BHARATHIDASAN UNIVERSITY TIRUCHIRAPPALLI-620024

B.Sc. CYBER SECURITY

CHOICE BASED CREDIT SYSTEM– LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2026 - 2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – II (AEC - II)	English Course – I	6	3	3	30	70	100
	III	Core Course -1 (CC - 1)	Programming in C and Data Structures	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Programming in C and Data Structures Lab	4	4	3	40	60	100
		Allied Course – 1 (AC - 1)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - I (AP-I)	Any one from the list	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course – 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**22**	--	--	--	**700**
II	I	Ability Enhancement Course – III (AEC - III)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – IV (AEC - IV)	English Course – II	6	3	3	30	70	100
	III	Core Course- 2(CC - 2)	Programming in Java	4	4	3	30	70	100
		Core Practical - 2(CP - 2)	Object Oriented Programming using Java Lab	4	4	3	40	60	100
		Allied Course – 2 (AC - 2)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - I (AP-I)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1(SEC - 1) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**

III	I	Ability Enhancement Course – V(AEC - V)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – VI (AEC - VI)	English Course – III	6	3	3	30	70	100
	III	Core Course- 3(CC - 3)	Programming in Python	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	Programming in Python Lab	4	4	3	40	60	100
		Allied Course – 3 (AC - 3)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - II (AP-II)	Any one from the list	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) $$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			**30**	**23**	--	--	--	**800**
	I	Ability Enhancement Course – VII (AEC - VII)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
IV	II	Ability Enhancement Course – VIII (AEC - VIII)	English Course – IV	6	3	3	30	70	100
	III	Core Course- 4(CC - 4)	Fundamentals of Cyber Security	4	4	3	30	70	100
		Core Practical - 4(CP - 4)	Cyber Security Lab	4	4	3	40	60	100
		Allied Course – 4 (AC - 4)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - II (AP-II)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) $$	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**
	Summer Internship / Industrial Activity during the Summer Vacation after II Year								

V	III	Core Course - 5 (CC - 5)	Ethical Hacking	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Cyber Crime and Mitigation Techniques	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Cloud Computing Security	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Block Chain Technology	5	4	3	30	70	100
		Core Practical - 5(CP - 5)	Ethical Hacking Lab	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			**30**	**28**	--	--	--	**900**
VI	III	Core Course - 9 (CC - 9)	Data Communication and Networks	4	4	3	30	70	100
		Core Course- 10 (CC - 10)	Fundamentals of Cryptography	5	4	3	30	70	100
		Core Course- 11 (CC - 11)	Penetration Testing	5	4	3	30	70	100
		Core Project Work (CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			**30**	**25**	**--**	**--**	**--**	**900**
	Grand Total			**180**	**150**	--	--	--	**4900**

ALLIED COURSE

First Year Students	**Second Year Students**
Mathematics	Applied Physics / Electronics

SKILL ENHANCEMENT COURSE (SEC)			
Sl. No.	**Title of paper**	**Sl. No.**	**MANDATORY Naan Mudhalvan Scheme ##**
1.	Computer Graphics	1.	**2nd Semester:**
2.	Mobile Application Development		
3.	Big Data Analytics	2.	**3rd Semester:**
4.	Internet of Things		
5.	Web and Information Security	3.	**4th Semester:**
6.	Social and Web Analytics		
7.	Cyber Law and Defence Technology	4.	**5th Semester:**
--		5.	**6th Semester:**

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART – I (for other Department Students only)	
1st Semester	Fundamentals of Information Technology
2nd Semester	Working Principles of Internet
3rd Semester	Digital Marketing
4th Semester	Introduction to Cyber Security

INTERDISCIPLINARY COURSE (IDC) # FOR WHO HAVE NOT OPT TAMIL AS PART - I		
Those who have studied Tamil upto 10th+2 but opt for other languages in degree	1st Semester	Special Tamil - I
	2nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	1st Semester	Basic Tamil - I
	2nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3rd and 4th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) $$ FOR NCC CADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	**NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:**
Introduction to NCC	1. Special Subject Army **(or)** 2. Special Subject Navy **(or)** 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (AP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		**EXTENSIONACTIVITIES** (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities	--	1	1	--
Total			**49**	**-**	**150**	**4900**

<table>
<tr><td>$</td><td>For those who have studied Tamil upto 10th+2 (Regular Stream)</td></tr>
<tr><td>+</td><td>Syllabus for other Languages should be on par with Tamil at degree level</td></tr>
<tr><td>#</td><td>Those who have studied Tamil upto 10th+2 but opt for other languages in degree level under Part - I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part – IV under the Interdisciplinary Course.</td></tr>
<tr><td>**</td><td>Examination at the end of the next semester</td></tr>
<tr><td>##</td><td>Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.</td></tr>
<tr><td>$$</td><td>NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.</td></tr>
<tr><td>@</td><td>Health and Wellness: Assessments:

● Use self-reflective worksheets to assess their understanding
● submit the worksheets to internal audit / external audit
● Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

<table>
<tr><th>Part</th><th>Description</th><th>Marks</th></tr>
<tr><td>A</td><td>Report</td><td>40</td></tr>
<tr><td>B</td><td>Attendance</td><td>20</td></tr>
<tr><td>C</td><td>Activities (Observation During Practice)</td><td>40</td></tr>
<tr><td colspan="2">Total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>@@</td><td>Summer Internship / Industrial Activity

Internship will be carried our during the summer vacation after the second year. Viva-Voce will be conducted by the college and Marks shall be send to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity & Project Work

Scheme of Evaluation:

<table>
<tr><th>Description</th><th>Marks</th></tr>
<tr><td>Report</td><td>80</td></tr>
<tr><td>Viva-Voce</td><td>20</td></tr>
<tr><td>Total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>*</td><td>Extension Activities shall be outside instruction hours.</td></tr>
</table>

PROGRAMME OUTCOMES:

PO 1	**Communication Skill:** Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
PO 2	**Disciplinary Knowledge:** Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
PO 3	**Critical thinking:** Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
PO 4	**Analytical Reasoning:** Through the interactions, students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
PO 5	**Scientific Reasoning:** Skill oriented courses will provide details on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
PO 6	**Self-directed Learning:** Preparation of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
PO 7	**Reflective Thinking:** All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
PO 8	**Problem Solving:** Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
PO 9	**Research-related Skills:** Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
PO 10	**Lifelong Learning:** Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

PROGRAMME SPECIFIC OUTCOMES:

PSO 1	To acquire the required knowledge in the Hardware and Software aspects of Computer Science domain and the art of programming.
PSO 2	To understand the development methodologies of software systems and the ability to analyse, design and develop computer applications for real life problems.
PSO 3	To gain knowledge and skills to collaborate and communicate with peers in IT / ITES industries
PSO 4	To understand, adjust and adapt with the dynamic technical environment for the growth of IT industry
PSO 5	To transfer the skills gained, to provide innovative and novel solutions by maintaining ethical norms for the betterment of humane society

Year : First **Semester: I**

CORE COURSE 1

PROGRAMMING IN C AND DATA STRUCTURES

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Identify and Recall the fundamental syntax of C programming while defining the basic concepts of linear and non-linear data structures.
- Explain and Interpret the logical flow and the operational mechanics of various linear and non-linear data structures.
- Apply C programming syntax and memory management techniques to implementation of linear and non-linear data structures.
- Analyze and Differentiate complex programming constructs and data structures to optimize memory and data management.
- Evaluate and justify the selection of programming constructs, memory management techniques, and data structures.

UNIT – I : INTRODUCTION

Basic of C: History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Order of Precedence, Evaluating of Arithmetic Expressions – Type Conversion- Decision Statements: if, if-else, and nested if statements.

UNIT – II : LOOPING AND FUNCTIONS

Loops Structures: For Loop, While, Do-while loop – Arrays: - One Dimensional Array, Two-dimensional Arrays, Character Arrays and Strings – Functions: Function with arrays - Function with decision and looping statements - Recursion.

UNIT – III : POINTERS AND STRUCTURES

Pointers: Introduction – Pointer Expressions – Chain of Pointers – Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Function pointer – Structures - declaration, initialization, Array of Structures – Pointer to structures, Structures and functions – Typed of Enumerated data types, Unions.

UNIT – IV : STRING AND FILES

Strings Processing, Standard string library functions – Files: introduction and files functions – Writing and reading in Text mode – Simple application: Display the contents of a file. Write data to a file. Append data to an existing file – File IO– Reading and writing structures.

UNIT – V : DATA STRUCTURES

Stack: LIFO concept, Stack operations, Array implementation of stack – Queue: FIFO concept, Queue operations, Array implementation of queue – Singly Linked List: concepts, operations – Doubly Linked List: concepts, operations – Trees: General trees, Binary trees.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS :

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Nineth Edition, 2024.
2. ReemaThareja, "Data Structure using C, "Oxford University Press", New Delhi, Third Edition, 2023

REFERENCES

1. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, Tata-McGraw Hill Edition, New Delhi, 1991.
2. E.Horowitz, S.Sahni and Susan Anderson Freed, "Fundamental Data Structures in C", 2ed, Orient BlackSwan Publisher, 2009
3. E. Karthikeyan, "A Textbook on C Fundamentals, Data Structures and Problem Solving", Prentice-Hall of India Private Limited, New Delhi, 2008.
4. YashavantKanetkar, "Let us C", BPB Publications, Tenth Edition, New Delhi, 2010.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://www.w3schools.in/data-structures/intro

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Demonstrate the ability to construct C programs by correctly utilizing basic building blocks
CO2	Design and implement modular software solutions using functions and recursion ad arrays
CO3	Apply pointer arithmetic to manage memory addresses and organize complex information using user-defined data types
CO4	Design and implement modular software solutions using functions and recursion
CO5	Analyze and implement core data structure concepts, including the LIFO/FIFO operations of stacks and queues

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	2	2	3	1	2	2	2	2	2	2	3	**2.1**
CO2	3	3	3	3	2	2	2	3	2	2	2	3	2	2	2	**2.4**
CO3	2	3	3	3	2	2	1	3	3	2	3	3	2	2	1	**2.3**
CO4	1	3	2	3	3	1	1	3	3	2	3	3	2	3	1	**2.3**
CO5	2	3	3	3	3	1	2	3	3	2	3	3	2	3	2	**2.5**
Average	**2.0**	**3.0**	**2.6**	**2.8**	**2.4**	**1.6**	**1.8**	**2.6**	**2.6**	**2.0**	**2.6**	**2.8**	**2.0**	**2.4**	**1.8**	**2.3**

Mean Co : 2.3

3 - Strong, 2 - Medium , 1- Low

Year : First **CORE PRACTICAL 1** **Semester: I**

PROGRAMMING IN C AND DATA STRUCTURES LAB

Code : **Practical** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Identify and define core C programming elements and the structural properties of linear data structures like Arrays and Stacks.
- Demonstrate how to use conditional logic and control structures to solve mathematical logic problems
- Implement fundamental algorithms for data retrieval and organization, specifically performing Linear Search and Bubble Sort
- Analyze and compare the operational mechanisms of various data structures,
- Design and construct modular programs that utilize dynamic memory and pointers to perform complex operations

To develop the C program for the following Exercises

1. **Input/Output, Arithmetic, and Conditional Logic:**
   Concepts: Basic I/O (printf, scanf), operators, expressions, decision-making (if, switch)
   Write a C Program to compute grade based on marks
2. **Loops and Pattern Printing :**
   Concepts: for, while, do-while loops, nested loops
   Write a C Program to Generate Multiplication Table

3. **Arrays and Strings :**
   Concepts: 1D & 2D arrays, string handling functions
   (a) Write a C Program to Find largest and smallest element in an array
   (b)Write a C Program to count vowels and consonants

