JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
B.TECH -CYBER SECURITY
(R23-IInd YEAR COURSE STRUCTURE & SYLLABUS)

B.Tech.– II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Digital Logic & Computer Organisation	3	0	0	3
4	Professional Core	Advanced Data Structures &Algorithm Analysis	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	Advanced Data Structures and Algorithm Analysis Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement Course	Python programming	0	1	2	2
9	AuditCourse	Environmental Science	2	0	0	0
Total			**16**	**2**	**8**	**20**

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics FinacialAnalysis	2	0	0	2
2	Engineering Science/ Basic Science	Number Theory & Applications	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Computer Networks	3	0	0	3
6	Professional Core	Computer Networks and Operating Systems Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
9	Skill Enhancement Course	Full Stack Development-1	0	1	2	2
10	BS&H	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08weeks duration during summer Vacation						

3	0	0	3

DISCRETE MATHEMATICS AND GRAPH THEORY

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

Course Outcomes: At the end of the course students will be able to

1. Build skills in solving mathematical problems (L3)
2. Comprehend mathematical principles and logic (L4)
3. Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L6)
4. Manipulate and analyze data numerically and/or graphicallysing appropriate Software (L3)
5. How to communicate effectively mathematical ideas/results verbally or in writing (L1)

UNIT–I: Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method ofProof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory:

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams. Functions: Bijective, Composition, Inverse, Permutation, and Recursive

UNIT-IV: Graph Theory:

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

Unit-V: Multi Graphs

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCE BOOKS:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby andSharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

2	1	0	3

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-

commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-

3	0	0	3

DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Objectives:

The main objectives of the course is to

- Provide students with acomprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input /output (I/O) systems and their inter action with the CPU, memory, and peripheral devices

UNIT–I:

Data Representation: Binary Numbers, Fixed Point Representation.Floating Point Representation. Number base conversions, Octal and HexadecimalNumbers,components,Signedbinarynumbers,Binarycodes

DigitalLogicCircuits-I: BasicLogicFunctions,Logicgates,universallogicgates, Minimization of Logic expressions. K-Map Simplification,CombinationalCircuits,Decoders,Multiplexers

UNIT–II:

DigitalLogicCircuits-II:SequentialCircuits,Flip-Flops,Binarycounters,Registers,ShiftRegisters,Ripplecounters.

BasicStructureofComputers: Computer Types, Functional units, Basicoperationalconcepts,Busstructures,Software,Performance,multiprocessorsandmulticomputers,ComputerGenerations,Von-NeumannArchitecture

UNIT–III:

ComputerArithmetic:AdditionandSubtractionofSigned Numbers,Design of Fast Adders, Multiplication ofPositive Numbers, Signed-operandMultiplication, Fast Multiplication, Integer Division, Floating-Point NumbersandOperations.

Processor Organization: Fundamental Concepts, Execution of a CompleteInstruction,Multiple

Input/Output Organization: Accessing I/O Devices, Interrupts, ProcessorExamples,DirectMemoryAccess,Buses,InterfaceCircuits,StandardI/OInterfaces

Textbooks:

1. ComputerOrganization,CarlHamacher,ZvonkoVranesic,SafwatZaky,6th edition,McGrawHill
2. DigitalDesign,6thEdition,M.MorrisMano,PearsonEducation.
3. OrganizationandArchitecture,WilliamStallings,11thEdition,Pearson.

ReferenceBooks:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition,Pearson
2. ComputerOrganizationandDesign,DavidA.Paterson,JohnL.Hennessy,Elsevier
3. FundamentalsofLogicDesign,Roth,5thEdition,Thomson

OnlineLearningResources:

1.https://nptel.ac.in/courses/106/103/106103068/

II Year I Semester

L	T	P	C
3	0	0	3

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Objectives:

The main objectives of the course is to

- Provide knowledge on advance datastructures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various datastructures in the algorithm design

UNIT–I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVLT rees–Creation, Insertion, Deletion operations and Applications. B. Trees–Creation,Insertion,Deletion operations and Applications

UNIT–II:

Heap Trees (PriorityQueues)–Minand MaxHeaps,Operations and Applications. Graphs–Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications. Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT–III:

GreedyMethod:GeneralMethod,JobSequencingwithdeadlines,KnapsackProblem,Minimumcostspanningtrees, Single Source Shortest PathsDynamicProgramming:GeneralMethod,Allpairsshortestpaths,SingleSourceShortestPaths–General Weights (BellmanFordAlgorithm),Optimal Binary SearchTrees,0/1Knapsack,String Editing,Travelling Salesperson problem

1. Fundamentals of Data Structures in C++,Horowitz, Ellis,Sahni Sartaj;Mehta,Dinesh,2nd Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni,Sanguthevar Rajasekaran,2nd Edition University Press

ReferenceBooks:

1. Data Structures and program design in C,RobertKruse,Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley&Sorenson, McGrawHill
3. TheArtofComputerProgramming,Vol.1:FundamentalAlgorithms,DonaldE Knuth,Addison-Wesley,1997.
4. DataStructuresusingC&C++:Langsam,Augenstein&Tanenbaum,Pearson,1995
5. Algorithms+DataStructures&Programs:,N.Wirth,PHI
6. FundamentalsofDataStructuresinC++:HorowitzSahni&Mehta,GalgottiaPub.
7. DatastructuresinJava:,ThomasStandish,PearsonEducationAsia

OnlineLearningResources:

https://www.tutorialspoint.com/advanced_data_structures/index.asphttp://peterindia.net/Algorithms.html

3	0	0	3

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

UNIT I

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.**Data Types**, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.**Control Statements**: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.**Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. **Interfaces:** Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.**Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.**Java I/O and File:** Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1) The complete Reference Java, 11th edition, Herbert Schildt,TMH
2) Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

0	0	3	1.5

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

Course Objectives:

The objectives of the course is to

- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists

1. Fundamentals of Data Structures in C++, Horowitz Ellis, Sahni Sartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

Online Learning Resources:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

0	0	3	1.5

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Objectives:

The aim of this course is to

- Practice object oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise - 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
b) Write a program illustrating **is Alive** and **join ()**
c) Write a Program illustrating Daemon Threads.
d) Write a JAVA program Producer Consumer Problem

Exercise – 8

a) Write a JAVA program that import and use the user defined packages
b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

0	**1**	**2**	**2**

PYTHON PROGRAMMING
(Skill Enhancement Course)

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

UNTI-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language. Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number

List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. addition ii. insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data,

21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson

ENVIRONMENTAL SCIENCE	2	0	0	0

CourseObjectives:

- To make the students to ge tawareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

CourseOutcomes:

- Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.
- Understand flow and bio-geo-chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste landreclamation.
- Casus of population explosion, value education and welfare programmes.

UNIT–I

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need forPublicAwareness.

Natural Resources:Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timberextraction – Mining, dams and other effects on forest and tribal people – Water resources – Use andover utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems–Mineral resources:Use and exploitation, environmental effects of extracting and using mineral resources, case studies– Food resources:World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity,casestudies.–Energy resources:

UNIT–II

Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and locallevels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss,poaching of wildlife, man-wildlife conflicts– Endangered and endemic species of India –Conservation of biodiversity:In-situand Ex-situ conservation of biodiversity.

UNIT–III

Environmental Pollution:Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Roleof an individual in prevention of pollution – Pollution case studies – Disaster management: floods,earthquake,cycloneandlandslides.

UNIT–IV

Social Issues and the Environment: From Unsustainable to Sustainable development– Urban problems related to energy – Water conservation, rain water harvesting, watershed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions–Climate change, global warming, acidrain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wastel and reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act–Wild life Protection Act–Forest Conservation Act–Issues involved inenforcement of environment allegislation–Public awareness.

UNIT–V

Human Population And The Environment: Population growth, variation among nations.

2. Palaniswamy, "Environmental Studies",Pearson education
3. S.AzeemUnnisa,"Environmental Studies"Academic Publishing Company
4. K.RaghavanNambiar,"Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt.Ltd.

Reference Books:

1. DeekshaDaveandE.SaiBabaReddy, "Text book of Environmental Science",Cengage Publications.
2. M.AnjiReddy,"Text book of Environmental Sciences and Technology",BSPublication.
3. J.P.Sharma,Comprehensive Environmental studies,Laxmi publications.
4. J.GlynnHenryandGaryW.Heinke,"Environmental Sciences and Engineering",Prentice Hall of India Private limited
5. G.R.Chatwal,"A Text Book of Environmental Studies"Himalaya Publishing House
6. Gilbert M.Masters and WendellP.Ela,"Introduction to Environmental Engineering and Science,Prentice Hall of India Private limited.

2	0	0	2

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input-out put relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-terminvestment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management.
- Understand the fundament also fEconomicsviz., Demand, Production, cost, revenue and markets
- Apply the Concept of Production costand revenues for effective Business decision
- Analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Develop the accounting statements and evaluate the financial performance of businessentity.

UNIT-I

Managerial Economics: Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function,Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT-II

Business Organizations and Markets: Introduction–Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-MonopolisticCompetition– Oligopoly-Price-Output Determination-Pricing Methods and Strategies

UNIT-IV

Capital Budgeting: Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting–Features, Proposals, Methods and Evaluation. Projects– Pay Back Method ,Accounting Rate of Return(ARR) Net Present Value(NPV)Internal Rate Return(IRR)
Method (sample problems)

UNIT-V

Financial Accounting and Analysis: Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis-Analysis and Interpretation of Liquidity Ratios,Activity Ratios,and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney &Maheswari:Managerial Economics,Sultan Chand,2013.

