques

Unit IV: Data Collection and Authentication **9**

Live Response Tool Selection - Live Data Collection on Windows and Unix Systems - Forensic Duplication Techniques - Network-Based Evidence Collection - Authentication and Evidence Handling Procedures – Hashing.

Unit V: Data Analysis and Reporting **6**

Forensics of Windows, Linux, Android, and iOS Systems - Memory Forensics - Router and Email Investigations - Network Traffic Analysis - Computer Forensics Report Preparation

TOTAL: 45 HOURS

TEXT BOOK

1. Kevin Mandia, Mathew Pepe, Jason Luttgens," Incident Response and Computer Forensics", 3rd Edition, McGraw-Hill Osborne Media,2014.

REFERENCES

1. Eoghan Casey," Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition,2011
2. Skoudis. E., Perlman. R. Counter Hack: A Step-by-Step Guide to Computer Attacks and Effective Defenses, Prentice Hall Professional Technical Reference.2012
3. Norbert Zaenglein," Disk Detective: Secret You Must Know to Recover Information from a Computer", Paladin Press,2010.
4. Bill Nelson, Amelia Philips and Christopher Steuart," Guide to computer forensics Investigation" Course technology, 4th edition,2011.
5. IosifI. Androulidakis," Mobile phone security and forensics: A practical approach", Springer publications,2012.
6. Andrew Hoog, " Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications,2011.

CF3618	CYBER LAW, SECURITY POLICIES AND ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of cyber law and the different Information Technology Acts.
- To acquire knowledge of the various issues in cyber laws.
- To explore the various security policies and procedures related to cyber security and privacy.
- To understand the fundamentals of information security and its tools.
- To be familiar with the cyber ethics and understand the importance of ethics in information security.

Course Outcome		Cognitive Skill
CO-01	Understand the importance of professional practice, law, and information technology in both personal lives and professional careers.	U
CO-02	Analyze and comprehend laws and policies in various countries concerning cybersecurity and privacy.	An
CO-03	Learn about the necessity of information security, various information security tools, and employees' responsibilities.	U
CO-04	Acquire knowledge of various security policies and procedures.	U, A
CO-05	Understand the significance of cyber ethics and the need for ethics in information technology.	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	S	S	S	M	S
CO-02	S	S	S	S	M	S	S	S	M	S
CO-03	S	S	S	S	M	S	S	S	M	S
CO-04	S	S	S	S	M	S	S	S	M	S
CO-05	S	S	S	S	M	S	S	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO CYBER LAW **9**

Cyberspace-Need for cyber law -Information Technology Act 2008- Limitations of IT Act- Cyber Jurisdiction- Information Technology Act 2000 with recent Amendments- Emerging issues in Cyber law.

UNIT II: IT ACT **9**

Penalty and Compensation for damage to computer, computer system, etc- Tampering with Computer Source Documents- Computer Related offenses: Punishment for sending offensive messages through communication service , Punishment for identity theft, Punishment for cheating by impersonation by using computer resource, Punishment for violation of privacy, Cyber Terrorism- Punishment for publishing or transmitting obscene material in electronic form- Powers to issue directions for interception or monitoring or decryption of any information through any computer resource- Case Studies-Digital Data Protection Act 2023.

UNIT III: INFORMATION SECURITY **9**

Introduction to Information Security, Fundamentals of Information Security, Employee Responsibilities, Information Classification, Information Handling, Tools of Information Security.

UNIT IV: INFORMATION SECURITY POLICIES **9**

Information Security Policies and Procedures: Corporate Policies- Tier 1, Tier 2 and Tier 3 Policies, Process Management, Planning and Preparation, Developing Policies, Developing Standards.

UNIT V: CYBER ETHICS **9**

The importance of cyber law, Significance of Cyber Ethics, Need for Cyber Regulations and Ethics, Ethics in Information Society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and Core Principles, Introduction to Block Chain Ethics.