4. **Functions and Recursion :**
   Concepts: User-defined functions, parameter passing, recursion
   Write a C Program to Print Fibonacci Series

5. **Structures and File I/O :**
   Concepts: Structures, unions (basic idea), file handling (fopen, fread, fwrite)
   Write a C Program Student record management using structures

6. **Dynamic Array Implementation *:***
Concepts: Dynamic memory allocation (malloc, calloc, realloc, free)
Write a C Program Create dynamic array and perform insertion/deletion

7. **Singly Linked List Operations :**
Concepts: Linked list creation, traversal, insertion, deletion
Write a C Program to Reverse a linked list and count number of nodes

8**. Doubly Linked List Operations :**
Concepts: Forward and backward traversal, insertion, deletion
Write a C Program toCreate and display doubly linked list, Forward and backward traversal, insertion, deletion

9. **Searching and Sorting Techniques :**
Concepts: Searching (Linear, Binary) and Sorting Techniques (Bubble, Selection, Insertion, Quick, Merge)

(a) Write a C Program to Implement Linear and Binary Search
(b) Write a C Program to Implement Sorting Techniques

10. Tree Traversals :
Concepts: Binary Trees, traversal techniques
Write a C Program to Create a Binary Tree and Counting leaf nodes

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Describe and implement basic control structures to solve mathematical problems
CO2	Apply iterative and conditional logic to perform data validation tasks, such as determining if a number is a palindrome
CO3	Demonstrate the ability to store, traverse, and perform aggregate calculations (sum and average) on data sets using arrays
CO4	Construct and analyze linear data structures by implementing Stack, Queue operations and Singly Linked Lists
CO5	Analyze and execute fundamental algorithms for data organization and retrieval, specifically implementing Linear Search and Bubble Sort

Year : First **Semester: II**

CORE COURSE 2
PROGRAMMING IN JAVA

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Explain the core features of Java and implement essential programming constructs
- Apply Object-Oriented Programming (OOP) principles by creating classes and objects
- Analyze and implement complex relationships using inheritance, interfaces, and polymorphism
- Build resilient applications by implementing comprehensive exception handling (try-catch, custom exceptions)
- Design and construct professional-grade desktop applications by integrating AWT/Swing.

UNIT – I : OVERVIEW OF JAVA

Object Oriented Programming, Structure of Java program, Control statements, Data types, variables, and Arrays, Operators. Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference. Introducing Methods, Constructors, this Keyword, finalize() class.

UNIT – II : METHODS AND CLASSES

Overloading Methods, Overloading Constructors, Recursion, Introducing final, Nested and Inner Classes, Using Command Line Arguments, Inheritance: Inheritance Basics, Using Super, Method Overriding, Abstract Classes, The Object Class

UNIT – III : PACKAGES AND INTERFACES

Packages, Access Protection, Importing packages, Interfaces, Exception Handling: Fundamentals, Exception Types, Uncaught Exceptions, try and catch, Multiple catch clauses, Nested try statements, Throw, throws, finally. Multithreaded Programming: Thread model, Creating a Thread, Creating Multiple Threads

UNIT – IV : STRING HANDLING

Special String operations, Character extraction and String Comparison, Modifying a String. The Applet Class: Applet Basics, Applet Architecture, Apple Skeleton, Simple Applet Display Methods, Request Repainting, HTML APPLET tag.

UNIT – V : EVENT HANDLING

Event Handling Mechanisms, Event Classes: ActionEvent Class, AdjustmentEvent Class, ComponentEvent Class, ContainerEvent Class, FocusEvent Class Introducing the AWT: AWT Class, Window Fundamentals, Working with Graphics, Working with Color

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS :

1. S. Sagayaraj, R. Denis, P. Karthik & D. Gajalakshmi, “Constructive Java Programming“, Universities Press, 2021.
2. E. Balagurusamy, “Programming with JAVA”, Tata McGraw Hill, New Delhi, 2019.
3.

REFERENCES

1. Herbert Schildt, Java: The Complete Reference
2. C. Muthu, “Programming with JAVA”, Vijay Nicole Imprints Private Limited, Chennai, Second Edition, 2011.
3. Bruce Eckel, Chuck Allison, “Thinking in Java”, Prentice Hall Publications, 2006
4. Malina Pronto, "Java: How To Learn Java Programming: How To Improve Your Java Coding In 2020/2021: 5 Programming Languages To Learn For Beginners In Tech", Independently Published, 2020.
5. Nick Samoylov, “Learn Java 12 Programming: A Step-by-step Guide to Learning Essential Concepts in Java”, Packt Publishing, 2019.
6. https://www.javatpoint.com/java-tutorial
7. https://www.geeksforgeeks.org
8. https://www.javatpoint.com

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1 Describe the Java runtime environment and implement fundamental programming constructs

CO2 Apply Object-Oriented Programming (OOP) principles to design modular code using classes, objects

CO3 Analyze and manage complex data relationships by implementing multi-dimensional arrays, advanced string handling

CO4 build fail-safe applications by implementing multi-level exception handling and developing multi-threaded programs

CO5 Synthesize full-scale Java applications by integrating interactive GUI components (AWT/Swing) with JDBC

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	3	3	2	1	3	1	3	1	1	2	2	2	2	2	2.1
CO2	3	2	1	2	2	2	1	1	3	1	3	3	3	3	2	2.1
CO3	2	3	2	3	1	2	1	1	1	1	2	2	3	2	1	1.8
CO4	3	3	3	2	2	1	3	2	2	1	2	2	2	2	2	2.1
CO5	3	3	3	3	2	2	2	3	1	2	3	3	1	3	2	2.4
Average	**2.8**	**2.8**	**2.4**	**2.4**	**1.6**	**2.0**	**1.6**	**2.0**	**1.6**	**1.2**	**2.4**	**2.4**	**2.2**	**2.4**	**1.8**	**2.4**

Mean CO's : 2.4

3 - Strong, 2 - Medium , 1- Low

Year : First **Semester: II**

CORE PRACTICAL 2

OBJECT ORIENTED PROGRAMMING USING JAVA LAB

Code : **Practical** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Identify and define the syntax required for basic Java programming,
- Explain and interpret the logic behind iterative and conditional statements used to solve mathematical problems
- Apply Java control structures to develop algorithms that manipulate data, specifically for reversing numbers and calculating the sum of digits.
- Analyze the requirements for graphical user interfaces to implement Applets
- Design and evaluate responsive Java applications that incorporate animation and event handling

To Implement Java Concepts for following exercises

1. Program to check whether a person is eligible to vote or not. If not find how many years he or she has wait to cause their vote.
2. Program to handle **looping and iterative statements**
3. Program to demonstrate **method overloading**.
4. Program to demonstrate **method overriding**
5. Program to handle **Exception Handling**.
6. Program to handle **Multithreading**
7. Program to demonstrate the various **string handling** functions.
8. Program to find area of **triangle and volume of rectangle** using inheritance.
9. Program to implement the concept of **packages.**
10. Program to create **multiple threads** using thread class.
11. JAVA applet to draw **multiple shapes with different colors**.
12. Program to handle a **button click event** and display a message

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Java syntax and control structures to solve fundamental problems
CO2	Construct algorithms to transform and analyze numerical data, specifically by reversing numbers and calculating the sum of digits
CO3	Construct algorithms to transform and analyze numerical data, specifically by reversing numbers and calculating the sum of digits
CO4	Evaluate and implement interactive applet features such as displaying system time, creating moving text animations
CO5	Synthesize event-handling techniques to create responsive programs

Year : Second **Semester: III**

CORE COURSE 3
PROGRAMMING IN PYTHON

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Identify core language features including reserved keywords, identifiers, and variables interpret
- Explain and apply decision-making constructs, nested loops, and various data types.
- Design modular solutions by defining functions with multiple return values, utilizing recursive logic, and organizing code
- Analyze and implement Object-Oriented principles such as encapsulation, inheritance, and polymorphism
- Construct integrated applications that perform sophisticated text processing

UNIT – I:INTRODUCTION TO PYTHON:

Features of Python - How to Run Python - Identifiers - Reserved Keywords - Variables - Comments in Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Quotes in Python - Input, Output and Import Functions - Operators. Data Types and Operations: Numbers – Strings – List – Tuple – Set – Dictionary – Data type conversion.

UNIT – II : FLOW CONTROL

Decision Making – Loops – Nested Loops – Types of Loops. Functions: Function Definition – Function Calling - Function Arguments - Recursive Functions - Function with more than one return value.

UNIT – III :MODULES AND PACKAGES

Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - The dir() function - The reload() function - Packages in Python - Date and Time Modules. Python Strings: String operations - Immutable Strings - Built-in String Methods and Functions - String Comparison - File Handling- Directories in Python.

UNIT – IV :OBJECT-ORIENTED PROGRAMMING

Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes- Destructors in Python – Encapsulation - Data Hiding – Inheritance - Method Overriding- Polymorphism.

UNIT – V :EXCEPTION HANDLING

Built-in Exceptions-Handling Exceptions- Exception with Arguments - Raising Exception - User-defined Exception - Assertions in Python. Regular Expressions: The match() function - The search() function - Search and Replace - Regular Expression Modifiers: Option Flags-Regular Expression Patterns- Character Classes-Special Character Classes - Repetition Cases - findall() method - compile() method.

UNIT – VI : CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS :

1. ReemaThareja, " PYTHON Programming", Oxford University Press, New Delhi, Third Edition, 2025
2. Jeeva Jose and P. SojanLal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Book Publishing Co, 2016.

REFERENCES

1. Mark Summerfield. — Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Martin C. Brown, —PYTHON: The Complete Reference‖, McGraw- Hill, 2001
3. Wesley J. Chun, "Core Python Programming", Prentice Hall Publication, 2006.
4. Timothy A Budd, "Exploring Python", Tata McGraw Hill, New Delhi, 2011
5. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016 Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Describe the core features of Python and utilize fundamental syntax
CO2	Apply decision-making constructs and various loop types to manipulate collections
CO3	Design modular applications by implementing recursive functions, custom modules, and hierarchical packages
CO4	Analyze and implement Object-Oriented principles, including inheritance and polymorphism
CO5	Synthesize complex programs that perform advanced text processing using regular expressions

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	3	3	2	3	2	1	3	2	3	3	2	2	3	3	2.5
CO2	2	3	2	3	3	3	3	3	2	2	3	3	3	3	2	2.7
CO3	3	2	2	1	3	1	3	3	2	3	3	3	3	3	2	2.3
CO4	3	3	3	2	3	2	2	2	2	2	2	2	3	3	2	2.4
CO5	3	3	3	2	2	1	3	2	1	1	2	3	2	3	1	2.0
Average	**2.8**	**2.8**	**2.6**	**2.0**	**2.8**	**1.8**	**2.4**	**2.6**	**1.8**	**2.2**	**2.6**	**2.6**	**2.6**	**3.0**	**2.0**	2.4

Mean Co : 2.4

3 - Strong, 2 - Medium , 1- Low

Year : Second **Semester: III**

CORE PRACTICAL 3

PROGRAMMING IN PYTHON LAB

Code : **Practical** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Identify and define core Python elements, including reserved keywords, identifiers, variables,
- Explain the mechanics of decision-making statements and iterative loops used to solve computational problems
- Implement functional programming by creating reusable code blocks and recursive functions
- Analyze and organize code using Object-Oriented principles—including inheritance and polymorphism.
- Construct comprehensive applications that integrate file handling for persistent storage with regular expressions

To Implement the PYTHON program for the following Exercises

1. Basic Syntax & Input/Output
2. Flow Controls & Loops
3. Lists &Iterables
4. Functions and Recursive Functions
5. Build in Modules
6. String Operations
7. Lists, Tuples, & Sets
8. Exception Handling
9. Object-Oriented Programming (OOP) – Inheritance, Polymorphism
10. Basic File I/O & Error Handling
11. Regular expression Modifiers
12. Advanced File & Data Handling (Eg. Directory Tree Generator, JSON Configuration Parser)

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Apply fundamental control structures to solve simple computational problems
CO2	Construct algorithms to perform mathematical operations, including calculating the sum of natural numbers
CO3	Analyze text data to perform pattern-based checks, such as identifying palindromes and categorizing characters into vowels or consonants
CO4	Design and implement recursive functions to solve complex mathematical problems
CO5	Synthesize file-handling techniques to process external data, specifically calculating metrics

Year : Second **Semester: IV**

CORE COURSE 4

FUNDAMENTALS OF CYBERSECURITY

Code : Theory Credits: 4

COURSE OBJECTIVES :

This course aims to :

- Understand the fundamental concepts of information security, including information systems, security principles, software development life cycle, and the role of security professionals in organizations.
- Identify and analyze security threats, vulnerabilities, and attacks affecting information systems and evaluate the need for secure software development practices.
- Apply security technologies and mechanisms such as access control, firewalls, intrusion detection and prevention systems, biometric authentication, and security monitoring tools to protect information assets.
- Understand and implement cryptographic techniques including cipher methods, cryptographic algorithms, protocols, and security tools for secure communication and data protection.
- Evaluate and manage information security risks by performing risk identification, assessment, and implementing appropriate risk control strategies to safeguard organizational resources.