Reference Books:

1. Managerial Economics: Principles And Worldwide Applications, 9E (Adaptation) by Dominick Salvatore and Siddhartha Rastogi
2. Managerial Economics: Principles and Worldwide Applications
   by Dominick Salvatore

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NUMBER THEORY AND ITS APPLICATIONS

Course Objectives:

This course enables the students to learn the concepts of number theory and its applications to information security.

Course Outcomes:

1. Apply the knowledge of GCD and Prime Factorization.
2. Understand principles on congruence
3. Develop the knowledge of congruence applications
4. Understand the finite fields and primality
5. Uevelop various encryption methods and its applications.

UNIT – I: Integers, Greatest common divisors and prime Factorization

The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations

UNIT – II: Congruence:

Introduction to congruence -Linear congruence-The Chinese remainder theorem-Systems of linear congruence

UNIT – III: Applications of Congruence:

Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem- Euler's phi-function- The sum and number of divisors- Perfect numbers and Mersenne primes.

Text Books:

1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.

Reference Books:

1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press

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OPERATING SYSTEMS

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.**Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues.**CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.**Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV

Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

DATABASE MANAGEMENT SYSTEMS

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Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNIT I:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.**Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II:

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III:

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.**Introduction to Indexing Techniques**: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1) Introduction to Database Systems, 8th edition, C J Date, Pearson.
2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066728202245 6_shared/overview

COMPUTER NETWORKS

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Course Objectives:

The main objectives of the course is to

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives

UNIT I:

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT II:

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical

Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT IV:

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V:

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Text Books:

Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183/3

II YEAR II SEMESTER

L	T	P	C
0	0	3	1.5

COMPUTER NETWORKS AND OPERATING SYSTEMS LAB

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To enlighten the working of networking commands supported by operating system
- Toimpart knowledge of Network simulator2/3
- To familiarize the use of networking functionality supported by JAVA
- To familiarize with computer networking tools**.**

List of Activities/Experiments:

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.
   - Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
   - Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.
2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup
3. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.

- Inspect HTTP Traffic to a Given IP Address,
- Reject Packets to Given IP Address,
- Monitor Apache and MySQL Network Traffic.

Experiments covering the Topics:

- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls
   fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate the following CPU scheduling algorithms
   a) FCFS b) SJF c) Priority d) Round Robin
4. Write a program to solve producer-consumer problem using Semaphores.
5. Implement the following memory allocation methods for fixed partition
   a) First fit b) Worst fit c) Best fit
6. Simulate the following page replacement algorithms
   a) FIFO b) LRU c) LFU
7. Simulate Paging Technique of memory management.
8. Implement Bankers Algorithm for Dead Lock avoidance

Text Books:

1. ShivendraS.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, "TCP/IP Essentials:A Lab-Based Approach", Cambridge University Press, 2004.
2. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.

Reference Books:

1. Cisco Networking Academy, "CCNA1 and CCNA2 Companion Guide", Cisco Networking Academy Program, 3rd edition, 2003.
2. Elloitte Rusty Harold, "Java Network Programming", 3rd edition, O'REILLY, 2011.
3. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016

Online Learning Resources:

https://www.netacad.com/courses/packet-tracer - Cisco Packet Tracer.

II Year II Semester

L	T	P	C
0	0	3	1.5

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers,

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between,

expression. The program can be extended using the NULLIF and COALESCE functions.

7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

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FULL STACK DEVELOPMENT – I
(Skill Enhancement Course)

Course Objectives:

The main objectives of the course are to

- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- Experiment with JavaScript to develop dynamic web pages and validate forms

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

(Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).

c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame → image, second frame → paragraph, third frame → hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, , tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms

i. Simple selector (element, id, class, group, universal)
ii. Combinator selector (descendant, child, adjacentsibling, general sibling)
iii. Pseudo-class selector
iv. Pseudo-element selector
v. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.

b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.

Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

a. Write a program usingdocument object properties and methods.
b. Write a program using window object properties and methods.
c. Write a program usingarray object properties and methods.
d. Write a program usingmath object properties and methods.
e. Write a program usingstring object properties and methods.
f. Write a program usingregex object properties and methods.
g. Write a program usingdate object properties and methods.
h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
b. Write a program to display week days using switch case.
c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
d. Write aprogram to print data in object using for-in, for-each and for-of loops
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]
f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events

a. Design a appropriate function should be called to display
    i. Factorial of that number
    ii. Fibonacci series up to that number

i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
ii. Mobile (only numbers and length 10 digits)
iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

10. Node.js

a. Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
b. Write a program to transfer data over http protocolusing http module.
c. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
d. Write a program to parse an URL using URL module.
e. Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Web Links:

https://www.w3schools.com/html
https://www.w3schools.com/css
https://www.w3schools.com/js/
https://www.w3schools.com/nodejs
https://www.w3schools.com/typescript

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DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity. Flow and planning from idea to innovation

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1

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B.Tech - CYBER SECURITY

B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Cloud Computing	3	0	0	3
2	Professional Core	Cryptography & Network Security	3	0	0	3
3	Professional Core	Automata Theory & Compiler Design	3	0	0	3
4	Professional Elective-I	1. Secure Coding Practices 2. Software Engineering 3. Artificial Intelligence 4. Microprocessors & Microcontrollers 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective- I	OR Entrepreneurship Development & Venture Creation	3	0	0	3
6	Professional Core	Cloud Computing Lab	0	0	3	1.5
7	Professional Core	Cryptography & Network Security Lab	0	0	3	1.5
8	Skill Enhancement Course	Full Stack Development-2	0	1	2	2
9	Engineering Science	User Interface Design Using Flutter	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			**15**	**1**	**10**	**23**
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course)		3	0	0	3
HC	Honors Course (Student may select from the same Honors pool)		3	0	0	3
HC	Honors Course (Student may select from the same Honors Pool)		3	0	0	3

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B.Tech.– III Year II Semester

	Category	Title	L	T	P	Credits
1	Professional Core	Cyber Security& Digital Forensics	3	0	0	3
2	Professional Core	Blockchain Technology	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Elective-II	1. Software Vulnerability Analysis 2. DevOps 3. Applied Cryptography 4. Internet of Things 5.12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1.Design of secure protocols 2.Firewalls & VPN Security 3.Web Application Security 4.Security Assessment and Risk Analysis 5.12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – III		3	0	0	3
7	Professional Core	Cyber Security& Digital Forensics Lab	0	0	3	1.5
8	Professional Core	Malware Analysis & Reverse Engineering lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills OR IELTS	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	0
Total			**20**	**1**	**8**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						
MC	Student may select from the same minors pool		3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	0	3
HC	Student may select from the same honors pool		3	0	0	3
HC	Honors Course (Student may select from the honors pool)		3	0	0	3

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OpenElectives&Minor

Note: ***To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.***

For Minor in Cyber Security:

		L-T-P-C
Open Elective I	: Computer Networks	3-0-0-3
Open Elective II	: Introduction to Cyber Security	3-0-0-3
Open Elective III	: Cryptography & Network Security	3-0-0-3
Open Elective IV	: Block Chain technology	3-0-0-3
Open Elective V	: Cloud Computing	3-0-0-3
Open Elective VI	: Cyber Security Lab	0-0-3-1.5
Open ElectiveVII	: Cryptography & Network Security Lab	0-0-3-1.5

OpenElectives,offeredtootherdepartmentstudents:

OpenElectiveI:JavaProgramming
OpenElectiveII:OperatingSystems
OpenElectiveIII:DataBaseManagementSystems
OpenElectiveIV:ComputerNetworks

COURSES OFFERED FOR HONOURS DEGREE IN CYBER SECURITY :

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1		Application Thread Detection	3	0		3
2		IOT security	3	0		3
3		Penetration Testing and Vulnerability Assessment	3	0		3
4		Social Media Security	3	0		3
5		NoSQL Databases	3	0		3
6		NoSQL Databases Lab		3		1.5
7		Social Media Security Lab		3		1.5
Total						**18**

III Year I Semester	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Explain the evolving utility computing model called cloud computing.
- Introduce the various levels of services offered by cloud.
- Discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- Emphasize the security and other challenges in cloud computing.
- Introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

UNIT -I: Introduction to Cloud Computing Fundamentals

Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II: Cloud Enabling Technologies

Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures (SISD, SIMD, MISD, MIMD), elements ofdistributed computing, technologies for distributed computing, IPC, RPC, Messaging systems, Service Oriented Architecture (SOA), Web services, virtualization.

UNIT-III: Virtualization and Containers

Characteristics of virtualized environments, taxonomy of virtualization techniques,virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware),building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm andKubernetes,public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV: Cloud computing challenges

Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V: Advanced concepts in cloud computing

Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS),serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

III Year I Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to

- Explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols.
- Implement various secure communication standards including Kerberos, IPsec, and SSL/TLS.

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNIT II:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography-algebraic structures, GF(2^n) Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES.

UNIT III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNIT IV:

Data Integrity, Digital Signature Schemes & Key Management: Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature-process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNIT V:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :**Security at the Network Layer: IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:

Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018

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III Year I Semester	AUTOMATA THEORY & COMPILER DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the. Fundamental concepts of formal languages, grammars and automatatheory.
- To understand deterministic and non-deterministic machines and the differences between decidability and undecidability.
- Introduce the major concepts of language translation and compiler design and impart the knowledge of practical skills necessary for constructing a compiler.
- Topics include phases of compiler, parsing, syntax directed translation, type checking use of symbol tables, intermediate code generation.