TOTAL: 45 HOURS

TEXT BOOKS

1. P.K.Duggal," Textbook on Cyber law", Prentice hallLtd.,2018
2. Aparna Viswanathan,"Cyber law Indian and International Perspective, Data security,E-Commerce, Cloud computing and Cybercrimes",2012.
3. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2016

REFERENCES

1. Pankaj Sharma,"Information security and Cyber law",2013.
2. Cyber Laws for Engineers, Naavi, Ujvala Consultants Pvt Ltd, 2010.
3. Prakash Pranad,"An introduction to cybercrime cases under IT act - details and analysis CyberLaw cases in Indian context",2017
4. KarnikaSeth," Computers, Internet and new Technology Laws-A comprehensive reference work with special focus on developments in India",2016

CF3679	ETHICAL HACKING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES

- To equip students with the ability to perform reconnaissance and gather essential information about networks and systems using ethical hacking techniques.
- To train students in executing various cyber-attacks, such as SQL injection and DoS, to understand and analyze system vulnerabilities.
- To develop students' proficiency in cracking passwords and decrypting network encryption methods to identify potential security weaknesses.
- To educate students on detecting and mitigating common cybersecurity threats, such as session hijacking and ARP spoofing, using appropriate tools and methods.

Course Outcome – Cos		Cognitive Skill
CO-01	Students will be able to conduct ethical network reconnaissance and information gathering.	U, An
CO-02	Students will be proficient in executing and analyzing various Cyber Attacks.	U,A
CO-03	Students will demonstrate the ability to crack passwords and assess network security.	An
CO-04	Students will be capable of identifying and mitigating common system vulnerabilities.	An
CO- 05	Students will effectively apply ethical hacking tools to strengthen system security.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	M	S	S	N	L	S	M	S
CO-02	S	S	S	M	M	N	M	S	S	S
CO-03	M	S	S	S	M	M	L	M	S	S
CO-04	S	S	S	S	S	N	L	M	S	S
CO-05	M	S	S	M	M	L	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Perform footprinting and Reconnaissance.
2. Analyze the network and gain information using a Sniffer application.

3. Mirror a target website using HTTrack Web Site Copier.
4. System hacking with Social Engineering Tool Kit.
5. Trace Emails using eMailTrackerPro.
6. Perform SQL Injection Attack using SQLMAP.
7. Perform dictionary attacks or brute force attacks on hashed passwords using John the Ripper
8. Perform DoS Attacks using Hping3.
9. Perform a Man-in-the-Middle (MITM) attack using Bettercap.
10. Hijack a session using Zed Attack Proxy (ZAP).
11. Crack a WEP network using Aircrack-ng.
12. Crack FTP, SSH credentials using a Hydra.
13. Implement a code to simulate buffer overflow attack.
14. Detect ARP spoofing using open source tool ARPWATCH

TOTAL: 30 HOURS

CF3680	**Database security Lab**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

OBJECTIVES

- To implement the Relational Database Management System and the features associated with it
- To make use of the integrity constraints and to make the database robust.
- To backup, recover database.
- To implement the access control methods.
- To demonstrate the various attacks to database.

Course Outcome		**Cognitive Skill**
CO-01	Implement basic DDL, DML and DDL Commands	A
CO-02	Use integrity constraints and make the database strong.	A
CO-03	Implementing commands for backup, recovery and similar actions.	A
CO-04	Design and implement access control rules to assign privileges and protect data in databases	An,A
CO-05	Demonstrate the various attacks to the database.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	M	M	S	S	M	S	S	M
CO-02	S	M	M	M	M	S	M	S	S	S
CO-03	S	S	S	S	M	S	S	S	S	S
CO-04	S	S	S	S	S	S	S	S	S	S
CO-05	S	S	S	M	M	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Implementation of DDL commands.
2. Implementation of DML commands.
3. Implementation of different types of constraints.
4. Implementation of database backup, recovery commands
5. Implementation of rollback, commit and save point commands.
6. Managing users and roles.
7. Designing and implementing password policies.
8. SQL injection attacks.
9. Directory attacks.
10. Brute force attacks.