UNIT- I INTRODUCTIONTOINFORMATIONSECURITY:

Components of Information System - Software Development Life Cycle –Security Software Development Life Cycle - Security Professionals and the Organisation - Communicates Of Interest

UNIT–II NEEDFORSECURITY:

Introduction - Business Need First - Threats - Attacks - Secure Software Development.

UNIT–III SECURITYTECHNOLOGIES:

Introduction-Access Control–Firewall-Protecting Remote Connections-Intrusion Detection and Prevention System–Honeypots, Honeynets and Padded Cell-System Scanning and Analysis Tools-Biometric Access Control

UNIT–IV CYRPTOGRAPHY:

Foundation of Cryptology - Cipher Methods – Cryptographic Algorithms – Cryptographic Tools –Protocols for Communication - Attacks on cryptosystems

UNIT–V RISKMANAGEMENT:

Introduction – An over view of Risk Management – Risk Identification – Risk Assessment – Risk Control Strategies – Selecting a Risk Control Strategy – Risk management Discussion Points-Recommended Risk Control Practices.

UNIT – VI : CURRENT CONTOURS (For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS :

1. Michael E. Whitman, Herbert J. Mattord," Principles of Information Security", CENGAGELearning,4thEdition.
2. Principles of Information Security By Michael E.Whitman and Herbert J. Mattord.

REFERENCES

1. William Stallings, "Cryptography and Network Security–Principles and Practice",Pearson Education, 7th Edition.
2. AtulKahate,"Cryptography and Network Security", McGrawHill, 4th Edition
3. Elementary Information Security By Richard E.Smith.
4. Fundamentals of Information Systems Security By David Kim and Michael G.Solomon.

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Understand the basic concepts, need, approaches, principles and components of security.
CO2	Explain the various cyber threats and attacks.
CO3	Describe the various Security Technologies and Tools.
CO4	Explain the basic principles of cryptography and algorithms.
CO5	Examine the various protocols for secure communication.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	3	2	2	1	1	1	1	1	1	3	2	1	2	2	**2.13**
CO2	1	3	3	3	2	1	1	3	1	1	2	2	1	2	2	**2.20**
CO3	1	3	2	3	3	1	2	3	2	1	3	3	1	2	2	**2.13**
CO4	1	3	2	3	2	1	1	2	1	1	3	2	1	2	2	**1.80**
CO5	2	3	2	3	2	1	1	3	2	1	2	3	2	2	2	**2.07**
Average	**1.40**	**3.00**	**2.20**	**2.80**	**2.00**	**1.00**	**1.20**	**2.40**	**1.40**	**1.00**	**2.60**	**2.40**	**1.20**	**2.00**	**2.00**	**2.00**

3 - Strong, 2 - Medium , 1- Low

Year : Second **Semester: IV**

CORE PRACTICAL 4
CYBER SECURITY LAB

Code : **Practical** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Understand and apply network security concepts by using reconnaissance, packet analysis, and monitoring tools to identify network activities and potential security threats.
- Configure and strengthen system security through the implementation of firewall policies, browser security settings, operating system hardening, and group policy management.
- Apply cryptographic techniques and algorithms to ensure confidentiality, integrity, and secure communication through encryption, hashing, and secure access mechanisms.
- Perform vulnerability assessment and penetration testing using industry-standard security tools to identify, analyze, and mitigate security vulnerabilities in systems and networks.
- Evaluate and secure web applications and network services by conducting security testing, analyzing attack vectors, and implementing appropriate cyber security controls and best practices.

LIST OF EXERCISES :

1. Working with Network Reconnaissance tools such as nslookup, traceroute, dig and Whois.
2. Capturing and Exploring packets with Wire shark packet sniffer.
3. Exploring Windows Firewall Security.
4. Configuring security for Web Browsers.
5. Hardening Windows Operating System.
6. Exploring Windows Group Policy.
7. Working with Ciphers.
8. Working with SHA-1 algorithm.
9. Perform encryption and decryption using transposition techniques:

a. Rail Fence Cipher b. Row & Column Transformation

10. Prevent Eavesdropping attacks using SSH.
11. Vulnerability Assessment and Penetration Testing using Open VAS/Nessus/Nmap.
12. Web Application Security Testing using OWASP ZAP or Burp Suite.

COURSE OUTCOMES :

Upon successful completion of this course, the students would be able to:

CO1	Demonstrate and exhibits skills with reconnaissance tools such as nslookup, trace route, dig and who is.
CO2	To Capture and Analyze the packets using Wireshark Tool
CO3	Configure and Secure the Windows Firewall and Group Policy in Windows OS
CO4	Configure and Secure the Web Browsers and harden the Windows OS.
CO5	Identify and Prevent Eavesdropping attack using SSH

Year : Three	**CORE COURSE 5** **ETHICAL HACKING**	**Semester: V**
Code :	**Theory**	**Credits: 4**

COURSE OBJECTIVES:

This course aims to :

- Understand and acknowledge the relevance of legal, ethical, and professional challenges faced by an ethical hacker.
- Apply fundamental principles of system, application, and network security to ethically attack / penetrate the system to uncover the security flaws.
- Perform evaluation of security systems through a systematic ethical hacking process and recommend countermeasures to improve security.
- Use various tools and techniques used in various stages of the ethical hacking process.
- Analyze and acknowledge the relevance of legal, ethical, and professional challenges faced by an ethical hacker.

UNIT – I: INTRODUCTION

Important Terminologies - Categories of Penetration Test - Writing Reports - Structure of PT report - Vulnerability Assessment Summary - Risk Assessment Methodology - Detailed Findings Reports-Types of Hackers- Ethical Hacking Process- OSI Model and TCP/IP Suite Network Addressing Common Ports and Protocols.

UINT – II: INFORMATION GATHERING

Active Information Gathering - Passive Information Gathering – Sources of Information Gathering - Copying Website - locally yougetsignal.com – Neo Trace - Intercepting a Response - Acunetix Vulnerability Scanner – Net Craft - Google Hacking - Interacting with DNS Servers - DNS Cache Snooping - Sniffing SNMP Passwords - SNMP Brute Force and Dictionary Attack Tool– WHOIS Tools.

UNIT – III: ENUMERATION AND PORT SCANNING:

Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - TCP Three-way handshake - TCP Flags Port Status - Types TCP SYN Scan - TCP Connect Scan - NULL, FIN and XMAS SCAN - NULL Scan - FIN Scan - XMAS Scan - TCP ACK Scan - Responses UDP Port Scan Scanning a vulnerable host - Performing an IDLE scan with NMAP - Service Version Detection-OS-Fingerprinting.

UNIT – IV: VULNERABILITY SCANNING:

What Are Vulnerability Scanners and How Do They Work - Vulnerability Assessment with Nmap - Testing SCADA Environments with Nmap- Nessus Vulnerability Scanner - Installing Nessus - Adding a user - Creating a new policy - Safe Checks - Silent Dependencies - Port Range - Preferences

UNIT – V: NETWORK SNIFFING:

Introduction - Types of Sniffing - Hubs vs. Switches - Promiscuous Mode vs. Non Promiscuous Mode - MITM Attacks - ARP Protocol Basics - How ARP works - ARP attacks- DoS Attacks - Sniffing with Wireshark - DNS Spoofing - DHCP Spoofing- Hijacking the Session

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS :

1. Jon Erickson, Hacking the Art of Exploitation, No Starch Press, San Francisco, 2nd Edition, 2008.
2. Rafay Baloch, Ethical Hacking and Penetration Testing Guide , CRC Press Taylor & Francis Group, 2015.

REFERENCES

1. Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, Gray Hat Hacking: The Ethical
2. Hackers Handbook, TMH, 3rd Edition, 2011.
3. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking

4. Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. Ethical Hacking and Penetration Testing Guide by Rafay Baloch Oreilly, November-2022
6. Ethical Hacking: Techniques, Tools, and Countermeasures, 4th Edition by Michael G. Solomon, Sean-Philip Oriyano, Oreilly, November-2022
7. EC-Council, "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
8. The Web Application Hacker's Handbook Second Edition Finding and Exploiting Security Flaws Dafydd Stuttard Marcus Pinto Wiley Publishing, Inc.

e-BOOK :

https://www.jstor.org/stable/resrep12574.6

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Understand Ethical and Legal Framework
CO2	Documentation and Risk Assessment
CO3	Information Reconnaissance
CO4	Network Scanning and Fingerprinting
CO5	Vulnerability Analysis, Network Sniffing and Attack Simulation

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	2	2	3	1	2	2	2	2	2	2	3	**2.1**
CO2	3	3	3	3	2	2	2	3	2	2	2	3	2	2	2	**2.4**
CO3	2	3	3	3	2	2	1	3	3	2	3	3	2	2	1	**2.3**
CO4	1	3	2	3	3	1	1	3	3	2	3	3	2	3	1	**2.3**
CO5	2	3	3	3	3	1	2	3	3	2	3	3	2	3	2	**2.5**
Average	**2.0**	**3.0**	**2.6**	**2.8**	**2.4**	**1.6**	**1.8**	**2.6**	**2.6**	**2.0**	**2.6**	**2.8**	**2.0**	**2.4**	**1.8**	**2.3**

Mean CO's:2.3

3 - Strong, 2 - Medium , 1- Low

Year : Three **CORE COURSE 6** **Semester: V**

CYBER CRIMES AND MITIGATION TECHNIQUES

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES:

This course aims to :

- Understand the fundamentals of cybercrime and cyber security, including the motivations, methods, growth, challenges, and future trends associated with cybercriminal activities.
- Analyze information-gathering techniques and emerging cyber threats, such as financial attacks, deepfakes, synthetic media attacks, and various offenses associated with hacking.
- Identify and evaluate malicious code attacks, including viruses, worms, Trojan horses, AI-accelerated attacks, and the legislative measures used to combat them.
- Examine phishing attacks and their impact on cyberspace, understanding different phishing techniques, their mechanisms, consequences, and preventive measures.
- Assess anonymity, privacy, and security issues in the cyber world, and apply appropriate security practices while understanding legal regulations and case laws related to cyberspace.

UNIT – I: INTRODUCTION

Cybercrime: Introduction, Motivation and Methods - The Scale of the Problem and Reasons for the Growth of Cybercrime - Profiling Cybercriminals - Challenges for Criminal Justice and Law Enforcement - The Future of Cybercrime.