Course Outcomes:

- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Demonstrate the knowledge of patterns, tokens & regular expressions for lexical analysis.
- Acquireskills in using lextool and design LR parsers

UNIT-I

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory–Alphabets, Strings, Languages, Problems.**Non deterministic Finite Automata**: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. **Deterministic Finite Automata:** Definition of DFA, How ADFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA

UNIT-II

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.**Pumping Lemma for Regular Languages**: Statement of the pumping lemma, Applications of the Pumping Lemma. **Context-Free Grammars:** Definition of Context-Free Grammars, Derivations Using a Grammar, Left most and Right most Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT-III

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state. **Turing Machines**: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine. **Undecidability:** Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines

UNIT-IV

Introduction: The structure of a compiler, **Lexical Analysis:** The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex. **Syntax Analysis:** Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers.

UNIT-V

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Code. **Run Time Environments:** Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management

TEXT BOOKS:

1. 1.Introduction to Automata Theory, Languages, and Computation, 3[nd]Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, Pearson Education.
2. Compilers: Principles, Techniques and Tools, Alfred V.Aho, Monica S.Lam, RaviSethi, Jeffry D.Ullman,2[nd]Edition, Pearson.
3. Theory of Computer Science— Automata languages and computation, MishraandChandrashekaran, 2[nd]Edition, PHI.

REFERENCE BOOKS:

1. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
3. Lex &yacc–John R. Levine, Tony Mason, Doug Brown, O'reilly
4. Compiler Construction, Kenneth C. Louden, Thomson. Course Technology.

III Year I Semester	SECURE CODING PRACTICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understanding of the various security attacks and knowledge to recognize and removecommon coding errorsthat lead to vulnerabilities.
2. It gives an outline of the techniques for developing a secure application.

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO 1: Implement security as a culture and show mistakes that make applications vulnerable to attacks.
CO 2: Understand various attacks like DoS, buffer overflow, web specific, database specific web-spoofing attacks.
CO 3: Analyze and demonstrate skills necessary to address common programming errors that lead to security issues and to learn how to develop secure applications.
CO 4: Analyze the nature of the threats to software and incorporate secure coding practices throughout the planning and development of the product.
CO 5: Apply proper techniques for handling application faults, implement secure authentication, authorization and data validation controls used to prevent common vulnerabilities.

UNIT- I

INTRODUCTION: Need for secure systems: Proactive Security development process, Secure Software Development Cycle (S-SDLC), Security issues while writing SRS, Design phase security, Development Phase, Test Phase, Maintenance Phase, Writing Secure Code – Best Practices SD3 (Secure by design, default and deployment), Security principles and Secure Product Development Timeline

UNIT -II

SECURE CODING TECHNIQUES: Protection against DoS attacks, Application Failure Attacks, CPU Starvation Attacks, Insecure Coding Practices in Java Technology. ARP Spoofing and its countermeasures. Buffer Overrun- Stack overrun, Heap Overrun, Array Indexing Errors, Format String Bugs. Security Issues in C Language: String Handling, Avoiding Integer Overflows and Underflows and Type Conversion Issues- Memory Management Issues, Code Injection Attacks, Canary based countermeasures using StackGuard and Propolice. Socket Security, Avoiding Server Hijacking, Securing RPC, ActiveX and DCOM

UNIT–III

Threat modelling process and its benefits: Identifying the Threats by Using Attack Trees and rating threats using DREAD, Risk Mitigation Techniques and Security Best Practices. Security techniques, authentication, authorization. Defense in Depth and Principle of Least Privilege.

UNIT-IV

AND WEB SPECIFIC INPUT ISSUES: SQL Injection Techniques and Remedies, Race conditions, Time of Check Versus Time of Use and its protection mechanisms. Validating Input and Inter process Communication, Securing Signal Handlers and File Operations. XSS scripting attack and its types – Persistent and Non persistent attack XSS Countermeasures and Bypassing the XSS Filters. Testing Secure Applications: Security code overview, secure software installation. The Role of the Security Tester, Building the Security Test Plan. Testing HTTP-Based Applications, Testing File-Based Applications, Testing Clients with Rogue Servers

UNIT -V

SOFTWARE SECURITY ENGINEERING: Requirements engineering for secure software: Misuse and abuse cases- SQUARE process model- Software security practices and knowledge for architecture and design.

Text Books:

1. Writing Secure Code, Michael Howard and David LeBlanc, Microsoft Press, 2nd Edition, 2004.
2. Threat Modeling, Frank Swiderski and Window Snyder, Microsoft Professional, 1st Edition, 2004.

Reference Books:

1. Robert C.Seacord, " *Secure Coding in C and C++*", Pearson Education, 2nd edition, 2013.
2. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, " *Software Security Engineering : A guide for Project Managers*", Addison-Wesley Professional, 2008.
3. Buffer Overflow Attacks: Detect, Exploit, Prevent by Jason Deckar, Syngress, 1st Edition, 2005.

III Year I Semester	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

The objectives of this course are to introduce

- Software life cycle models
- Software requirements and SRS document.
- How to plan for a project.
- The quality control and how to ensure good quality software.
- Testing **Course** methods of software, use of CASE tools
- Implementation issues, validation and verification procedures.

Course Outcomes:

CO	Course Outcomes	Knowledge Level(K)#
CO1	Compare and analyse various process models	K1
CO2	Develop SRS document and estimate the modularity of the project	K2
CO3	Develop data flow diagrams and compare the user interface design	K2
CO4	Compare testing strategies and analyse the software quality	K3
CO5	Apply Computer Aided Software Engineering tools and analyse the components of software maintenance and reuse.	K2

#basedonsuggestedRevisedBTL

UNIT-I

INTRODUCTION: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering. **SOFTWARE LIFE CYCLE MODELS:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model and Spiral model.

UNIT -II:

SOFTWARE PROJECT MANAGEMENT: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, and risk management. **REQUIREMENTS ANALYSIS AND SPECIFICATION:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:

SOFTWARE DESIGN: Overview of the design process, How to characterise a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design. **FUNCTION-ORIENTED SOFTWARE DESIGN:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review. **USER INTERFACE DESIGN:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:

CODING AND TESTING: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing. **SOFTWARE RELIABILITY AND QUALITY MANAGEMENT:** Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V:

COMPUTER-AIDED SOFTWARE ENGINEERING (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, Other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. **SOFTWARE MAINTENANCE:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. **SOFTWARE REUSE:** What can be reused? Why almost no reuse so far? Basic issues in any reuse program, A reuse approach, and Reuse at organisation level.

Text Books

1. Fundamentals of Software Engineering, Raji b Mall, Fifth Edition, PHI.

Reference Books

1. Software Engineering Apractitioner's Approach, Roger S. Pressman, Ninth Edition, McGraw Hill International Edition.
2. Software Engineering, Ian Sommerville, Tenth Edition, Pearson Education.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605895063871 48827_shared/overview
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003 904735_shared/overview

III Year I Semester	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Outcome(s):
This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence.

UNIT-I
Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. **Problem Solving, Problem Space & search:** Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT-II
Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT-III
Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT – IV
Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT – V
Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. **Expert Systems:** Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Home Assignments:

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
2. Artificial Intelligence, Russel, Pearson

Reference Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
3. Logic & Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS

III Year I Semester	MICROPROCESSORS & MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051
- To introduce16 bit and 32 bit microcontrollers.

UNIT I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

UNIT V

Interfacing Microcontroller, Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.

2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

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III Year I Semester	CLOUD COMPUTING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce the various levels of services offered by cloud.
- To give practical knowledge about working with virtualization and containers.
- To introduce the advanced concepts such as serverless computing and cloud simulation.

Course Outcomes: At the end of the course, the student should be able to

- Demonstrate various service types, delivery models and technologies of a cloud computing environment.
- Distinguish the services based on virtual machines and containers in the cloud offerings.
- Assess the challenges associated with a cloud-based application.
- Discuss advanced cloud concepts such as serverless computing and cloud simulation.
- Examine various programming paradigms suitable to solve real world and scientific problems using cloud services.

List of Experiments:

1. Lab on web services
2. Lab on IPC, messagaging, publish/subscribe
3. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or above.
4. Install a C compiler in the virtual machine created using VirtualBox and execute Simple Programs.
5. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access to port 80 on the instance.

   OR
6. Do the same with OpenStack
7. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
8. Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.
9. Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container.
10. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11. Install Hadoop single node cluster and run simple applications like word count.
12. Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.
13. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Text Books:

1. Mastering Cloud Computing, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Cloud Computing: Principles and Paradigms by RajkumarBuyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
4. Docker, Reference documentation, https://docs.docker.com/reference/
   OpenFaaS, Serverless Functions Made Simple, https://docs.openfaas.com/

III Year II Semester	CRYPTOGRAPHY & NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implementencryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
    a) Ceaser Cipher
    b) Substitution Cipher
    c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

III Year I Semester	FULL STACK DEVELOPMENT - 2	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Make use of router, template engine and authentication using sessions to develop application in Express JS.
- Build a single page application using RESTful APIs in Express JS
- Apply router and hooks in designing React JS application
- Make use of MongoDB queries to perform CRUD operations on document database

Experiments covering the Topics:

- Express JS – Routing, HTTP Methods, Middleware, Templating, Form Data
- Express JS – Cookies, Sessions, Authentication, Database, RESTful APIs
- React JS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
- React JS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- React JS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

Sample Experiments:

1. Express JS – Routing, HTTP Methods, Middleware.

a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
c. Write a program to show the working of middleware.

2. Express JS – Templating, Form Data

a. Write a program using templating engine.
b. Write a program to work with form data.

3. Express JS – Cookies, Sessions, Authentication

a. Write a program for session management using cookies and sessions.
b. Write a program for user authentication.