TOTAL: 30 HOURS

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CF3619	Fundamentals of Cloud Computing	3	0	0	3
2.	CF3620	Mobile and Wireless Technology and Security	3	0	0	3
3.	*****	Elective II	3	0	0	3
PRACTICAL						
4.	CF36P1	Project	0	0	12	6
TOTAL			9	0	12	15

CF3619	FUNDAMENTALS OF CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about the basic concepts of cloud computing.
- To study about virtualization and cloud resource management.
- To understand the management of cloud and cloud storage.
- To study the basics of cloud security.
- To be aware of different cloud services.

Course Outcome		Cognitive Skill
CO-01	Understand the main concepts, key technologies, cloud service and deployment models.	U
CO-02	Understand the importance of virtualization in cloud and about the usage of cloud platforms.	U
CO-03	Develop the ability to understand the concepts of managing the cloud and storage provided by cloud.	U, An
CO-04	Analyze the core issues of securing the cloud	An
CO-05	Evaluate the different frameworks and services provided by cloud.	E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	M	L	S	S	S	M	M	M
CO-02	S	M	S	M	S	M	M	S	S	S
CO-03	S	S	S	L	N	S	S	M	M	M
CO-04	S	M	S	M	S	M	S	S	S	S
CO-05	S	S	M	M	M	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction to Cloud Computing **9**

Introduction to Cloud Computing – Evolution of Cloud Computing – Essential Characteristics of cloud computing – NIST Cloud Computing Reference Architecture – Cloud Deployment Models – Cloud Service Models - Benefits of Cloud Computing.

Unit II: Virtualization and Cloud Applications **9**

Virtualization: Characteristics of Virtualized Environments – Taxonomy of virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Cloud Applications: Scientific Applications – Business and Consumer Applications.

Unit III: Managing the Cloud and Cloud Storage **9**

Managing the Cloud: Administrating the Clouds – Emerging Cloud Management Standards – Migrating Applications to Cloud – Cloud Storage - Provisioning Cloud Storage - Exploring Cloud Backup Solutions – Cloud Storage Interoperability – Cloud Federation – Multicloud.

Unit IV: Cloud Security **9**

Challenges with Cloud Data – Challenges with Data Security – Data Confidentiality and Encryption – Data Availability and Data Integrity – Cloud Storage Gateways (CSGs) - CSA Cloud Security Architecture – Data Security.

Unit V: Cloud Services **9**

Compute Services – Storage Services – Database Services – Application Services – Content Delivery Services – Analytics Services – Deployment and Management Services – Identity and Access Management Services.

TOTAL: 45 HOURS

TEXTBOOKS

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, "Mastering Cloud Computing-Foundations and Applications Programming", Elsevier, 2013.
2. K. Chandrasekaran, "Essentials of Cloud Computing", CRC Press, 2015.
3. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", The McGraw Hill Companies, 2010.
4. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishing Inc., 2011.

REFERENCES

1. Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", CRC Press, Taylor and Francis, 2021.
2. Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", Pearson Education, 2014.
3. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", John Wiley, 2011.
4. John W. Rittinghouse, James F. Ransome, "Cloud Computing: Implementation "Management and Security", CRC Press, 2010.

CF3620	MOBILE AND WIRELESS TECHNOLOGY AND SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- Learn the basics of wireless and mobile networks.
- Study the working principles of various generations of telecommunication systems in wireless networks.
- Gain knowledge about different mobile platforms and application development.
- Understand the security issues in mobile and wireless networks.
- Apply cryptographic techniques to enhance the wireless security applications.

Course Outcome		Cognitive Skill
CO-01	Understand the basic concepts of wireless and mobile networks.	U

CO-02	Illustrate the generations of telecommunication systems in mobile networks.	U
CO-03	Develop a mobile application using different mobile platforms.	A
CO-04	Identify state-of-the-art and open problems in mobile and wireless security.	U
CO-05	Apply cryptographic techniques to enhance the wireless security applications.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	S	S	S	M
CO-02	S	S	S	S	M	M	S	S	S	M
CO-03	S	S	S	S	M	M	S	S	S	M
CO-04	S	S	S	S	M	M	S	S	S	M
CO-05	S	S	S	S	M	M	S	S	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Wireless and Mobile Fundamentals **9**

Wireless Networks: Introduction – Generation of Wireless Networks – Characteristics of the Wireless Medium – Wireless Network Typologies – Mobile computing: Characteristics – Functions of Mobile computing – Multiple Access Procedures – Mobile Computing Applications.