UINT – II: INFORMATION GATHERING

Emerging Threats: Game- Financial Threat-Deepfakes and Synthetic Media Attacks -Expected Targets and Forms - Criminal Statues - 2.3 Other Offences Associated with Hacking.

UNIT – III: INJECTION OF MALICIOUS CODE IN APPLICATION:

Introduction - Types of Malicious Code - Threats Posed by Viruses, Worms and Trojan Horses –AI Accelerated Attacks - Legislative Approaches.

UNIT – IV: ATTEMPTS AND IMPACT OF PHISHING IN CYBERWORLD

The Problem of Phishing - Impact and Harm Generated by Phishing - Mechanisms of Cyberspace Phishing - Dragnet Method - Rod—and—Reel Method - Lobsterpot Method - Gillnet Phishing - Political Phishing- Attempts and Impact of Phishing in Cyberworld

UNIT – V: ANONYMITY, PRIVACY AND SECURITY ISSUES IN CYBER WORLD:

Introduction - Anonymity in Cyberspace Impact and Harm Generated by Anonymity - Regulating Anonymity in Cyberspace - Security Measures for Individual Internet Users-The Case Law.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Majid Yar and Kevin F. Steinmetz, Cybercrime and Society, 4th Edition, Sage Publications, 2023.
2. Nina Godbole and SunitBelapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India, 2021.

REFERENCES

1. Jonathan Clough, Principles of Cybercrime, 3rd Edition, Routledge, 2022.
2. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, 5th Edition, Pearson Education, 2024.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, and Jonathan Margulies, Security in Computing, 6th Edition, Pearson, 2023.
4. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Cengage Learning, Latest Edition.
5. Kevin Beaver, Hacking For Dummies, 7th Edition, Wiley, 2024.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Explain the concepts, characteristics, motivations, methods, and emerging trends of cybercrime, and analyze the challenges faced by criminal justice systems and law enforcement agencies in combating cybercriminal activities.

CO2 Identify and assess information-gathering techniques, hacking-related offenses, and emerging cyber threats such as financial cybercrime, deepfakes, and synthetic media attacks.

CO3 Analyze various types of malicious code, including viruses, worms, Trojan horses, and AI-accelerated cyberattacks, and evaluate legislative approaches for mitigating such threats.

CO4 Examine different phishing techniques and attack methodologies, evaluate their impact on individuals and organizations, and recommend appropriate countermeasures to reduce phishing-related risks.

CO5 Evaluate anonymity, privacy, and security issues in cyberspace, apply security measures for individual Internet users, and interpret relevant cyber laws and case studies related to cyberspace governance.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	3	3	2	1	2	2	2	2	2	2	2	2	3	**2.2**
CO2	2	3	3	3	2	1	2	3	2	2	3	3	2	2	2	**2.3**
CO3	2	3	3	3	3	1	2	3	3	2	3	3	2	3	2	**2.5**
CO4	2	3	2	3	3	1	2	3	2	2	3	3	2	3	2	**2.4**
CO5	3	3	3	2	2	2	3	2	3	3	2	2	3	2	3	**2.5**
Average	**2.2**	**3.0**	**2.8**	**2.8**	**2.4**	**1.2**	**2.2**	**2.6**	**2.4**	**2.2**	**2.6**	**2.6**	**2.2**	**2.4**	**2.4**	**2.4**

Mean CO's:2.4

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: V**

CORE COURSE 7

CLOUD COMPUTING SECURITY

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Understand the fundamental concepts, architectural influences, technological influences, and operational aspects of cloud computing and IT service management.
- Explain cloud computing architectures, service delivery models (SaaS, PaaS, IaaS), deployment models, and their benefits in comparison with traditional computing infrastructures.
- Apply cloud software security principles, secure development practices, security testing techniques, and business continuity/disaster recovery strategies in cloud environments.
- Analyze cloud security architectures, identity and access management mechanisms, trusted cloud computing concepts, and risk assessment methodologies.
- Evaluate security challenges in cloud environments, including virtualization security, multi-tenancy risks, incident response strategies, and virtual machine protection techniques.

UNIT – I: CLOUD COMPUTING FUNDAMENTALS

Cloud Computing Fundamentals - Cloud Computing Fundamentals -Architectural Influences - Technological Influences - Operational Influences - Outsourcing - IT Service Management.

UINT – II: CLOUD COMPUTING ARCHITECTURE

Cloud Delivery Models - Cloud Software as a Service (SaaS) - Cloud Platform as a Service (PaaS) - Cloud Infrastructure as a Service (IaaS) - Cloud Deployment Models - Expected Benefits – Cloud vs VPN Architecture

UNIT – III: CLOUD COMPUTING SOFTWARE SECURITY FUNDAMENTALS

Cloud Information Security Objectives - Cloud Security Services - Relevant Cloud Security Design Principles - Secure Cloud Software Requirements – Secure Development Practices - Approaches to Cloud Software Requirements Engineering -

Cloud Security Policy Implementation and Decomposition - NIST 33 Security Principles - Secure Cloud Software Testing - Testing for Security Quality Assurance - Cloud Penetration Testing - Regression Testing - Cloud Computing and Business Continuity Planning/Disaster Recovery - General Principles and Practices - Using the Cloud for BCP/DRP - Redundancy Provided by the Cloud - Secure Remote Access - Integration into Normal Business Processes.

UNIT – IV: CLOUD COMPUTING SECURITY ARCHITECTURE

Architectural Considerations - General Issues - Trusted Cloud Computing - Secure Execution Environments and Communications - Microarchitectures - Identity Management and Access Control - Identity Management - Access Control - Autonomic Security - Risk in cloud computing- risk assessment and management.

UNIT – V: CLOUD COMPUTING SECURITY CHALLENGES

Security Policy Implementation - Policy Types - Computer Security Incident Response Team (CSIRT) - Virtualization Security Management - Virtual Threats - VM Security Recommendations - VM-Specific Security Techniques

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Krutz, R. L., & Vines, R. D. (2010). Cloud security: A comprehensive guide to secure cloud computing. Wiley Publishing.

2. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.

REFERENCES:

1. Ronald L. Krutz, Russell Dean Vines, “Cloud Security” [ISBN: 0470589876], 2010.

2. John Rittinghouse, James Ransome, “Cloud Computing” CRC Press; 1 edition [ISBN: 1439806802], 2009.

3. J.R. ("Vic") Winkler, “Securing the Cloud” Syngress [ISBN: 1597495921] 2011

4. Cloud Security Alliance, “Security Guidance for Critical Areas of Focus in Cloud Computing” 2009.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Describe the security architecture of cloud computing and security service models.
CO2	Analyse the Strategies for Secure Operation the cloud architecture and list the security requirements.
CO3	Explain different key strategies for data security and apply the best practice models in real time application.
CO4	Appy the security model for cloud application with network, data and security considerations.
CO5	Develop an information security framework model for cloud operation

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	3	3	2	1	2	2	2	2	2	2	2	2	3	2.2
CO2	2	3	3	3	2	1	2	3	2	2	3	3	2	2	2	2.3
CO3	2	3	3	3	3	1	2	3	3	2	3	3	2	3	2	2.5
CO4	2	3	2	3	3	1	2	3	2	2	3	3	2	3	2	2.4
CO5	3	3	3	2	2	2	3	2	3	3	2	2	3	2	3	2.5
Average	2.2	3.0	2.8	2.8	2.4	1.2	2.2	2.6	2.4	2.2	2.6	2.6	2.2	2.4	2.4	2.4

Mean CO’s:2.4

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: V**

CORE COURSE 8

BLOCK CHAIN TECHNOLOGY

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES:

This course aims to:

- understand the architecture, and applications of blockchain technology.
- learn consensus mechanisms and blockchain implementation platforms.
- explore Bitcoin blockchain operations, transactions, and smart contracts.
- analyse security, challenges, and practical aspects of blockchain networks.
- apply blockchain technology to solve real-world business problems.

UNIT – I: BLOCKCHAIN FUNDAMENTALS

Tracing Blockchain's Origin - The shortcomings of current transaction systems - The emergence of Bitcoin - The birth of blockchain - Revolutionizing the Traditional Business Network. Blockchains - The Structure of Blockchains - Blockchain Applications - The Blockchain Life Cycle

UNIT – II: CONSENSUS

The Driving Force of Blockchains - Blockchains in Use -Blockchain applications - Picking a Blockchain - Blockchains Substance - determining needs - Defining goal - Choosing a Solution - Drawing a blockchain decision tree Comparing Popular Blockchain Implementations - Making digital currency work - Providing computation control -Scaling to meet enterprise needs

UNIT – III: DIVING INTO THE BITCOIN BLOCKCHAIN

Creating Bitcoin wallet - Generating a Bitcoin vanity address - Transferring vanity address - Making an entry into the Bitcoin blockchain - Reading a blockchain entry in Bitcoin - Using Smart Contracts with Bitcoin - Building your first smart bond - Checking the status of contract - Blockchain For Dummies Building a Private Blockchain with Docker - Preparing your computer - Building your blockchain.

UNIT – IV: BEHOLDING THE BITCOIN BLOCKCHAIN

Getting a Brief History of the Bitcoin Blockchain - Debunking Some Common Bitcoin Misconceptions - Bitcoin: The New Wild West - Fake sites - Mining for Bitcoins - Making First Paper Wallet - The Ten Rules to Never Break on the Blockchain

UNIT – V: BLOCKCHAIN IN ACTION

Use Cases: Determining How Blockchain Fits in Industry - Identifying Speed Bumps in Business Processes- Determining How Blockchain Can Help - Choosing an Appropriate Use Case - Determining the Goal of Your Blockchain Network - Identifying Dependencies - Choosing a Blockchain Provider and Platform - Developing and Deploying Smart Contracts - Testing and Fine-Tuning Your Application and Network

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Manav Gupta, "BlockchainFor Dummies", IBM Limited Edition, John Wiley & Sons, Inc., 2018.
2. Bashir, Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", 2017.

REFERENCES

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction" Princeton University Press, 2016.
2. Joseph Bonneau et al, "SoK: Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy, 2015.
3. Srinivas Mahankali, Blockchain for Non IT Professionals: An Example Driven, Metaphorical Approach, Notion Press, 2020.
4. Laurence, Tiana., Introduction to Blockchain Technology: The many faces of blockchain technology in the 21st century, Van Haren, 2019.

COURSE OUTCOMES:

Upon successful completion of this course, students would be able to:

CO1:explain the fundamentals, types, and working principles of cloud computing.
CO2:describe cloud architecture and cloud computing technologies.
CO3:apply cloud storage and cloud-based services for data management.
CO4:analyse security challenges and protection mechanisms in cloud.
CO5:evaluate cloud applications and services provided by platforms.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean CO
CO1	1	3	1	2	2	1	1	1	0	2	2	1	2	1	2	1.47
CO2	1	3	2	2	2	1	1	2	1	2	3	2	2	2	2	1.87
CO3	1	3	2	3	2	1	1	3	1	2	3	3	2	3	2	2.13
CO4	1	3	3	3	3	1	1	3	2	2	3	2	2	3	2	2.27
CO5	1	3	3	3	3	1	1	3	2	3	3	3	3	3	3	2.53
	1.00	3.00	2.20	2.60	2.40	1.00	1.00	2.40	1.20	2.20	2.80	2.20	2.20	2.40	2.20	**2.05**

Mean CO's :2.05

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: V**

CORE PRACTICAL 5
ETHICAL HACKING LAB

Code : **Practical** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- provide practical exposure to cyber security concepts, tools, and techniques used in security assessment and penetration testing.
- familiarize students with network reconnaissance, vulnerability assessment, and security auditing methodologies.
- develop skills in identifying common web application vulnerabilities and security threats in controlled environments.
- introduce cryptographic techniques and their implementation for securing information systems.
- enable students to understand defensive security mechanisms such as honeypots and vulnerability scanners.