4. Express JS – Database, RESTful APIs

a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
b. Write a program to develop a single page application using RESTful APIs.

5. ReactJS – Render HTML, JSX, Components – function & Class

a. Write a program to render HTML to a web page.
b. Write a program for writing markup with JSX.
c. Write a program for creating and nesting components (function and class).
d.

6. ReactJS – Props and States, Styles, Respond to Events

a. Write a program to work with props and states.
b. Write a program to add styles (CSS & Sass Styling) and display data.
c. Write a program for responding to events.

7. ReactJS – Conditional Rendering, Rendering Lists, React Forms

a. Write a program for conditional rendering.
b. Write a program for rendering lists.
c. Write a program for working with different form fields using react forms.

8. ReactJS – React Router, Updating the Screen

a. Write a program for routing to different pages using react router.
b. Write a program for updating the screen.

9. ReactJS – Hooks, Sharing data between Components

a. Write a program to understand the importance of using hooks.
b. Write a program for sharing data between components.

10. MongoDB – Installation, Configuration, CRUD operations

a. Install MongoDB and configure ATLAS
b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

11. MongoDB – Databases, Collections and Records

a. Write MongoDB queries to Create and drop databases and collections.
b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

12. Augmented Programs: (Any 2 must be completed)

a. Design a to-do list application using NodeJS and ExpressJS.
b. Design a Quiz app using ReactJS.
c. Complete the MongoDB certification from MongoDB University website.

Text Books:

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2. Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich,Manning Publications. (Chapters 1-11)
3. React Quickly, AzatMardan,Manning Publications(Chapters 1-8,12-14)

Web Links:

1. ExpressJS - https://www.tutorialspoint.com/expressjs
2. ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn#
3. MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003,Andhra Pradesh, India
R23 B.Tech Cyber Security
(R23 – IIIrd YEAR COURSE STRUCTURE & SYLLABUS)

III Year I Semester	USER INTERFACE DESIGN USING FLUTTER	L	T	P	C
		0	0	2	1

Course Objectives:

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widges and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

List of Experiments:

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.

2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.

3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.

4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.

5. a) Learn about stateful and stateless widgets.
   b) Implement state management using set State and Provider.

6. a) Create custom widgets for specific UI elements.
   b) Apply styling using themes and custom styles.

7. a) Design a form with various input fields.
   b) Implement form validation and error handling.

8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).

9. a) Fetch data from a REST API.
   b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.
    b) Use Flutter's debugging tools to identify and fix issues.

Text Book:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres

III Year II Semester	CYBER SECURITY & DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

Course Objectives:
The aim of the course is to

- Identify security risks and take preventive steps
- understand the forensics fundamentals
- understand the evidence capturing process
- understand the preservation of digital evidence

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II: Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III: Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-MailRecovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV: Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating andTesting Forensics Software, Face,Iris and Finger print Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V: Cyber Crime Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenge to Indian Law and Cyber crime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cyber crime and Punishment, Cyber law,Technology and Students:Indian Scenario.

Text Books:

1. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Reference Books:

1. Michael T. Simpson, Kent Backman and James E. Corley, "Hands on Ethical Hacking and Network Defence", Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta,Mary Brown and Ravinder Kumar "Cyber Security and Cyber Laws" , Cengage,2018.

E-Resources:

1. CERT-In Guidelines- http://www.cert-in.org.in/
2. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3. https://computersecurity.stanford.edu/free-online-videos [Free Online Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.eduLicense:CreativeCommonsBY-NC-SA.

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III Year II Semester	BLOCKCHAIN TECHNOLOGYS	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- Able to know the security issues of blockchain technology.

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **Cryptocurrency:** Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. **Smart Contracts:** Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. **Consortium Blockchain:** Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. **Initial Coin Offering:** Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:
Case Study 1 – Retail,
Case Study 2 – Banking and Financial Services,
Case Study 3 – Healthcare,
Case Study 4 – Energy and Utilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. "Block chain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

III Year II Semester	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:
The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

,

Course Outcomes: At the end of the course, student will be able to

- Enumerate the Fundamentals of Machine Learning
- Build Nearest neighbour based models
- Apply Models based on decision trees and Bayes rule
- Make use of Linear discriminants for machine Learning
- Choose appropriate clustering technique

UNIT-I: Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:

1.“Machine Learning Theory and Practice”, M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1.“Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2.“Machine Learning in Action”,Peter Harrington, DreamTech
3.“Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

III Year II Semester	SOFTWARE VULNERABILITY ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

- This course provides the user to know the software vulnerabilities in the real software world.
- Different application-level security
- Able to find the malicious code actions and different protection techniques.

Course Outcomes: At the end of the course, student will be able to

	Course Outcomes	Knowledge Level (K)#
CO1	Acquire the basic concepts of security & Authentication	K3
CO2	How to detect Malicious Code in software applications	K1
CO3	Analyze and apply Access Control & Physical Protection to the UNIX and Windows operating system	K4
CO4	Brief explain the concepts of OSI Model, Sockets	K2
CO5	Ability to Acquire the concepts of Counter Measures	K1

UNIT-I:

Introduction to security & Authentication- Software Security Dealing with Widespread Security Failures, Bugtraq, CERT Advisories, RISKS Digest, Technical Trends Affecting Software Security, The ileitis, Beyond Reliability, Penetrate and Patch, On Art and Engineering, Security Goals, Prevention, Traceability and Auditing, Monitoring, Privacy and Confidentiality, Multilevel Security.

UNIT-II:

Security & Malicious Code-Managing Software Security Risk: An Overview Of Software Risk Management For Security, The Role Of Security Personnel, Software Security Personnel In The Life Cycle, Deriving Requirements, Risk Assessment, Software Risk Management, Architectural Risk Analysis, Risk-Based Security Testing, Security Requirements, Security Operations.

UNIT-III:

Access Control & Physical Protection- The UNIX Access Control Model, How UNIX and Windows Exploits, Modifying File Attributes, Modifying Ownership, The unmask, The Programmatic Interface, Setuid Programming, Access Control In Windows NT, Compartmentalization, Fine-Grained Privileges. Buffer Overflow & Root kits: Buffer Overflows As Security Problems, Defending Against Buffer Overflow.

UNIT-IV:

Network Security& Intrusion- OSI Model, Sockets-Functions, Addresses, Network Byte Order, Internet Address Conversion, Simple Server and Web Clients, Tiny web Server. Peeling Back the Lower Layers, Network Sniffing, Raw Socket Sniffer, libpcap Sniffer, Decoding the Layers, Active Sniffing, Denial of Service, SYN Flooding, The Ping of Death, Teardrop, Ping Flooding, Amplification Attacks, Distributed DoS Flooding.

UNIT-V:

Counter Measures- Detection of System Daemons, Crash Course in Signals, Tiny web Daemon, Tools of the Trade, tiny web Exploit Tool, Log Files, Log less Exploitation, Socket Reuse, Payload Smuggling, String Encoding, Buffer Restrictions, Polymorphic Printable ASCII Shell code. Hardening Countermeasures, Non executable Stack, ret2libc, Returning into system() Randomized Stack Space, Investigations with BASH and GDB, Bouncing Off Linux gate, Applied Knowledge, First Attempts, Paying the Odds.

Text Books:

1. John Viega & Gary McGraw: Building Secure Software: How to Avoid Security Problems the Right Way (Addison-Wesley Professional Computing Series), 2001.
2. Gary McGraw: Software Security: Building Security In (Addison-Wesley Professional Computing Series), 2008.

Reference Books:

1. Michael Howard, David LeBlanc, John Viega: 19 Deadly Sins of Software Security: Programming Flaws and How to Fix Them (Security One-off) (Addison-Wesley Professional Computing Series), 2001.
2. Jon Erickson: Hacking: The Art of Exploitation, 2nd Edition (No Starch Press, San Fransico), 2005.
3. Richard Sinn “Software Security, Theory Programming and Practice” Cengage Learning, 2004.

III Year II Semester	DevOps	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

UNIT-I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to DevOps. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT-II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit& Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT-III

Build Automation - Continuous Integration (CI): Build Automation, What is CI Why Cl is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT-IV

Continuous Delivery (CD): Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT-V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinjatemplating, Vaults, Deployments using Ansible.

CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC &ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

Text Books:

1. Joyner, Joseph.,Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1st Edition MihailsKonoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux,1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1stEdition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2ndedition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

III Year II Semester	APPLIED CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

Course Objectives:
Knowledge on significance of cryptographic protocols and symmetric and public key algorithms

Course Outcomes:
1. Understand the various cryptographic protocols
2. Analyze key length and algorithm types and modes
3. Illustrate different public key algorithms in cryptosystems
4. Understand special algorithms for protocols and usage in the real world.

UNIT - I
Foundations: Terminology, Steganography, Substitution Ciphers and Transposition Ciphers, Simple XOR, One-Time Pads, Computer Algorithms, Large Numbers, Cryptographic Protocols: Protocol Building Blocks: Introduction to Protocols, Communications Using Symmetric Cryptography, One-Way Functions, One-Way Hash Functions, Communications Using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo-Random-Sequence Generation

UNIT - II
Cryptographic Techniques: Key length: Symmetric Key length, Public key length, comparing symmetric and public key length. Algorithm types and modes: Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Cipher, Self-Synchronizing Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mod, Counter Mode, Other Block-Cipher Modes.