Unit II: Mobile Telecommunication Systems **9**

Introduction to Cellular Systems – Channel interference and frequency reuse – Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS) – LTE – Introduction to 5G.

Unit III: Mobile Platforms **9**

Mobile Phones – Mobile Device Operating Systems – Android: Overview – Architecture – Application Components – Application Development – iOS: Overview – Architecture – Application Development.

Unit IV: Wireless and Mobile Security **9**

Security Issues and attacks in Wireless Networks – Review of Network Security: from Crypto to Security Protocols – Wireless Network Security – Cryptographic Protocols for Mobile and Wireless Networks – Key Management in Mobile and Wireless Computing.

Unit V: Wireless Security Applications **9**

Application-Level Security in Cellular Networks – Mobile Application Security – Wireless Application Protocol (WAP) – RFID Security – Bluetooth Security – M-Commerce – Structure – Mobile Payment System – Secure Electronic Transaction – Cryptocurrency and Block chain Technologies.

TOTAL: 45 HOURS

TEXT BOOKS

1. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing - Technology, Application and Service Creation", Tata McGraw-Hill Publishing Computing Ltd, 2010.
2. Andrea Goldsmith, Wireless Communications. Cambridge University Press, 2012.

REFERENCES

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2008.
2. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2014.
3. Kaveh Pahlavan and Prasanth Krishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
4. Prasant Kumar Pattnaik and Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, 2012.
5. Pallapa Venkataram, Satish Babu: "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010.
6. NikolayElenkov, "Android Security Internals: An In-Depth Guide to Android's Security Architecture", No Starch Press, 2014.

ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CF36A1	Vulnerability Assessment and Penetration Testing	3	0	0	3
2.	CF36A2	Cyber Security and Forensic Tools	3	0	0	3
3.	CF36A4	Biometric Security				

CF36A1	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the ethics of hacking and the importance of ethical

hacking, as well as developknowledge and skills in vulnerability assessment and penetration testing.

- Comprehend and analyse various types of attacks in cyber security, Gain proficiency in using Metasploit penetration testing.
- Develop management and reporting skills for penetration test. Explore and exploitvulnerabilities in operating systems.
- Gain knowledge of web application security vulnerabilities and acquire skills in vulnerabilityanalysis.
- Develop skills in malware analysis and client-side browser exploits.

Course Outcome		Cognitive Skill
CO-01	Understand and evaluate the ethical considerations and legal implications in conducting ethical hackingactivities using appropriate tools.	U, E
CO-02	Analyze and defend against social engineering, physical penetration, and insider attacks usingautomating penetration testing processes.	An
CO-03	Manage and report penetration tests effectively and Develop and execute Linux and Windowsexploits, bypassing memory protections.	A
CO-04	Analyze and mitigate web application security vulnerabilities and Conduct vulnerabilityanalysis.	An
CO-05	Evaluate and protect against client-side browser exploits.	E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	M	S	S	S
CO-02	M	S	S	S	S	S	S	S	S	M
CO-03	S	M	S	M	S	S	S	S	S	S
CO-04	S	S	M	S	S	S	M	S	S	S
CO-05	S	S	S	M	S	M	M	M	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction **9**

Introduction Ethics of Ethical Hacking: Why you need to understand your enemy's tactics, recognizing the gray areas in security, Vulnerability Assessment and Penetration Testing. Penetration Testing and Tools: Social Engineering Attacks: How a social engineering attack works, conducting a social engineering attack, common attacks used in penetration testing, preparing yourself for face-to-face attacks, defending against social engineering attacks.

Unit II: Penetration Attacks **9**

Physical Penetration Attacks: Why a physical penetration is important, conducting a physical penetration, Common ways into a building, Defending against physical penetrations. Insider Attacks: Conducting an insider attack, Defending against insider attacks. Metasploit: The Big Picture, Getting Metasploit, Using the Metasploit Console to Launch Exploits, Exploiting Client- Side Vulnerabilities with Metasploit, Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, Going Further with Metasploit.