LIST OF EXPERIMENTS:

1. Demonstrate DoS attacks
2. Create a social networking website login page using phishing techniques
3. implement Techniques uses for Web Based Password Capturing.
4. Write a script or code to demonstrate SQL injection attacks
5. Install rootkits and study variety of options
6. Setup a honey pot and monitor the honey pot on network
7. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto
8. Implement Passive scanning, active scanning, session hizaking, cookies extraction using Burp suit tool
9. Implement Fingerprinting with NMAP
10. Working with Nessus Vulnerability Scanner
11. Working with Acunetix Vulnerability Scanner
12. Demonstrating different types of port scanning

COURSE OUTCOMES:

Upon successful completion of the course, students would be able to:

CO1: Demonstrate network reconnaissance, fingerprinting, and various port scanning techniques using security tools.

CO2: Analyze and assess system and web application vulnerabilities through ethical security testing and vulnerability scanning tools.

CO3: Apply cryptographic methods including symmetric and asymmetric encryption techniques to secure information.

CO4: Configure and monitor security mechanisms such as honeypots and evaluate system security using industry-standard tools.

CO5: Identify common cyber threats and security weaknesses, and recommend appropriate mitigation measures following ethical and legal guidelines.

Year : Third **CORE COURSE 9** **Semester: VI**

DATA COMMUNICATION AND NETWORKS

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to:

- Understand the fundamental concepts of data communication, network models, and the OSI and TCP/IP protocol architectures.
- Learn different transmission techniques, switching methods, and multiplexing techniques used in computer networks.
- Gain knowledge of data link layer services including error detection, error correction, and reliable data transfer protocols.
- Analyze network layer concepts such as IP addressing, routing algorithms, and packet forwarding techniques.
- Understand transport and application layer protocols and their roles in internet communication services.

UNIT - I: INTRODUCTION

Data Communications – Components – Data Flows – Networks – Physical Structures–Network Types–LAN–WAN–Switching–The Internet –Network Models– Principles of Protocol Layering-TCP/IP Protocol Suite– Description of TCP/IP Layers–The OSI Model.

UNIT – II : TRANSMISSION MEDIA

Transmission Impairment - Transmission Modes – Multiplexing –FDM – WDM–TDM–Circuit Switched Networks–Packet Switching–Datagram Networks – Virtual Circuit Networks – Structure of Circuit Switches – Structure of Packet Switches.

UNIT – III : DATA LINK LAYER

Introduction - Error Detection and Correction – Block Coding – Cycle Codes - Checksum – Forward Error Correction – DLC Services – Data Link Layer Protocols-HDLC–CSMA/CD/CA-Controlled Access–Connecting Devices

UNIT – IV : NETWORK LAYER

Network Layer Services–Network Layer Performance–IPv4Addresses– Internet Protocol (IP)–Routing Algorithms–Least Cost Routing- Distance Vector Routing – Link State Routing – Path-Vector Routing**.**

UNIT – V : TRANSPORT LAYER

Introduction – Transport Layer Protocols – User Datagram Protocol– TransmissionControlProtocol–ApplicationLayer:-WorldWideWeb and HTTP–File Transfer Protocol–E-Mail–TELNET–Domain Name System.

UNIT VI - CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill,5th Edition,2013.
2. Andrew S Tanenbaum, Computer Networks, Pearson Education India, Sixth Edition,2021.

REFERENCES

1. William Stallings, Data and Computer Communication, Pearson Education India, Eighth Edition, 2007.

E – BOOKS

1. https://elcomhu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf
2. https://nptel.ac.in/courses/106105183
3. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Explain the fundamental concepts of data communication, network models, and the OSI and TCP/IP reference architectures.
CO2	Apply transmission techniques, switching methods, and multiplexing concepts in the design of computer networks.
CO3	Analyze data link layer services including error detection, error correction, and reliable data transfer mechanisms.
CO4	Evaluate network layer functionalities such as IP addressing, routing algorithms, and packet forwarding techniques.
CO5	Illustrate transport and application layer protocols and their role in enabling internet-based communication services.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	1	2	1	2	1	2	3	2	2	2	1	1.87
CO2	1	3	3	3	2	2	2	3	2	2	3	3	3	2	1	2.33
CO3	1	3	3	3	2	2	2	3	2	2	3	3	2	2	1	2.27
CO4	1	3	3	3	2	2	2	3	2	3	3	3	2	0	1	2.20
CO5	3	3	2	3	1	2	2	3	1	3	3	3	2	1	0	2.13
Average	1.60	3.00	2.60	2.80	1.60	2.00	1.80	2.80	1.60	2.40	3.00	2.80	2.20	1.40	0.80	**2.16**

Mean CO's :2.16

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: VI**

CORE COURSE 10

FUNDAMENTALS OF CRYPTOGRAPHY

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :	
❖	Understand the fundamental concepts of network security, security services, security mechanisms, security attacks, and classical encryption techniques used to protect information systems.
❖	Explain the principles of block ciphers, Data Encryption Standard (DES), cryptanalysis techniques, and the design considerations of modern symmetric-key encryption algorithms.
❖	Apply public key cryptography concepts, including Diffie–Hellman key exchange, RSA algorithm, elliptic curve cryptography, message authentication, and hash functions for secure communication.
❖	Analyze secure communication protocols and mechanisms such as PGP, S/MIME, IP Security (IPSec), authentication headers, encapsulating security payloads, and key management techniques.
❖	Evaluate web security technologies, including SSL/TLS, Secure Electronic Transactions (SET), firewalls, intrusion threats, malware protection, and trusted system architectures.

UNIT – I INTRODUCTION:

INTRODUCTION: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography

UNIT – II BLOCK CIPHER AND DATA ENCRYPTION STANDARDS:

Block Cipher Principles, Data Encryption Standards, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles

UNIT – III PUBLIC KEY CRYPTOGRAPHY:

Principles, Public key crypto Systems, Diffie Hellman Key Exchange, RSA algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.MESSAGE AUTHENTICATION AND HASH FUNCTIONS:

Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs.

UNIT – IV EMAIL SECURITY:

Pretty Good Privacy (PGP) and S/MIME. IP SECURITY: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT – V WEB SECURITY:

Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats. FIREWALL: Firewall Design principles, Trusted Systems

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. William Stallings (2006), Cryptography and Network Security: Principles and Practice,4th edition, Pearson Education, India.
2. Hans Delfs, Helmut Knebl, "Introduction to Cryptography, Principles and Applications",Springer Verlag.

REFERENCES

1. William Stallings (2000), Network Security Essentials (Applicationsand Standards), Pearson Education, India.
2. Charlie Kaufman (2002), Network Security: Private Communication ina Public World,2nd edition, Prentice Hall of India, NewDelhi.
3. AtulKahate (2008), Cryptography and Network Security, 2nd edition, Tata McGrawhill,India.
4. Robert Bragg, Mark Rhodes (2004), Network Security: The complete reference, Tata McGrawhill, India
5. O. Goldreich, Foundations of Cryptography, CRC Press.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Use symmetric and asymmetric key algorithms for cryptography
CO2	Design a security solution for a given application
CO3	Analyze Key Management techniques and importance of number Theory.
CO4	Understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
CO5	To examine the issues and structure of Authentication Service and Electronic Mail Security

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	1	3	2	2	3	1	1	3	2	2	3	2	1	2	2	2.0
CO2	2	3	3	3	3	1	2	3	2	2	3	3	2	3	2	2.4
CO3	1	3	3	3	3	1	2	3	3	2	3	3	1	2	2	2.3
CO4	2	3	2	3	2	1	2	3	2	2	3	3	2	3	2	2.3
CO5	2	3	3	2	2	2	2	3	3	3	2	3	3	2	3	2.5
Average	1.6	3.0	2.6	2.6	2.6	1.2	1.8	3.0	2.4	2.2	2.8	2.8	1.8	2.4	2.2	2.3

Mean CO's: 2.3

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: VI**

CORE COURSE 11
PENETRATION TESTING

Code : **Theory** **Credits: 4**

COURSE OBJECTIVES :

This course aims to :

- Understand the fundamentals of penetration testing, ethical hacking methodologies, and the setup of secure virtual laboratory environments for security assessment.
- Apply Linux operating system commands, file management techniques, networking concepts, and security tools to perform system administration and security-related tasks.
- Analyze target systems through information gathering, vulnerability assessment, network scanning, and security auditing using industry-standard tools and techniques.
- Evaluate common web application vulnerabilities, including SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), file inclusion attacks, and secure testing methodologies.
- Assess mobile device security threats, attack vectors, penetration testing frameworks, and post-exploitation techniques used in mobile security testing.

UNIT – I PENETRATION TESTING & SETTING UP YOUR VIRTUAL LAB:

The Stages of the Penetration Test - Installing VMware - Setting Up Kali Linux - Target Virtual Machines - Creating the Windows XP Target - Setting Up the Ubuntu 8.10 Target - Creating the Windows 7 Target

UNIT – II USING KALI LINUX & PROGRAMMING:

Linux Command Line - The Linux File system - Learning About Commands – User Privileges - File Permissions - Editing Files - Data Manipulation - Processes and Services - Managing Networking - Netcat: The Swiss Army Knife of TCP/IP Connections**.**

UNIT – III INFORMATION GATHERING & FINDING VULNERABILITIES:

Open Source Intelligence Gathering - Port Scanning - Finding Vulnerabilities: From Nmap Version Scan to Potential Vulnerability - Nessus - The Nmap Scripting

Engine - Running a Single NSE Script - Metasploit Scanner Modules - Metasploit Exploit Check Functions - Web Application Scanning – Manual Analysis

UNIT – IV INTRODUCTION TO SQL INJECTION

Using Burp Proxy - SQL Injection - X Path Injection - Local File Inclusion – Remote File Inclusion - Command Execution - Cross-Site Scripting - Cross-Site Request Forgery - Web Application Scanning
with w3af.

UNIT – V USING THE SMARTPHONE PENTEST FRAMEWORK:

Mobile Attack Vectors - The Smartphone Pen test Framework - Remote Attacks - Client-Side Attacks - Malicious Apps - Mobile Post Exploitation

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Georgia Weidman," Penetration Testing: A Hands-On Introduction to Hacking", 1st Edition
2. Patrick Engebretson," The Basics of Hacking and Penetration Testing
Ethical Hackingand Penetration Testing Made Easy", Elsevier Inc., 2011.

REFERENCES

1. Michael Rash, "Linux Firewalls", No Starch Press, ISBN:978-1-59327-141-1, October2007
2. The Web Application Hacker's Hand Book - Discovering and Exploiting Security flaws, DafyddSuttard, Marcuspinto,1st Edition, Wiley Publishing.
3. Penetration Testing: Hands-on Introduction to Hacking, Georgia Weidman, 1st Edition, No Starch Press.
4. Starch Press. 3. The Pen Tester Blueprint - Starting a Career as an Ethical Hacker, L. Wylie, Kim Crawly,1st Edition, Wiley Publications.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Use the concepts of Penetration Testing.
CO2	Get knowledge of Penetration Testing, Network security and its protocols to protect applications.
CO3	Test windows password strength.
CO4	Implement open password- protected files.
CO5	Design and implement subvert vulnerable software applications.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	3	2	1	3	3	1	3	3	2	2	2	**2.3**
CO2	3	3	3	2	3	1	2	3	2	3	3	3	2	2	1	**2.4**
CO3	2	3	2	2	2	3	2	2	3	1	3	3	3	2	2	**2.3**
CO4	2	2	1	1	3	1	2	1	2	2	3	3	2	2	2	**1.9**
CO5	3	3	3	3	2	1	3	1	2	3	3	3	3	2	2	**2.5**
Average	**2.4**	**2.8**	**2.2**	**2.0**	**2.6**	**1.6**	**2.0**	**2.0**	**2.4**	**2.0**	**3.0**	**3.0**	**2.4**	**2.0**	**1.8**	**2.3**

Mean CO's: 2.3

3 - Strong, 2 - Medium , 1- Low

Year : Third **Semester: VI**

CORE PROJECT WORK
PROJECT WORK

Code : **Credits: 4**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University

Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

PROJECT REPORT EVALUATION (Both Internal & External)

I.	Plan of the Project	20 marks
	Execution of the Plan/collection of Data / Organisation of Materials/ Hypothesis, Testing etc. and presentation of the report	45 marks
	Individual initiative	15 marks
II.	Viva-Voce / Internal & External	20 marks
III.	**TOTAL**	**100 Marks**

PASSING MINIMUM:

Project	**Vivo-Voce 20 Marks** 40% out of 20 Marks **(i.e. 8 Marks)**	**Dissertation 80 Marks** 40% out of 80 marks **(i.e. 32 marks)**

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

SKILL ENHANCEMENT COURSE - I
COMPUTER GRAPHICS

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to :

- Introduce the basic concepts and components of Computer Graphics systems.
- Understand various input and output devices used in graphics applications.
- Learn algorithms for drawing graphical objects and applying their attributes.
- Develop knowledge of 2D geometric transformations and clipping techniques.
- Understand graphical user interfaces (GUI) fundamental concepts.