UNIT - III
Public-Key Algorithms: Background, Knapsack Algorithms, RSA, Pohlig-Hellman, Rabin, ElGamal, McEliece, Elliptic Curve Cryptosystems, LUC, Finite Automaton Public-Key Cryptosystems Public-Key Digital Signature Algorithms: Digital Signature Algorithm (DSA), DSA Variants, Gost Digital Signature Algorithm, Discrete Logarithm Signature Schemes, Ong-Schnorr-Shamir, ESIGN

UNIT - IV

Special Algorithms for Protocols: Multiple-Key Public-Key Cryptography, Secret-Sharing Algorithms, Subliminal Channel, Undeniable Digital Signatures, Designated Confirmer Signatures, Computing with Encrypted Data, Fair Coin Flips, One-Way Accumulators, All-or-Nothing Disclosure of Secrets, Fair and Failsafe Cryptosystems, Zero-Knowledge Proofs of Knowledge, Blind Signatures, Oblivious Transfer, Secure Multiparty Computation, Probabilistic Encryption, Quantum Cryptography

UNIT - V

Real World Approaches: IBM Secret key management protocol, ISDN, Kerberos, KryptoKnight, Privacy enhanced mail (PEM), Message security protocol (MSP), PGP, Public-Key Cryptography Standards (PKCS), Universal Electronic Payment System (UEPS).

Text books:

1. Bruce Schneier, Applied Cryptography, Second Edition: Protocols, Algorithms, and Source Code in C (cloth)

III Year II Semester	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

From the course the student will learn

- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

UNIT I:

Predecessors of IoT: Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems. Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT

UNIT II:

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNIT III:

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, WirelessHART, RFID, NFC,DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth. IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.

UNIT IV:

IoT Interoperability: Introduction, Standards, Frameworks. Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing

UNIT V:

Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT. IoT Case Studies: Agricultural IoT, Vehicular IoT

Text Books:

1. Introduction to IoT, SudipMisra, AnandarupMukhaerjee, Arjit Roy, Cambridge University Press, 2021
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education

Reference Books:

1. Fog and Edge Computing: Principles and Paradigms, RajkumarBuyya (Editor), Satish narayanaSrirama (Editor) , ISBN: 978-1-119-52498-4, January 2019
2. Getting Started with the Internet of Things, CunoPfister ,Oreilly

III Year II Semester	DESIGN OF SECURE PROTOCOLS	L	T	P	C
		3	0	0	3

Courseobjectives:

The main objective of this course is that to explore various protocols and design of various protocols with deeper security.

Course Outcomes:

- Get the exposure to various protocols.
- Gain knowledge on various secure mechanisms through set of protocols.
- Apply different data link layer protocols
- Efficiently design new set of protocols.
- Learn Security issues and over comemeans with protocols.

UNIT–I

OSI: ISO Layer Protocols:- Application Layer Protocols-TCP/IP, HTTP, SHTTP, LDAP, MIME, - POP & POP3 - RMON-SNTP-SNMP. Presentation Layer Protocols –Light Weight Presentation Protocol Session layer protocols.

UNIT–II

RPC protocols transport layer protocols ITOT,RDP,RUDP,TALI,TCP/UDP, compressed TCP. Network layer Protocols – routing protocols-border gateway protocol-exterior gateway protocol-internet protocol IPv4- IPv6- Internet Message Control Protocol- IRDP- Transport Layer Security-TSL-SSL-DTLS

UNIT–III

Data Link layer Protocol – ARP – In ARP – IPCP – IPv6CP – RARP – SLIP .Wide Area and NetworkProtocols- ATM protocols – Broadband Protocols – Point to Point Protocols – Other WAN Protocols-securityissues.

UNIT–IV

Local Area Network and LAN Protocols – ETHERNET Protocols–VLAN protocols– Wireless LAN Protocols–Metropolitan Area Network Protocol–Storage Area Network and SAN

UNIT–V

Protocols - FDMA, WIFI and WIMAX Protocols - security issues. Mobile IP – Mobile Support Protocol for IPv4 and IPv6 – Resource Reservation Protocol. Multi – casting Protocol–VGMP, IGMPMSDP. Network Security and Technologies and Protocols–AAA Protocols–Tunneling Protocols– Secured Routing Protocols– GRE-Generic Routing Encapsulation– IPSEC–Security.

TEXTBOOKS:

1. Jawin:"Networks Protocols Handbook",3rd Edition, Jawin Technologies Inc., 2005.
2. Bruce Potter and BobFleck:"802.11Security",1st Edition, O'Reilly Publications,2002.

REFERENCES:

1. Ralph Oppliger:"SSLandTSL:Theory and Practice",1st Edition, Arttech House,2009.
2. Lawrence Harte:"Introduction to CDMA-Network services Technologies and Operations", 1st Edition ,Althos Publishing, 004.
3. Lawrence Harte: "IntroductiontoWIMAX", 1st Edition, Althos Publishing, 2005.

III Year II Semester	FIREWALLS & VPN SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Identify and assess current and anticipated security risks and vulnerabilities
- Develop a network security plan and policies
- Establish a VPN to allow IPSec remote access traffic
- Monitor, evaluate and test security conditions and environment
- Develop critical situation contingency plans and disaster recovery plan
- Implement/test contingency and backup plans and coordinate with stakeholders
- Monitor, report and resolve security problems

Course Outcomes: At the end of the course, student will be able to

- To show the fundamental knowledge of Firewalls and it types
- Construct a VPN to allow Remote Access, Hashing, connections with Cryptography and VPN Authorization
- Elaborate the knowledge of depths of Firewalls, Interpreting firewall logs, alerts, Intrusion and Detection
- Infer the design of Control Systems of SCAD, DCS, PLC's and ICS's
- Evaluate the SCADA protocols like RTU, TCP/IP, DNP3, OPC,DA/HAD

SYLLABUS

UNIT–I: Firewall Fundamentals-Introduction, Types of Firewalls, Ingress and Egress Filtering, Types of Filtering, Network Address Translation (NAT), Application Proxy, Circuit Proxy, Content Filtering, Software versus Hardware Firewalls, IPv4 versus IPv6 Firewalls, Dual-Homed and Triple-Homed Firewalls, Placement of Firewalls.

UNIT– II: VPN Fundamentals-VPN Deployment Models and Architecture, Edge Router, Corporate Firewall, VPN Appliance, Remote Access, Site-to-Site, Host-to-Host, Extranet Access, Tunnel versus Transport Mode, The Relationship Between Encryption and VPNs, Establishing VPN Connections with Cryptography, VPN Authorization.

UNIT–III: Exploring the Depths of Firewalls-Firewall Rules, Authentication and Authorization, Monitoring and Logging, Understanding and Interpreting Firewall Logs and Alerts, Intrusion Detection, Limitations of Firewalls, Downside of Encryption with Firewalls, Firewall Enhancements and Management Interfaces.

UNIT–IV: Overview of Industrial Control Systems-Overview of SCADA, DCS, and PLCs, ICS Operation, Key ICS Components, Control Components, Network Components, SCADA Systems, Distributed Control Systems, Programmable Logic Controllers, Industrial Sectors and their Interdependencies.

UNIT–V: SCADA Protocols-Modbus RTU, Modbus TCP/IP, DNP3, DNP3 TCP/IP, OPC, DA/HAD, SCADA protocol fuzzing. Finding Vulnerabilities in HMI: software- Buffer Overflows, Shell code. Previous attacks Analysis- Stuxnet, Duqu.

Text Books:

1. Michael Stewart "Network Security, Firewalls, and VPNs" Jones & Bartlett Learning September 2010.
2. T. Macaulay and B. L. Singer, Cyber security for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS, Auerbach Publications, 2011.

Reference Books:

1. J. Lopez, R. Setola, and S. Wolthusen, Critical Infrastructure Protection Information Infrastructure Models, Analysis, and Defense, Springer-Verlag Berlin Heidelberg, 2012.
2. Robert Radvanovsky and Jacob Brodsky, editors. Handbook of SCADA/Control Systems Security. CRC Press, 2013.
3. A.W. Colombo, T. Bangemann, S. Karnouskos, S. Delsing, P. Stluka, R. Harrison, et al. Industrial cloud-based cyber-physical systems Springer International Publishing, 2014.
4. D. Bailey, Practical SCADA for Industry. Burlington, MA: Newnes, 2003.

III Year II Semester	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

Prerequisites: Networking Fundamentals, Web Development Basics and Cyber security Fundamentals

Course Objectives: This course aims to provide students with a fundamental understanding of web application security principles, common vulnerabilities, and security best practices.

Course Outcomes:

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

CO1- Identify and analyze web application security vulnerabilities.

CO2- Apply secure coding practices to develop and maintain web applications.

CO3- Perform security testing and assessment on web applications.

CO4- Configure and manage Web Application Firewalls (WAFs) for protection.

CO5- Develop an incident response plan for web application security breaches.

UNIT I: **(9 Hours)**

Introduction to Web Application Security: Introduction to web application security concepts, Importance of web application security, Threat landscape and security challenges in web applications, The role of security in the software development lifecycle

UNIT II: **(9 Hours)**

Web Application Vulnerabilities: Common web application vulnerabilities (e.g., SQL injection, XSS, CSRF), Understanding attack vectors and exploitation techniques, Real-world examples of web application breaches and their impact, Introduction to the OWASP Top Ten Project

UNIT III: **(10 Hours)**

Secure Coding Practices: Principles of secure coding for web applications, Input validation and sanitization, Authentication and authorization mechanisms, Session management and secure communication, Error handling and logging

UNIT IV: **(9 Hours)**

Web Application Security Testing: Manual and automated security testing techniques, Vulnerability scanning and assessment tools, Security testing methodologies (e.g., black-box, white-box, gray-box testing), Reporting and remediation of security findings

UNIT V: **(9 Hours)**

Web Application Firewall (WAF) and Incident Response: Introduction to Web Application Firewalls (WAF), Deploying and configuring WAF for web application protection, Incident response and handling security breaches, Web application security monitoring and alerting.