Unit III: Penetration Test **9**

Managing a Penetration Test:planning a penetration test, structuring a penetration test, execution of a penetration test, information sharing during a penetration test, reporting the results of a Penetration Test. Basic Linux Exploits: Stack Operations, Buffer Overflows, Local Buffer Overflow Exploits, Exploit Development Process. Windows Exploits: Compiling and Debugging Windows Programs, Writing Windows Exploits, Understanding Structured Exception Handling (SEH),Understanding Windows Memory Protections (XPSP3,Vista,7and Server2008), Bypassing Windows Memory Protections.

Unit IV: Web Application Security **9**

Web Application Security Vulnerabilities: Overview of top web application security vulnerabilities, Injection vulnerabilities, cross-Site scripting vulnerabilities, the rest of the OWASP Top Ten SQL Injection vulnerabilities, Cross-site scripting vulnerabilities. Vulnerability Analysis: Passive Analysis, Source Code Analysis, Binary Analysis.

Unit V: Exploiting Systems **9**

Client-Side Browser Exploits: Why client-side vulnerabilities are interesting, Internet explorer security concepts, history of client- side exploits and latest trends, finding new browser-based vulnerabilities heap spray to exploit, protecting yourself from client- side exploit. Malware Analysis : Collecting Malware and Initial Analysis: Malware, Latest Trends in Honey net Technology, Catching Malware: Setting the Trap, Initial Analysis of Malware.

TOTAL: 45 HOURS

TEXTBOOKS

1. Allen Harper,Stephen Sims, Michael Baucom, "Gray Hat Hacking - The Ethical Hacker's Handbook", Tata McGraw-Hill, 2022.
2. Dafydd Suttard, Marcuspinto, "The Web Application Hacker's Handbook- Discovering and Exploiting Security flaws", 2nd Edition,Wiley publishing.

REFERENCES

1. Georgia Weidman, "Penetration Testing: Hands- on Introduction to Hacking", No Starch Press, 2014.

2. L.Wylie, KimCrawly ,"The Pen Tester Blueprint- Starting a Career as an Ethical Hacker", Wiley Publications, 2020.

CF36A2	CYBER SECURITY AND FORENSIC TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn basic of cyber security
- To know the cyber security technologies and standards
- To understand the issues in cyber security implementation
- To practice the cyber security tools
- To practice the forensic tool

Course Outcome		Cognitive Skill
CO-01	Understand the basic of cyber security.	U
CO-02	Gain knowledge in the cyber security technologies and standards.	U, R
CO-03	Understand the issues in cyber security implementation	An
CO-04	Apply cyber security tools to identify and detect security flaws.	A
CO-05	Practice the forensic tool to analyze incidents related to cyber-crime	E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	S	M	L	M	L	L	L	S
CO-02	S	L	S	S	S	L	M	M	L	S
CO-03	M	S	S	M	S	M	M	L	M	L

CO-04	M	S	S	M	M	L	S	L	L	M
CO-05	M	L	L	M	L	L	L	L	L	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction **6**

Overview of Cyber Security- Understanding Threats, Vulnerabilities, and Incidents

Consequences of Cyber Attacks - Protection Stages and Recovery - US Federal Initiatives for Critical Infrastructure Protection.

Unit II: Cyber Security Technologies and Standards **9**

Cyber Security Technologies Overview - Protocol Classification and Attacks - Knowledge Discovery from Network Logs - Trusted Computing and DRM - Introduction to Cyber Security Standards

Unit III: Cyber Security Implementation **9**

Risk-Based Framework for Infrastructure Owners - Implementing Cyber Security Technologies - Access Control and Firewall Implementation - Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) - Encryption Techniques Overview

Unit IV: Cyber Security Tools **9**

Introduction to Cyber Security Tools - Network Scanning with Nmap and OpenVAS - Intrusion Detection with OSSEC, Snort, and Bro IDS - Packet Analysis with Wireshark