UNIT I: INTRODUCTION TO COMPUTER GRAPHICS

Introduction to Computer Graphics – Video Display Devices – Raster Scan Systems – Random Scan Systems – Graphics Monitors and Workstations – Graphics Software.

UNIT II: INPUT PRIMITIVES

Input Devices – Hardcopy Devices – User Dialogue – Input of Graphical Data – Input Functions – Interactive Picture Construction Techniques.

UNIT III: OUTPUT PRIMITIVES

Output Primitives – Line Drawing Algorithms – Loading the Frame Buffer – Line Function – Circle Generating Algorithms – Line Attributes – Curve Attributes – Colour and Greyscale Levels – Area Fill Attributes – Character Attributes – Bundled Attributes – Inquiry Functions.

UNIT – IV: 2D GEOMETRIC TRANSFORMATIONS

Basic Transformations – Matrix Representations – Composite Transformations – Window to Viewport Coordinate Transformations – Point Clipping – Line Clipping – Cohen-Sutherland Line Clipping — Curve Clipping – Text Clipping.

UNIT – V: GRAPHICAL USER INTERFACES

Graphical User Interfaces and Interactive Input Methods: The User Dialogue – Input of Graphical Data – Input Functions – Interactive Picture Construction Techniques.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Donald Hearn M. Pauline Baker, Computer Graphics C Version, Pearson Education, 2014.
2. Alexey Boreskov, Evgeniy Shikin, "Computer Graphics From Pixels to Programmable Graphics Hardware", CRC Press, 2013.

REFERENCES

1. Donald Hearn M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2014.
2. Branislav Sobota, "Computer Graphics and Imaging", Intech Open Publication, 2019.
3. Dr. Deepali A. Godse, Atul P. Godse, "Computer Graphics", UNICORN Publishing Group, 2020.
4. Gabriel Gambetta, "Computer Graphics from Scratch A Programmer's Introduction to 3D Rendering", No Starch Press, 2021.
5. https://archive.org/details/computer-graphics-c-version-hearn-baker.
6. https://gabrielgambetta.com/computer-graphics-from-scratch/

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Explain the fundamentals of computer graphics systems and display technologies.
CO2	Identify and use different input and output devices in graphics applications.
CO3	Apply line, circle, and other output primitive generation algorithms.
CO4	Perform 2D geometric transformations and clipping operations on graphical objects.
CO5	Design simple graphical applications using GUI concepts.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean Cos
CO1	3	3	3	3	3	2	1	2	1	2	3	2	3	3	1	2.3
CO2	3	3	2	2	3	3	3	3	2	2	3	3	3	2	2	2.6
CO3	3	3	3	3	3	3	1	3	1	1	2	3	3	3	1	2.4
CO4	2	2	2	2	2	3	1	3	2	1	2	3	1	2	2	2.0
CO5	2	3	3	3	3	2	2	3	2	1	2	2	3	3	1	2.3
Average	**2.6**	**2.8**	**2.6**	**2.6**	**2.8**	**2.6**	**1.6**	**2.8**	**1.6**	**1.4**	**2.4**	**2.6**	**2.6**	**2.6**	**1.4**	**2.3**

Mean CO's : 2.3

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE - II
MOBILE APPLICATION DEVELOPMENT

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to :

- Gain a comprehensive understanding of the basic concepts of mobile app using Android Platform
- Learn the detail framework of Android Platform
- Acquire the knowledge on the design aspects in Creating intuitive, reliable mobile apps using the android services and components
- Explore the various additional features of mobile app development
- Impart skills on Graphical features to design attractive web apps

UNIT I: ANDROID PLATFORM

Introducing the Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine-The Directory Structure of an Android Project-Common Default Resources Folders-The Values Folder- Leveraging Android XML-Screen Sizes-Desktop Clocks- Using Android Application Resources-Launching Application: The Android Manifest.xml File - Creating Your First Android Application

UNIT II: ANDROID FRAMEWORK

Android Framework Overview: The Foundation of OOP: The Object-The Blue print for an Object: The Class-Providing Structure for Classes: Inheritance-Defining an Interface Bundling Classes-An overview of XML- The APK File-Android Application Components Android Activities- Android Services - Broad cast Receivers - Content Providers - Android Manifest XML.

UNIT III: WORKING WITH SCREEN LAYOUTS

Screen Layout Design- Android View Hierarchies - Nesting Views-Defining Screen Layouts - Editing the main.xml File-Using Relative Layouts- Sliding Drawers-Using Padding and Margins with Views and Layouts.

UNIT IV: WORKING WITH BUTTONS, MENUS, AND DIALOGS

UI Design: Buttons, Menus, and Dialogs: Using Common UI Elements-Adding an Image Button to Your Layout-Defining Multistate Image Button - Replacing the Default Background- Adding a Text to Your Layout- Adding an Image-Using Menus in Android-Creating the Menu Structure with XML- Running the Application in the Android Emulator

UNIT V: GRAPHICS IN ANDROID

An Introduction to Graphics Resources in Android: Introducing the Drawable-Implementing Images - Creating Animation in Android- Tween Animation in Android-Using Transitions

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Jackson W, "Android Apps for Absolute Beginners", 1st Edition, Apress.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2011.

REFERENCES

1. Barry Burd and John Paul Mueller, Android Application Development All-in-One For Dummies, 3rd Edition, 2020.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2011.
3. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt,Ltd,2010
4. Mark L Murphy, "Beginning Android3", Apress Publications, 2011.
5. https://www.javatpoint.com/android-tutorial
6. https://developer.android.com/develop.com/dos

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Identify various concepts of mobile application programming in Android platform
CO2	Implement the business logic in an app with java
CO3	Understand Android User Interface Design with XML
CO4	Know about Common Android APIs
CO5	Deploy applications to the Android marketplace for distribution

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	2	3	2	3	2	1	3	2	1	2	2	3	2	2	2.2
CO2	3	3	2	2	3	2	1	1	1	2	3	2	2	2	2	2.1
CO3	3	3	1	2	3	3	1	2	2	3	3	3	1	3	1	2.3
CO4	3	3	3	3	3	2	2	2	2	1	3	2	3	3	2	2.5
CO5	3	3	3	3	2	1	1	2	3	1	3	2	3	3	2	2.3
Average	**2.8**	**2.8**	**2.4**	**2.4**	**2.8**	**2.0**	**1.2**	**2.0**	**2.0**	**1.6**	**2.8**	**2.2**	**2.4**	**2.6**	**1.8**	**2.3**

Mean CO's : 2.3

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE - III
BIG DATA ANALYTICS

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to:

- Explain the concepts and applications of Big Data.
- Describe Big Data technologies and business applications.
- Apply data collection, storage, and management techniques
- Use Hadoop & distributed processing frameworks for Big Data
- Analyse data using machine learning, and visualization tools

UNIT I: INTRODUCTION

Concepts and Terminology – Big Data Characteristics – Different Types of Data – case study

UNIT II: BIG DATA ADOPTION AND PLANNING CONSIDERATIONS

Data Identification – Data Acquisition and Filtering – Data Extraction – Data validation and cleansing – Data Aggregation and Representation

UNIT III: ENTERPRISE TECHNOLOGIES AND BIG DATA BUSINESS INTELLIGENCE:

Online Transaction and Processing (OLTP) – Online Analytical Processing (OLAP) – Extract Transform Load (ETL) – Data Warehouses – Data Marts.

UNIT – IV: BIG DATA PROCESSING CONCEPTS

Distributed Data Processing – Hadoop – Processing Workloads – Cluster – Processing in Batch Mode – Map – Combine – Partition – Shuffle and Sort.

UNIT – V: BIG DATA STORAGE TECHNOLOGY

On-Disk Storage Devices – NoSQL Database – In- Memory Storage Device

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Paul Buhler, Wajid Khattak and Thomas Erl, "Big Data Fundamentals: Concepts, Drivers & Techniques", Prentice Hall Publications, 1st Edition, January 2016.
2. Dr. A.V.K. Shanthi, Dr. Praveen Kumar Misra, Dr.BramahHazela, Dr.Saptarshi Gupta, published a book "Big Data Analytics- Discovering, Analysying, Visualizing and Presenting Data", by Scientific International Publishing House.

REFERENCES

1. DT Editorial Services, "Big Data (Hadoop 2, Map Reduce, Hive, YARN, Pig, R and Data Visualization) Black Book", 1st Edition, Dreamtech Press, 2016.
2. SoumendraMohanty, MadhuJagadeesh, and Harsha Srivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", Apress Media, 2013.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly Media, 2012
4. https://hadoop.apache.org/docs/r1.2.1/hadoop-project-dist/hadoop-common/GettingStarted.html.
5. https://www.pdfdrive.com/big-data-fundamentals-e187420663.html.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Recall the basics of Big Data and its applications
CO2 Know about OLTP, OLAP and ETL
CO3 Apply the cutting-edge tools and technologies to analyse Big Data
CO4 Analyse various big data tools and techniques
CO5 Evaluate various storage and analytical techniques

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	2	2	2	1	1	1	2	1	1	3	2	2	2	1	1.73
CO2	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.93
CO3	3	3	3	3	2	1	1	2	1	2	3	3	2	3	1	2.20
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.40
CO5	3	3	3	3	2	1	1	3	2	2	3	3	3	3	2	2.47
Average	3.00	2.80	2.60	2.60	1.80	1.00	1.00	2.40	1.40	1.80	3.00	2.60	2.20	2.60	1.40	**2.15**

Mean CO's :2.15

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE - IV
INTERNET OF THINGS

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to:

- Understand the fundamental concepts, architecture, technologies, and applications of the Internet of Things (IoT).
- Analyse IoT communication models, M2M systems, network management protocols, and enabling technologies.
- Apply IoT design methodologies to develop domain-specific IoT solutions.
- Develop IoT applications using Python programming and Raspberry Pi-based embedded systems.
- Explore cloud computing platforms and web services for IoT data storage, processing, and application deployment.

UNIT-I: INTRODUCTION

Definition & characteristics of IoT - physical design of IoT - logical design of IoT - IoT enabling Technologies - IoT levels & Deployment templates.

UNIT-II: DOMAIN SPECIFIC IOT

Home Automation - cities - Environment - Energy - retail - logistics - Agriculture - Industry Health and life style.

UNIT – III: IoT and M2M

Deference between IoT and M2M - SDN and NFV for lot - IoT systems management - SNMP - YANG – NETOPEER.