TEXT BOOKS:

1. "Web Application Security: A Beginner's Guide" by Bryan Sullivan, Vincent Liu
2. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by DafyddStuttard and Marcus Pinto
3. "Secure Coding in C and C++" by Robert C. Seacord (For secure coding practices)
4. "OWASP Testing Guide" by The OWASP Foundation (Free online resource for security testing)

REFERENCE BOOKS:

1. Web Application Security: Threats, Countermeasures, and Best Practices" by Lakshmanan Ganapathy and Mike Ware
2. Hacking Web Apps: Detecting and Preventing Web Application Security Problems" by Mike Shema
3. Secure Programming with Static Analysis" by Brian Chess and Jacob West

III Year II Semester	SECURITY ASSESSMENT AND RISK ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. The course takes a software development perspective to the challenges of engineering software systems that are secure.
2. This course addresses design and implementation issues critical to producing secure software systems.
3. The course deals with the question of how to make the requirements for confidentiality, integrity, and availability integral to the software development process.
4. Secure software requirements gathering to design, development, configuration, deployment, and ongoing maintenance
5. Security of enterprise information systems.

COURSE OUTCOMES:

1. Understand various aspects and principles of software security.
2. Devise security models for implementing at the design level.
3. Identify and analyze the risks associated with s/w engineering and use relevant models to mitigate the risks.
4. Understand the various security algorithms to implement for secured computing and computer networks
5. Explain different security frameworks for different types of systems including electronic systems.

UNIT-I

Defining computer security, the principles of secure software, trusted computing base, etc, threat modeling, advanced techniques for mapping security requirements into design specifications. Secure software implementation, deployment and ongoing management.

UNIT-II

Software design and an introduction to hierarchical design representations.Difference between high-level and detailed design.Handling security with high-level design. General Design Notions. Security concerns designs at multiple levels of abstraction, Design patterns, quality assurance activities and strategies that support early vulnerability detection, Trust models, security Architecture & design reviews .

UNIT-III

Software Assurance Model: Identify project security risks & selecting risk management strategies, Risk Management Framework, Security Best practices/ Known Security Flaws, Architectural risk analysis, Security Testing & Reliability (Penn testing, Risk- Based Security Testing

UNIT-IV

Security in Enterprise Business: Identification and authentication, Enterprise Information Security, Symmetric and asymmetric cryptography, including public key cryptography, data encryption standard (DES), advanced encryption standard (AES), algorithms for hashes and message digests. Authentication, authentication schemes , access control models, Kerberos protocol, public key infrastructure (PKI), protocols specially designed for e-commerce and web applications, firewalls and VPNs.

UNIT-V

Security development frameworks. Security issues associated with the development and deployment of information systems, including Internet-based e-commerce, e-business, and e-service systems.

TEXT BOOKS:

1. W. Stallings, Cryptography and network security: Principles and practice, 5 th Edition, Upper Saddle River, NJ: Prentice Hall., 2011
2. C. Kaufman, r. Perlman, & M. Speciner, Network security: Private communication in a public world, 2 nd Edition, Upper Saddle River, NJ:PrenticeHalL, 2002
3. C. P. Pfleeger, S. L. Pfleeger, Security in Computing, 4 th Edition, Upper Saddle River, NJ:Prentice Hall, 2007
4. T. M. Merkow, & J. Breithaupt, Information security: Principles and practices. Upper Saddle River, NJ:Prentice Hall, 2005

REFERENCE BOOKS:

1. Gary McGraw, Software Security: Building Security In, Addison-Wesley, 2006

III Year II Semester	CYBER SECURITY & DIGITAL FORENSICS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Investigate cybercrime and collect evidences
- Able to use knowledge of forensic tools and software
- To understand the preservation of digital evidence.
- To learn about stenography Perceptual models

Course Outcomes: At the end of the course, student will be able to

	Course Outcomes	Knowledge Level (K)#
CO1	Identify the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing.	K3
CO2	Construct the file system storage mechanisms of two common desktop opera ting systems and forensics tools used in data analysis.	K6
CO3	List and Implement all running processes, network connections from a memory image and find whether a firewall is set by analyzing a memory image.	K4
CO4	Define and perform live incident response on a system, View all browser history and List out all established network connections in a computer (Hint: Triage Incident Response).	K1

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												

(Please fill the above with Levels of Correlation, viz., L, M, H)

Experiment- 1

Evidence Collection

a) Linux: Capturing RAM dump using fmem
   https://github.com/NateBrune/fmem
   i) dcfldd if=/dev/fmem of=memory.dump hash=sha256
      sha256log=memory.dump.sha256 bs=1MB count=1000
b) Linux: Capturing Disk using dfldd

   https://www.obsidianforensics.com/blog/imaging-using-dcfldd

   i) dcfldd if=/dev/sdb1 of=/media/disk/test_image.dd hash=md5,
      sha1hashlog=/media/disk/hashlog.txt
c) Windows: Capture RAM dump of a windows system
   a. Hint: FTK Imager or RAMCapture
d) Windows: Capture Disk Image of a windows system

Hint: FTK Imager

Experiment- 2

Disk Analysis

i) List all files in a directory from a disk image
   a. FTK Imager
ii) Export a particular file from a disk image
   a. FTK Imager
iii) Recover a deleted file from a disk image

FTK Imager

Experiment- 3

Memory Analysis

1. List all running processes from a memory image
2. List all network connections from a memory image
3. Find out whether a firewall is set by analyzing a memory image

Hint: volatility

Experiment- 4

4) Live Incident Response
   1. Perform live incident response on a system
   2. View all browser history in a computer
   3. List out all established network connections in a computer

Hint: Triage Incident Response

Exercise- 5
Implement E-Mail Tracking and Email Investigation

Exercise- 6
Implement video Analytics for a live video

Exercise- 7
Analysis on different Malware Working

Exercise- 8
Work on Mail Bombs &SMS bombs

Exercise- 9
Implement a case on windows and Linux forensics

Exercise- 10
Implement a case on network Forensic

Exercise- 11
Work on different types of vulnerabilities

Exercise- 12
Implement a case on Mobile Forensics

Exercise- 13
Develop a Evidence and Preparation and Documentation

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III Year II Semester	MALWARE ANALYSIS & REVERSE ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- This course provides students a foundational knowledge about reverse engineering and malware analysis, through the study of various cases.
- This course provides students a hand-on analysis of malware samples.
- It covers fundamental concepts in malware investigations so as to equip the students with enough background knowledge in handling malicious software attacks.

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO 1: Demonstrate the cyber security challenges posed by malicious software attacks. [K2]
CO 2: Analyze security risks, threats and potential vulnerabilities in enterprise networks environment. [K3]
CO 3: Independently to conduct in-depth analysis of modern malware samples using behavioural, code analysis and memory forensic techniques. [K3]
CO 4: Apply the techniques learned to proactively protect computer systems and networks, reduce security risks and mitigate the potential for malicious software attacks. [K5]
CO 5: Apply immunity debugger for reverse engineering [K3]

EXPERIMENTS:

WEEK-1: Malware analysis lab environment setup

WEEK-2: Building malwares using tools

WEEK-3: Static Malware Analysis

1. Upload the files to http://www.VirusTotal.com/ and view the reports. Does either file match any existing antivirus signatures?
2. When were these files compiled?
3. Are there any indications that either of these files is packed or obfuscated? If so, what are these indicators?
4. Do any imports hint at what this malware does? If so, which imports are they?
5. Are there any other files or host-based indicators that you could look for on infected systems?
6. What network-based indicators could be used to find this malware on infected machines?
7. What would you guess is the purpose of these files?

WEEK-4: Static Malware Analysis

1. Upload the Lab01-02.exe file to http://www.VirusTotal.com/. Does it match any existing antivirus definitions?
2. Are there any indications that this file is packed or obfuscated? If so, what are these indicators? If the file is packed, unpack it if possible.
3. Do any imports hint at this program's functionality? If so, which imports are they and what do they tell you?
4. What host- or network-based indicators could be used to identify this malware on infected machines

WEEK-5: Dynamic Malware Analysis

1. How can you get this malware to install itself?
2. What are the command-line options for this program? What is the password requirement?
3. How can you use OllyDbg to permanently patch this malware, so that it doesn't require thespecial command-line password?
4. What are the host-based indicators of this malware?
5. What are the different actions this malware can be instructed to take via the network?
6. Arethere any useful network-based signatures for this malware?

WEEK-6: Dynamic Malware Analysis

1. What strings do you see statically in the binary?
2. What happens when you run this binary?
3. How can you get this sample to run its malicious payload?
4. What is happening at 0x00401133?
5. What arguments are being passed to subroutine 0x00401089?
6. What domain name does this malware use?
7. What encoding routine is being used to obfuscate the domain name?
8. What is the significance of the Create Process A call at 0x0040106E?

WEEK-7: Automated Malware Analysis

WEEK-8: Android malware analysis using tools

WEEK-9: Malware hunting Techniques using 1.Backdoors 2.Ransomware

WEEK-10: Malware hunting Techniques using 1.Credential stealers
2. Persistence mechanisms

WEEK-11: Host exploitation and forensic analysis

WEEK-12:

1. Reverse Engineering with Immunity Debugger
2. Software Cracking with HexEditor Tool
3. Rebuilding the software after cracking

Text Books:

1. Sikorski, M., & Honig, A. (2012). Practical malware analysis: the hands-on guide to dissecting malicious software. No starch press.
2. Eilam, E. (2005). Reversing, Secrets of Reverse Engineering Wiley Publishing.
3. Malin, C. H. (2013). Linux Malware Incident Response: A Practitioner's Guide to Forensic Collection and Examination of Volatile Data: An Excerpt from Malware Forensic FieldGuide for Linux Systems. Elsevier.