Unit V: Forensic Tools **12**

Introduction to Forensic Tools - Netforce Suite, CDR Analyser SIM Xtractor, Cyber Check Suite, Mobile Check, WinLifT - CAINE - X-Ways Forensics - EnCase - Registry Recon-The Sleuth Kit- Volatility - Windows SCOPE - The Coroner's Toolkit - Oxygen Forensic Suite-Bulk Extractor-Xplico-Mandiant RedLine-Computer Online Forensic Evidence Extractor (COFEE)

TOTAL: 45 HOURS

TEXT BOOKS

1. Keith A Rodes, Joel Willemssen," Technology assessment cybersecurity for critical infrastructure protection", GAO United States General Accounting Office, DIANE Publishing andCo.,2004
2. Martti Lehto, Pekka Neittaanmaki," Cyber Security Analytics, Technology and Automation", Springer,2015
3. Anne Kohnke, Ken Sigler, Dan Shoemaker, "Implementing Cybersecurity: A Guide to the National Institute of Standardsand Technolgoy Risk Management Framework", CRC Press,2017.

REFERENCES

1. Junaid Ahmed Zubairi, Athar Mahboob," Cyber Security Standards, Practices and Industrial Applications: Systems and Methodologies", Information Science Reference (an imprint of IGIGlobal),2012
2. http://resources.infosecinstitute.com/computer-forensics-tools/#gref

   https://en.wikipedia.org/wiki/List of` digital forensics tools.

CF36A3	BIOMETRIC SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To have a thorough understanding of the basic concepts of biometrics
- To discuss in detail about the physiological biometrics authentication techniques.
- To discuss in detail about the behavioural biometrics authentication techniques.
- To discuss about Signature and handwriting technology.
- To familiarize the students with multi biometrics and multi factor biometrics.

Course Outcome		Cognitive Skill
CO-01	Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.	A
CO-02	Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.	U, An
CO-03	Be able to work effectively in teams and express their work and ideas orally and in writing.	A
CO-04	Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.	A
CO-05	Understand various Biometric security issues.	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	S	S	S	M	M	S	S	M	M
CO-02	S	S	S	S	M	M	S	S	M	M

CO-03	S	S	S	S	S	S	S	S	S	S
CO-04	M	M	S	S	M	M	S	M	M	M
CO-05	M	M	S	S	M	M	S	M	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: Biometric fundamentals and standards **9**

Definition, Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification - Identification - Biometric matching, Performance measures in biometric systems, assessing the privacy risks of biometrics - Designing privacy sympathetic biometric systems, Different biometric standards, and Application properties.

UNIT II: Physiological Biometric Technologies I **9**

Fingerprints, Technical description, characteristics, Competing technologies, strengths, weaknesses, deployment, Facial scan, Technical description, characteristics, weaknesses-deployment, Iris scan, Technical description, characteristics, strengths, weaknesses, deployment

UNIT III: Physiological and Behavioral Biometric Technologies **9**

Retina vascular pattern, Technical description, characteristics, strengths, weaknesses, Deployment, Hand scan, Technical description, characteristics, strengths, weaknesses deployment, DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics, DNA Biometrics.

UNIT IV: Behavioral Biometric Technologies: **9**

Signature and handwriting technology, Technical description, classification, keyboard / keystroke dynamics, Voice, data acquisition, feature extraction, characteristics, strengths, weaknesses, deployment.

UNIT V: Multi Biometrics **9**

Multi biometrics and multi factor biometrics, two-factor authentication with passwords, tickets and tokens, executive decision, implementation plan.

TOTAL: 45 HOURS

TEXT BOOKS

1. "Handbook of Biometrics,Anil K Jain, Patrick Flynn and Arun A Ross,2010, Springer, USA.
2. Biometric Technologies and Verification Systems, John R Vacca,2009. Elsevier, USA

REFERENCES

1. Biometrics -Identity verification in a network, Samir Nanavathi, Michel Thieme, and Raj Nanavathi, 1st Edition,2002.Wiley Eastern.
2. Implementing Biometric Security,John Chirillo and Scott Blaul, 1st Edition, 2005, Wiley Eastern Publication.
3. Biometrics for Network Security, John Berger, 1st Edition, 2004, Prentice Hall.
4. Mohammad S Obaidat, Issa Traore and Isacc Woungang, “Biometric-based physical and cyber security systems”, Springer 2019.