UNIT-III: IoT SPECIFICATION

IoT platforms design Methodology - Domain model specification - Information model specification - IoT level specification - functional view specification - Application Development.

UNIT-IV: LOGICAL DESIGN USING PYTHON

Logical design using python - IoT physical devices and Endpoints, building blocks of IoT device- Raspberry Pi-Linuxon Raspberry Pi - Raspberry Pi interfaces.

UNIT-V: IoT AND CLOUD COMPUTING

IoT physical servers & cloud computing-WAMP-Xively cloud for IoT- python Web application framework-Amazon web services for IoT.

RECOMMENDED BOOKS:

1. Bahga, A., &Madisetti, V. K. (2015). Internet of things: A hands-on approach. Universities Press.
2. Srinivasa, K. G., Siddesh, G. M., & Raju, R. H. (2018). Internet of things. Cengage Learning India.

REFERENCES

1. *"Internet of Things: A Hands-On Approach"* by Arshdeep Bahga and Vijay Madisetti
2. *"Internet of Things: Principles and Paradigms"* by Rajkumar Buyya and Amir Vahid Dastjerdi
3. *"The Internet of Things: Enabling Technologies, Platforms, and Use Cases"* by Pethuru Raj and Anupama C. Raman
4. https://dotnet.microsoft.com/en-us/learn/iot
5. https://docs.aws.amazon.com/iot/latest/developerguide/iot-tutorials.html

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1 Explain the basic concepts, characteristics, and architecture of IoT.
CO2 Identify IoT applications in various domains such as smart homes, cities, agriculture, and healthcare.
CO3 Describe IoT communication, management concepts, and related protocols.
CO4 Apply IoT design methodologies and specifications to develop IoT solutions.
CO5 Develop simple IoT applications using Python, Raspberry Pi, and cloud platforms

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.9
CO2	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.2
CO3	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.2
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
CO5	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.5
Average	3.0	3.0	2.4	2.4	2.0	1.2	1.0	2.6	1.8	2.0	3.0	2.6	2.2	2.6	1.8	**2.3**

Mean CO's : 2.3

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE - V
WEB AND INFORMATION SECURITY

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to :

- Understand the fundamental concepts of information security, including security principles, threats, attacks, vulnerabilities, security requirements, and security strategies for protecting information assets.
- Analyze and manage IT security risks by applying security policies, risk assessment techniques, security controls, safeguards, and organizational security management practices.
- Identify and mitigate web-based security threats such as browser attacks, malicious web content, phishing, spam, fake emails, and other attacks targeting web users and applications.
- Evaluate network security threats and implement protection mechanisms for wired and wireless networks, including intrusion prevention, secure communication protocols, wireless security standards, and denial-of-service countermeasures.
- Apply cryptographic techniques for secure communication, including encryption, hashing, digital signatures, RSA, El Gamal algorithms, and emerging concepts in quantum cryptography for data confidentiality, integrity, and authentication.

UNIT–I INTRODUCTIONTOINFORMATIONSECURITY:

Computer Security Concepts - Threats, Attacks, and Assets - Security Functional Requirements - Fundamental Security Design Principles - Attack Surfaces and Attack Trees - Computer Security Strategy.

UNIT–II ITSECURITYMANAGEMENTANDRISKASSESSMENT:

IT Security Management - Organizational Context and Security Policy - Security Risk Assessment-Detailed Security Risk Analysis

UNIT–III CASE STUDY:

Silver Star Mines IT Security Controls, Plans, and Procedures - IT Security Management Implementation- Security Controls or Safeguards-IT Security Plan- Implementation of Controls-Monitoring Risks-Case Study: Silver Star Mines

UNIT–IV BROWSER ATTACKS:

Browser Attack Types - Failed Identification and Authentication - Web Attacks Targeting Users - False or Misleading Content- Malicious Web Content - Protecting Against Malicious Web Pages

UNIT–V EMAIL ATTACKS

Foiling Data Attacks - Email Attacks - Fake Email - Fake Email Messages as Spam - Fake (Inaccurate) Email Header Data - Phishing - Protecting Against Email Attacks

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Computer Security: Principles and Practice, William Stallings & Lawrie Brown, 4th Edition, Pearson Education, 2018.
2. Principles of Information Security, Michael E. Whitman & Herbert J. Mattord, 7th Edition, Cengage Learning, 2021.
3. Cryptography and Network Security: Principles and Practice, William Stallings, 8th Edition, Pearson Education, 2022.

REFERENCES

1. Network Security Essentials: Applications and Standards, William Stallings, 7th Edition, Pearson Education, 2017.
2. Information Security: The Complete Reference, Mark Rhodes-Ousley, 2nd Edition, McGraw-Hill Education, 2013.
3. Security in Computing, Charles P. Pfleeger& Shari Lawrence Pfleeger, 5th Edition, Pearson Education, 2015.
4. Computer Security Fundamentals, Chuck Easttom, 4th Edition, Pearson Education, 2022.
5. Web Security, Privacy and Commerce, Simson Garfinkel & Gene Spafford, O'Reilly Media.
6. Applied Cryptography: Protocols, Algorithms and Source Code in C, Bruce Schneier, Wiley India.

7. Introduction to Modern Cryptography, Jonathan Katz & Yehuda Lindell, 3rd Edition, CRC Press, 2020.
8. Network Security Bible, Eric Cole, 2nd Edition, Wiley Publishing.

E-Resources

- NIST Computer Security Resource Centre
- SANS Institute Security Resources
- Cyber security and Infrastructure Security Agency (CISA)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Describefundamentalconceptsofinformationsecurityandsystemauditing.
- Under stand the difference between security metrics and audits.
- Students will be able to understand web security
- Students would be able authenticate for different application.
- Students would be able to implement sessions and security principles

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	1	3	2	2	1	1	1	1	1	1	3	2	1	1	1	**1.47**
CO2	1	3	2	3	2	1	1	2	1	1	2	2	1	1	1	**1.60**
CO3	1	3	2	3	2	1	1	3	1	1	3	3	1	2	2	**1.93**
CO4	1	3	2	3	2	1	1	3	2	1	3	3	2	2	2	**2.07**
CO5	1	3	2	3	2	2	1	3	2	2	3	3	2	2	3	**2.27**
Average	**1.00**	**3.00**	**2.00**	**2.80**	**1.80**	**1.20**	**1.00**	**2.40**	**1.40**	**1.20**	**2.80**	**2.60**	**1.40**	**1.60**	**1.80**	**1.87**

Mean CO's :1.87

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE – VI
SOCIAL AND WEB ANALYTICS

Code : (Theory) Credits: 2

COURSE OBJECTIVES :

This course aims to :

- Introduce the fundamental concepts, characteristics, and analytical techniques of social network data and online social networks.
- Understand graph theory concepts and their applications in modeling and analyzing social network structures and relationships.
- Study random walk algorithms and their applications in information retrieval, recommendation systems, and network analysis.
- Explore community discovery methods and techniques for identifying groups and patterns within social networks.
- Develop skills in node classification and large-scale social network analysis for solving real-world data analytics problems.

UNIT–I INTRODUCTIONSOCIALNETWORKDATAANALYTICS:

An Introduction to Social Network Data Analytics-Online Social Networks: Research Issues-Research Topics in Social Networks-Statistical Properties of Social Networks–Preliminaries-Static Properties-Dynamic Properties

UNIT–II GRAPHTHEORYANDSOCIALNETWORKS:

Graphs - Strong and Weak Ties - Networks in Their Surrounding Contexts - Positive and Negative Relationships

UNIT – III RANDOM WALKS IN SOCIAL NETWORKS AND THEIR APPLICATIONS:

Introduction-RandomWalksonGraphs:Background-Algorithms–Applications-Evaluationanddatasets

UNIT–IV COMMUNITYDISCOVERYINSOCIALNETWORKS:

Community Discovery in Social Networks: Applications, Methods. Introduction - Core Methods - Emerging Fields and Problems

UNIT–V NODECLASSIFICATIONINSOCIALNETWORKS:

Problem Formulation - Methods using Local Classification - Random Walk based Methods - Applying Node Classification to Large Social Networks - Related approaches - Variations on Node Classification.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Social Network Analysis: Methods and Applications, Stanley Wasserman & Katherine Faust, Cambridge University Press, 1994.
2. Mining the Social Web, Matthew A. Russell & Mikhail Klassen, 3rd Edition, O'Reilly Media, 2018.
3. Social Network Data Analytics, Edited by Charu C. Aggarwal, Springer, 2011.

REFERENCES

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
2. Mining of Massive Datasets, 3rd Edition, Cambridge University Press, 2020.
3. Social and Economic Networks, Princeton University Press, 2010.
4. Introduction to Social Network Methods, University of California, Riverside.
5. Data Mining: Concepts and Techniques, 4th Edition, Morgan Kaufmann, 2022.

E- Resources

- Stanford Network Analysis Project (SNAP)
- NetworkX Documentation
- Kaggle Social Network Datasets
- UCI Machine Learning Repository

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Describe fundamental concepts of information security and system auditing.
- Understand the difference between security metrics and audits.
- Students will beable to under stand web security
- Students would be able authenticate for different application.
- Students would be able to implement sessions and security principles

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	1	3	2	2	2	1	1	1	1	1	2	2	1	1	1	**1.47**
CO2	1	3	3	3	2	1	1	2	1	1	3	3	1	2	1	**1.87**
CO3	1	3	2	3	2	1	1	3	2	1	3	3	1	2	2	**2.00**
CO4	1	3	2	3	2	1	2	3	2	1	3	3	1	2	3	**2.13**
CO5	1	3	3	3	2	2	2	3	2	2	3	3	2	3	3	**2.47**
Average	**1.00**	**3.00**	**2.40**	**2.80**	**2.00**	**1.20**	**1.40**	**2.40**	**1.60**	**1.20**	**2.80**	**2.80**	**1.20**	**2.00**	**2.00**	**1.99**

Mean CO's :1.99

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE – VII
CYBER LAW AND DEFENCE TECHNOLOGY

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to :

- Understand the fundamentals of cyber law, cyber ethics, and cybercrime in the digital environment.
- Explain legal frameworks, cyber regulations, and digital evidence handling procedures.
- Analyze cyber threats, cyber warfare techniques, and defence technologies.
- Evaluate cyber security governance, risk management, and incident response mechanisms.
- Assess emerging cyber defence technologies and legal challenges in securing cyberspace.

UNIT I – INTRODUCTION TO CYBER LAW

Fundamentals of Cyber Law -Evolution of Cyberspace and Internet Governance -Cyber Ethics and Digital Rights -Types of Cyber Crimes

UNIT II – CYBER CRIME INVESTIGATION AND DIGITAL EVIDENCE

Cyber Crime Investigation Process-Digital Evidence Collection and Preservation -Cyber Forensics Fundamentals -Electronic Records and Admissibility -Data Protection and Privacy Laws -International Cyber Law Frameworks

UNIT III – CYBER DEFENCE TECHNOLOGIES

Fundamentals of Cyber Defence -Cyber Warfare and Cyber Terrorism -Malware, Ransom ware and Advanced Persistent Threats (APT) -Intrusion Detection and Prevention Systems -Threat Intelligence and Security Monitoring -Critical Infrastructure Protection

UNIT IV – CYBER SECURITY GOVERNANCE AND RISK MANAGEMENT

Security Policies and Standards-Security Governance Frameworks -Risk Assessment and Risk Mitigation -Incident Response and Recovery -Security Auditing and Compliance -Security Operations Centres (SOC)

UNIT V – EMERGING TRENDS IN CYBER LAW AND DEFENCE

Artificial Intelligence in Cyber Defence -Block chain for Cyber Security -Cloud Security and Legal Issues -Ethical Hacking and Responsible Disclosure -Privacy and Data Protection Regulations -Future Trends in Cyber Defence.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Cyber Security and Cyber Laws, Wiley India.
2. Cyber Law Simplified, McGraw Hill Education.
3. Computer Security Principles and Practice, Pearson Education.