Reference Books:

1. Sikorski, M., & Honig, A. (2012). Practical malware analysis: the hands-on guide to dissectingmalicious software. No starch press.
2. Shashidhar, N., & Cooper, P. (2016, April). Teaching malware analysis: The designphilosophy of a model curriculum. In 2016 4th International Symposium on Digital Forensic andSecurity (ISDFS) (pp. 119-125). IEEE.
3. Singh, A.(Ed.). (2009). Identifying malicious code through reverse engineering (Vol. 4).Springer Science & Business Media.

III Year II Semester	SOFT SKILLS or IELTS	L	T	P	C
		0	1	2	2

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

UNIT -I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT -II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities. Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT - III

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

Reference books:

1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:

https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

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III Year II Semester	TECHNICAL PAPER WRITING & IPR	L	T	P	C
		2	0	0	0

Course Objective :

- The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report.
- This will help students to comprehend the concept of proofreading, proposals and practice

UNIT-I

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing. **Planning and Structuring:** Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

UNIT-II

Drafting report and design issues: The use of drafts, Illustrations and graphics.**Final edits:** Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

UNIT-III

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

UNIT-IV Using word processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

UNIT-V

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal &Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Reference Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

E-resources:

1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

MINORS

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

Course Outcomes (CO): After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network. (L1)
- Explain the functionality of each layer of a computer network. (L2)
- Identify and analyze flow control, congestion control, and routing issues. (L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements. (L3)

UNIT-I

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT-II

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet,

Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT-III

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT-IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT-V

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbook:

1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.
3. YouluZheng, ShakilAkthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25

http://www.nptelvideos.in/2012/11/computer-networks.html

https://nptel.ac.in/courses/106105183

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	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and it applications.

Course Outcomes: By the end of the course, the student should be able to:

- Differentiate among different types of security attacks.
- Define computer forensics.
- Identify the process in taking digital evidence.
- Describe how to conduct an investigation using methods of memory, operating system, network and email forensics with different forensic tools.

UNIT-I

Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks--Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

UNIT-II

Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

UNIT-III

Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, defining a web application test scope and process, Defining types of penetration testing.

UNIT-IV

Web Application Security: Common Issues in Web Apps, what is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues. **Forensics & Network Assurance:** Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

UNIT-V

Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. Cyber Security & Digital Forensics by Anas Zakir, Clever Fox Publishing, Publication Date- 2022
2. “Beginners Guide To Ethical Hacking and Cyber Security “, by Abhinav Ojha, Khanna Publishers, First Edition, Publication Date-2023

Reference Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart

	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques	K2
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	K3
CO3	Students will be able learn different types of symmetric and Asymmetric algorithms	K3
CO4	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security	K4
CO5	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	1	1		1		2	2	2	2
CO2	3	1	1	2	2	2	1	2		3	3	2	3	2	1
CO3	2	2	2	1	2	1	1	1		2		3	1		
CO4	3	2	3	2	3	2	1	1		2	1	2	2	1	
CO5	3	2	3	1	2	2	1	1		2	2	2	1	2	1

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT-I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stenography.

UNIT-II

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials.**Mathematics of Asymmetric cryptography:** Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT-III

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA). **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC. **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT-V

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH. **IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol. **Electronic-Mail Security:** Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice ByWenbo Mao. Pearson

	BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- Able to know the security issues of blockchain technology.

UNIT – I

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **Cryptocurrency:** Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains,

The Bitcoin Blockchain, Ethereum Blockchain. **Smart Contracts:** Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. **Consortium Blockchain:** Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. **Initial Coin Offering:** Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:
Case Study 1 – Retail,
Case Study 2 – Banking and Financial Services,
Case Study 3 – Healthcare,
Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. "Block chain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

UNIT -I

Introduction to Cloud Computing Fundamentals, Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II

Cloud Enabling Technologies, Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III

Virtualization and Containers, Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV

Cloud computing challenges, Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V

Advanced concepts in cloud computing, Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

	CYBER SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objective: To get practical exposure to Cybersecurity threats and Forensics tools.

Course Outcome:

- Get the skill to identify cyber threats/attacks.
- Get the knowledge to solve security issues in day-to-day life.
- Able to use Autopsy tools
- Perform Memory capture and analysis
- Demonstrate Network analysis using Network miner tools

List of Experiments:

1. Perform an Experiment for port scanning with nmap
2. Set up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using openSSL command
5. Perform practical approach to implement Footprinting - Gathering target information using Dmitry-Dmagic, UA tester
6. Work with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real-time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

Text Books:

1. Real Digital Forensics for Handheld Devices, E.P. Dorothy, Auerback Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

Reference Books:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C.H. Malin, E. Casey and J.M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

	CRYPTOGRAPHY & NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implementencryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
    a) Ceaser Cipher
    b) Substitution Cipher
    c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

OPEN ELECTIVES

	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- Identify language components and how they work to get her in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with in heritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

UNIT I

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,**Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. **Control Statements**: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator ?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded ConstructorMethods, NestedClasses, FinalClassandMethods, Passing ArgumentsbyValue and by Reference, Keyword this. **Methods:** Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage ofArray in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Valuesin Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. **Interfaces:** Introduction, Declaration of Interface, Implementation ofInterface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNITIV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto- boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, RandomClass, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time inJava, Temporal Adjusters Class, Temporal Adjusters Class. **Exception Handling:** Introduction, Hierarchyof Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

JavaI/OandFile: JavaI/OAPI,standardI/Ostreams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

UNITV

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer. **MultithreadedProgramming:**Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor,Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication-Suspending, Resuming, and Stopping of Threads .**Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface. **Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

TextBooks:

1. JAVAonestepahead, AnithaSeth, B.L.Juneja,Oxford.
2. Joy with JAVA,Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA9forProgrammers,PaulDeitel,HarveyDeitel,4thEdition,Pearson.

ReferencesBooks:

1. ThecompleteReferenceJava,11thedition,HerbertSchildt,TMH
2. IntroductiontoJavaprogramming, 7thEdition, YDanielLiang, Pearson

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

	OPERATINGSYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for dead lock and their possible solutions.

UNIT-I

Operating Systems Overview: Introduction, Operating systemfunctions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT-II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT– III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT-IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, Copy-on-write, Pagereplacement, Allocationoffframes, Thrashing. **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling.

UNIT-V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File- System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

TextBooks:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. ModernOperatingSystems,TanenbaumAS,4thEdition,Pearson,2016

ReferenceBooks:

1. OperatingSystems-InternalsandDesignPrinciples,StallingsW,9thedition, Pearson, 2018
2. OperatingSystems:AConceptBasedApproach,D.MDhamdhere,3rdEdition, McGraw- Hill, 2013

OnlineLearningResources:

1. https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL asa universal Data base language
- Demonstrate the principles behind systematic data base design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNIT-I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Threetier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT-II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASICSQL: Simple Databaseschema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT-III

SQL: Basic SQL querying (select andproject) using where clause, arithmetic& logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable andnon-updatable), relational set operations.

UNIT-IV

Schema Refinement (Normalization):Purpose of Normalization or schema refinement, conceptof functional dependency, normal forms based on functional dependency Loss less join and dependency preserving decomposition,(1NF,2NFand3NF), concept of surrogatekey, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT-V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification,Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke,TMH (For Chapters 2, 3, 4)
2) Database SystemConcepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

ReferenceBooks:

1) Introduction to Data base Systems, 8thedition, CJDate,Pearson.
2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820224 56_shared/overview

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003,Andhra Pradesh, India
R23 B.Tech Cyber Security
(R23 – III[rd] YEAR COURSE STRUCTURE & SYLLABUS)

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware c omponents of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OS Imodel and the function so flayered structure.
- To explain networking protocols, algorithms and design perspectives.

CourseOutcomes(CO):

After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network.(L1)
- Explain the functionality of each layer of a computer network.(L2)
  Identify and analyze flow control, congestion control, and routing issues.(L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements.(L3)

UNIT-I

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship ofServices to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT-II

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, CoaxialCable, PowerLines, Fiber Optics, Data Link Layer DesignIssues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation,AssumptionsForDynamicChannelAllocation,MultipleAccessProtocols,Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT-III

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes:Packet Fragmentation,The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT-IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Band width Allocation, Regulating The Sending Rate,Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols:TCP,IntroductionToTCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT-V

TheApplicationLayer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbook:

1. AndrewTanenbaum,FeamsterWetherall,ComputerNetworks,6th Edition,Global Edition.

ReferenceBooks:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. JamesF.Kurose,KeithW.Ross,"Computer Networking: A Top-Down Approach",6th edition, Pearson, 2019.
3. YouluZheng,ShakilAkthar,"NetworksforComputerScientistsandEngineers",Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html https://nptel.ac.in/courses/106105183/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA –533003 (A.P) INDIA
B. TECH R23 IV YEAR CYBER SECURITY SYLLABUS