REFERENCES

1. Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners, Syngress Publications.
2. Guide to Computer Network Security, Springer.
3. Information Security Principles and Practice, Wiley.
4. Cyber Crimes and Law, Asian School of Cyber Laws.
5. Cyber Law and Information Technology, Universal Law Publishing.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Explain cyber law, cyber ethics, cybercrime, and legal frameworks governing cyberspace.
CO2	Interpret cybercrime investigation procedures, digital evidence, and cyber legal provisions.
CO3	Analyze cyber threats, cyber warfare techniques, and defence technologies.

CO4 Evaluate cyber security governance, risk management, and incident response mechanisms.

CO5 Assess emerging cyber defence technologies and legal approaches for securing digital environments.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	1	1	1	1	1	1	2	2	2	1	2	**1.60**
CO2	1	3	3	3	2	1	1	2	2	1	3	3	2	2	2	**2.07**
CO3	1	3	2	3	2	1	1	3	2	1	3	3	2	3	2	**2.13**
CO4	1	3	2	3	3	2	2	3	2	2	3	3	1	3	3	**2.40**
CO5	1	3	2	3	2	2	2	3	2	3	2	3	2	3	3	**2.40**
Average	**1.20**	**3.00**	**2.20**	**2.80**	**2.00**	**1.40**	**1.40**	**2.40**	**1.80**	**1.60**	**2.60**	**2.80**	**1.80**	**2.40**	**2.40**	**2.12**

Mean CO's:2.12

3 - Strong, 2 - Medium , 1- Low

Year: First **INTERDISCIPLINARY COURSE – I** **Semester: I**

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES:

This course aims to:

- Understand the fundamental concepts and evolution of computers.
- Learn the components of computer systems.
- gain knowledge of software, operating systems, and database systems.
- understand computer networks, the Internet, email, and web technologies.
- explore applications and computer security concepts.

UNIT – I : INTRODUCTION TO COMPUTERS

IntroductiontoComputers-GenerationofComputers-ClassificationofDigital Computer - Anatomy of Digital Computer.

UNIT – II :COMPUTER HARDWARE

CPU and Memory-Secondary Story Devices-Input Devices-Output Devices.

UNIT – III :COMPUTER SOFTWARE

Introduction to Computer Software-Programming Language-Operating System - Introduction to Database Management System.

UNIT – IV :NETWORKS

Computer Networks-WWW and Internet-Email-WebDesign

UNIT – V :APPLICATIONS AND SECURITY

Computers at Home, Education, Entertainment, Science,Medicine and Engineering - Introduction to Computer Security - Computer Viruses, Bombs, Worms.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Alexis Leon and Mathews Leon, Fundamentals of Information Technology, Vikas Publishing House Pvt. Ltd, 2009
2. Fundamentals of Computers and Information Technology, M.N Doja,2005

REFERENCES

1. Ramesh Bangia,"Computer Fundamentals and Information Technology", Laxmi Publications Pvt Limited, 2008.
2. Bharihoke, "Fundamentals of Information Technology", Excel Books, 2009.
3. Ralph Stair, George Reynolds, "Fundamentals of Information Systems" Cengage Learning, 2015

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

CO1: Explain the basic concepts, generations, classifications, and architecture of computers.
CO2: Describe the functions of CPU, memory, input devices, output devices, and storage devices.
CO3: Explain computer software, programming languages, operating systems, and database management systems.
CO4: Demonstrate knowledge of computer networks, the Internet, email, and web design concepts.
CO5: Analyse the applications of computers and identify common security threats such as viruses, worms, and malware.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.9
CO2	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.2
CO3	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.2
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
CO5	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.5
Average	3.0	3.0	2.4	2.4	2.0	1.2	1.0	2.6	1.8	2.0	3.0	2.6	2.2	2.6	1.8	**2.3**

Mean CO's :2.3

3 - Strong, 2 - Medium , 1- Low

Year: First **INTERDISCIPLINARY COURSE – II** **Semester: II**

WORKING PRINCIPLES OF INTERNET

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES:

This course aims to:

- Understand the fundamentals and architecture of the Internet.
- Learn various methods of Internet connectivity and online communication.
- Explore the World Wide Web and common Internet tools.
- Understand multimedia, e-commerce, and intranet applications.
- Gain awareness of Internet security and safe online practices.

UNIT – I: INTRODUCTION TO THE INTERNET

Basics of Internet – Internet Architecture – Basic Internet Services.

UNIT – II: INTERNET CONNECTIVITY AND COMMUNICATION

Connecting to the Internet – Internet Service Providers – E-mail – Online Communication Tools.

UNIT – III: WORLD WIDE WEB

How the World Wide Web Works – Web Browsers – Search Engines – Common Internet Tools.

UNIT – IV: INTERNET APPLICATIONS

Multimedia on the Internet – Intranet – E-Commerce and Online Shopping.

UNIT – V: INTERNET SECURITY

Internet Security Basics – Safe Browsing Practices – Cyber Threats – Privacy and Data Protection.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOK

1. Xavier, C. (2021). Fundamentals of Internet and emerging technologies (1st ed.). New Age International Publishers.

REFERENCES

1. Comer, D. E. (2018). The Internet book: Everything you need to know about computer networking and how the Internet works (5th ed.). CRC Press.
2. Fox, R., & Hao, W. (2017). Internet infrastructure: Networking, web services, and cloud computing. CRC Press.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

CO1: Explain the basic concepts and architecture of the Internet.
CO2: Use Internet services and communication tools effectively.
CO3: Demonstrate the use of the World Wide Web and common Internet tools.
CO4: Apply Internet-based services such as multimedia applications and online shopping.
CO5: Identify Internet security threats and adopt safe online practices.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
Average	**2.8**	**3.0**	**2.2**	**2.2**	**2.2**	**2.4**	**1.4**	**2.0**	**1.8**	**2.0**	**2.8**	**2.8**	**2.4**	**2.4**	**1.6**	**2.3**

Mean CO's :2.3

3 - Strong, 2 - Medium , 1- Low

Year: Second **INTERDISCIPLINARY COURSE – III** **Semester: III**

DIGITAL MARKETING

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES:

This course aims to:

- Understand the fundamentals of digital marketing and e-business.
- Learn the components of the online marketing mix.
- Explore digital media channels and online promotional strategies.
- Analyse online consumer behaviour and website characteristics.
- Evaluate digital branding concepts and brand performance metrics.

UNIT – I: INTRODUCTION TO DIGITAL MARKETING

Digital Marketing – Transition from Traditional Marketing to Digital Marketing – Growth of E-Concepts – Growth of E-Business.

UNIT – II: ONLINE MARKETING MIX

Online Marketing Mix – E-Product – E-Promotion – E-Price – E-Place.

UNIT – III: DIGITAL MEDIA CHANNELS

Digital Media Channels – Search Engine Marketing (SEM) – Electronic Public Relations (ePR) – Affiliate Marketing – Interactive Display Advertising.

UNIT – IV: ONLINE CONSUMER BEHAVIOR

Online Consumer Behavior – Factors Influencing Online Consumers – Cultural Implications of Key Website Characteristics**.**

UNIT – V: DIGITAL BRAND ANALYSIS

Digital Brand Analysis – Meaning – Benefits – Components – Brand Share Dimensions – Brand Audience Dimensions.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS

1. Chaffey, D., & Ellis-Chadwick, F. (2024). Digital marketing: Strategy, implementation and practice (9th ed.). Pearson Education.
2. Ryan, D. (2024). Understanding digital marketing: Marketing strategies for engaging the digital generation (6th ed.). Kogan Page.

REFERENCES

1. Kingsnorth, S. (2022). Digital marketing strategy: An integrated approach to online marketing (3rd ed.). Kogan Page.
2. Tuten, T. L., & Solomon, M. R. (2024). Social media marketing (5th ed.). Sage Publications.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

CO1: Explain the concepts of digital marketing, e-business, and online business models.
CO2: Apply the online marketing mix elements in digital business environments.
CO3: Analyse the role of digital media channels and online promotional strategies.
CO4: Evaluate online consumer behaviour and website characteristics influencing customer decisions.
CO5: Assess digital brand performance using brand share and audience dimensions.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
Average	2.8	3.0	2.2	2.2	2.2	2.4	1.4	2.0	1.8	2.0	2.8	2.8	2.4	2.4	1.6	2.3

Mean CO's :2.3

3 - Strong, 2 - Medium , 1- Low

Year : Second **INTER DISCIPLINARY COURSE – IV** **Semester : IV**

INTRODUCTION TO CYBER SECURITY

Code : **(Theory)** **Credits: 2**

COURSE OBJECTIVES :

This course aims to:

- Understand the fundamental concepts of cyber security.
- Learn common cyber-attacks and security vulnerabilities.
- Gain knowledge of network and Internet security practices.
- Understand cyber laws, ethics, and digital safety measures.
- Develop awareness of cyber security tools and protection systems.

UNIT – I: INTRODUCTION TO CYBER SECURITY

Introduction to Cyber Security – Need for Cyber Security – Cyber Space – Cyber Threats – Cyber Crimes – Types of Cyber Attacks.

UNIT – II: CYBER ATTACKS AND MALWARE

Phishing – Spoofing – Social Engineering – Malware – Viruses – Spyware.

UNIT – III: NETWORK AND INTERNET SECURITY

Network Security Basics – Firewalls – Intrusion Detection Systems – Password Security – Secure Browsing – Email Security.

UNIT – IV: DATA SECURITY AND PRIVACY

Data Protection – Authentication and Authorization – Privacy Issues – Safe Use of social media.

UNIT – V: CYBER ETHICS AND CYBER LAWS

Cyber Ethics – Digital Footprints – Cyber Laws – Cyber Safety Best Practices.

UNIT – VI :CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Stallings, W., & Brown, L. (2024). *Computer security: Principles and practice* (5th ed.). Pearson.
2. Whitman, M. E., &Mattord, H. J. (2024). *Principles of information security* (8th ed.). Cengage Learning.

REFERENCES

1. Easttom, C. (2022). *Computer security fundamentals* (5th ed.). Pearson.
2. Vacca, J. R. (2021). *Computer and information security handbook* (3rd ed.). Elsevier.
3. Hadnagy, C. (2021). *Social engineering: The science of human hacking* (2nd ed.). Wiley.
4. Brooks, C. J., Grow, C., Craig, P., & Short, D. (2022). *Cybersecurity essentials*. Wiley.

COURSE OUTCOMES:

Upon successful completion of this course, students would be able to:
CO1: Explain the basic concepts of cyber security, threats, and cyber-crimes.
CO2: Identify common cyber-attacks affecting information systems.
CO3: Apply security measures to protect networks and systems.
CO4: Demonstrate awareness of data security, and safe Internet practices.
CO5: Explain cyber ethics, cyber laws, and best practices for responsible digital citizenship.

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	Mean COs
CO1	3	2	2	2	2	1	1	2	1	2	3	2	2	2	1	1.87
CO2	3	3	2	2	2	1	1	2	1	2	3	3	2	2	1	2.00
CO3	3	3	3	3	2	1	1	2	2	2	3	3	2	3	1	2.27
CO4	3	3	2	3	3	1	1	2	2	2	3	3	2	3	2	2.33
CO5	2	3	2	2	3	2	2	2	2	3	2	2	2	2	3	2.27
Average	2.80	2.80	2.20	2.40	2.40	1.20	1.20	2.00	1.60	2.20	2.80	2.60	2.00	2.40	1.60	**2.15**

Mean CO's :2.15

3 - Strong, 2 - Medium , 1- Low