B.Tech IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
2	Professional Core	Malware Analysis & Reverse Engineering	3	0	0	3
3	Management Course- II	Human Resources & Project Management	2	0	0	2
4	Professional Elective-IV	1. Data Base Security and Privacy 2. Application Threat detection 3. Biometrics 4. Deep Learning 5. Operating Systems Administration And Security 6. MOOCS (NPTEL/Swayam) -Any subject related to Cyber Security or which is not covered under Professional core subject	3	0	0	3
5	Professional Elective-V	1. Agumented Reality & Virtual Reality 2. Intrusion Detection and Prevention System 3. Cloud Architectures And Security 4. Cyber Laws and Security Policies 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective-III		3	0	0	3
7	Open Elective-IV		3	0	0	3
8	SkillEnhancement Course	Ethical Hacking	0	1	2	2
9	AuditCourse	Constitution of India	2	0	0	0
10	Internship	Evaluation of Industry Internship / Mini Project	-	-	-	2
		Total	**19**	**1**	**02**	**21**

B.Tech IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship & ProjectWork	Full semester Internship & ProjectWork	0	0	24	12

Note : ***Student need to do at least ONE MOOC/NPTEL Course (of 3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations); they are allowed to register one semester in advance***

Minor Courses & Honor Courses

Sl.No	Category	L	T	P	Credits
1	Minor Course (Student may select from the specialized minors pool)	3	0	3	4.5
2	Honors Course through SWAYAM/NPTEL(minimum 12week, 3 credit course)- Student may select from the honors pool	3	0	0	3

OpenElectives&Minor

Note: ***To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.***

For Minor in Cyber Security:

		L-T-P-C
Open Elective I	: Computer Networks	3-0-0-3
Open Elective II	: Introduction to Cyber Security	3-0-0-3
Open Elective III	: Cryptography & Network Security	3-0-0-3
Open Elective IV	: Block Chain technology	3-0-0-3
Open Elective V	: Cloud Computing	3-0-0-3
Open Elective VI	: Cyber Security Lab	0-0-3-1.5
Open ElectiveVII	: Cryptography & Network Security Lab	0-0-3-1.5

OpenElectives,offeredtootherdepartmentstudents:

OpenElective I:JavaProgramming
OpenElective II:OperatingSystems
OpenElective III:DataBaseManagementSystems
OpenElective IV: 1.Computer Networks
2. Quantum Science and Technology

COURSES OFFERED FOR HONOURS DEGREE IN BTech CYBER SECURITY :

S.No.	Course Name	Contact Hours per week			Credits
		L	T	P	
1	Application Thread Detection	3	0		3
2	IOT security	3	0		3
3	Penetration Testing and Vulnerability Assessment	3	0		3
4	Social Media Security	3	0		3
5	NoSQL Databases	3	0		3
6	NoSQL Databases Lab		3		1.5
7	Social Media Security Lab		3		1.5
	Total				**18**

I Semester	MALWARE ANALYSIS & REVERSE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn fundamentals of malware analysis which includes analysis of JIT compilers for malware detection in legitimate code.
- To explore the techniques for detecting, analyzing, reverse engineering and eradicating malware.
- Employ network and system-monitoring tools to examine how malware interacts with the file system, registry, network, and other processes in a Windows environment.
- Assess the threat associated with malicious documents.
- Build an isolated, controlled laboratory environment for analyzing the code and behaviour of malicious program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1 : Demonstrate the concept of malware and reverse engineering. [K2]
CO2 : Apply various tools and techniques of malware analysis to examine malicious software. [K3]
CO3 : Analyse and evaluate various techniques for used in malware analysis & reverse engineering to identify vulnerabilities. [K4]
CO4 : Utilize the python language for development & analysis of anti-malwares. [K4]
CO5 : Setup an environment for malware analysis & recognize common malware characteristics. [K1]

SYLLABUS:

UNIT–I:

Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM) Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioural Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV Signatures, Creating Custom Clam AV Databases.

UNIT–II:

Malware Forensics Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plu-gins, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

UNIT–III:

Malware and Kernel Debugging Opening and Attaching to Processes, Configuration of JITDebugger for Shellcode Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands, DLL Export Enumeration, Execution, and Debugging, Debugging a VMware Workstation Guest (on Windows), Debugging a Parallels Guest (on Mac OS X).

UNIT–IV:

Memory Forensics and Volatility Memory Dumping with MoonSols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.

UNIT–V:

Researching and Mapping Source Domains/IPs Using WHOIS to Research Domains, DNS Hostname Resolution, Querying Passive DNS, Checking DNS Records, Reverse IP Search New Course Form, Creating Static Maps, Creating Interactive Maps.

TEXT BOOKS:

1. Sikorski, M., &Honig, A. (2012). Practical malware analysis: the hands-on guide to dissecting malicious software. No starch press.
2. Eilam, E. (2005). Reversing, Secrets of Reverse Engineering Wiley Publishing.
3. Malin, C. H. (2013). Linux Malware Incident Response: A Practitioner's Guide to Forensic Collection and Examination of Volatile Data: An Excerpt from Malware Forensic Field Guide for Linux Systems. Elsevier.

REFERENCE BOOKS:

1. Shashidhar, N., & Cooper, P. (2016, April). Teaching malware analysis: The design philosophy of a model curriculum. In 2016 4th International Symposium on Digital Forensic and Security (ISDFS) (pp. 119-125). IEEE.
2. Singh, A. (Ed.). (2009). Identifying malicious code through reverse engineering (Vol. 44). Springer Science & Business Media.

I Semester	HUMAN RESOURCES & PROJECT MANAGEMENT	L	T	P	C
		2	0	0	2

Course Objectives: The main objectives of the course are to

- Provide knowledge about HR planning, recruitment, selection, and job design.
- Develop skills in managing HR functions such as performance appraisal, compensation, and employee relations.
- Emphasize the importance of ethical practices and HR audits in maintaining organizational health.
- Understand the HRD framework and its impact on organizational success.
- **Improve group interaction and team dynamics** for better collaboration and performance.
- Understand the Fundamentals of Project Management and Project Networks
- Implement appropriate management strategies tailored to specific challenges in different project types.

UNIT –I: HRM: Nature, Scope, Concept of HRM, Functions of HRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR, Job Design, Recruitment, Sources of recruitment, Selection- Selection Procedure.

UNIT –II: HRD, HR accounting, Models, Concept of Training and Development, Methods of Training. Performance Appraisal: Importance Methods of performance appraisal, Career Development and Counseling, group interaction.

UNIT –III: Basics of Project Management, Concept, resource management, Project environment, Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring project progress, Project appraisal and Project selection, 80-20 rules, production technology, communication matrix

UNIT-IV: Identify various project types and their unique management challenges and apply appropriate management strategies for each. abandonment analysis

UNIT-V: Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

Text Books:

1. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
2. Sharon Pande and Swapnalekha Basak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.
3. Stewart R. Clegg, Torgeir Skyttermoen, Anne Live Vaagaasar, Project Management, Sage Publications, 1e, 2021.
4. K. Nagarajan, Project Management, New Age International Publishers, 8e, 2017.

Reference Books :

1. Subba Rao P, "Personnel and Human Resource Management-Text and Cases", Himalaya Publications, Mumbai, 2013.
2. K Aswathappa, "Human Resource and Personnel Management", Tata McGraw Hill, New Delhi, 2013.
3. Prasanna Chandra, "Projects, Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
4. Vasanth Desai, "Project Management", 4th edition, Himalaya Publications, 2018.
5. Lalitha Balakrishnan, Gowri, "Project Management", Himalaya publishing house, New Delhi, 2022.

I Semester	DATA BASE SECURITY AND PRIVACY	L	T	P	C
		3	0	0	3

Course Objectives:

- Learners will get an exposure to common database security issues and how to patch them.
- Students will know about different secured access methods to networked database servers.
- Students will gain knowledge of how to perform SQL injections to breach database security and also, they can gain knowledge of granular access control.
- Students will get exposure to securing database links and know about auditing methods of database security.

Course Outcomes:

1. Ability to demonstrate basic knowledge of data base security issues and countermeasures.
2. Ability to implement network or remote data base security through passwords and authentication.
3. Ability to perform and understand how SQL injections can be done on data bases.
4. Ability to explain about granular access control in data base security
5. Ability to understand the methods to protect and secure data base links and recognize various database security auditing categories.

UNIT I

Introduction

Introduction to Databases Security Problems, hardening the databases, patching, auditing and access control.Defense in depth, security software landscape, application security, securing the core, PKI, vulnerability, patch and incident management.

UNIT II

Database as a networked server, track tools and applications, remove unnecessary services, secure services from known network attacks. Authentication and password security, choose appropriate privileges, implementing account lockout after repeated failures, password profiles, secure authentication backdoors, use of Kerberos.

UNIT III

Application security, obfuscate application code, securing databases from SQL injection attacks, protecting from combination of buffer overflow and SQL injections, address packaged application suites.

UNIT IV

Using granular access control, use row-level security, use label security, integrate with enterprise user repositories for multi-tiered authentication, do not use external procedures, do not make database a web server, do not generate HTML from within the stored procedures.

UNIT V

Securing database to database communications, monitor and limit outbound communications, secure database links, protect link usernames and passwords, monitor usage of database links, secure replication mechanisms, map and secure all data sources and sinks.

Auditing categories: Audit logon/logoff, database usage, DDL activity, database errors, audit all changes. Auditing architecture: do not create a false sense of security, have an independent audit trail, archive and secure auditing information.

TEXT BOOKS:

1. Implementing database security and auditing, Ron Ben Natan, Digital Press Elsevier.

REFERENCES:

1. Database Security by Castano *Pearson Edition (*1/e)
2. Database Security and Auditing: Protecting Data Integrity and Accessibility
1st Edition, Hassan Afyouni, THOMOS Edition

I Semester	APPLICATION THREAT DETECTION	L	T	P	C
		3	0	0	3

Course Objectives:

- Can detect threats to any web app.
- Able to perform various Input Injection Attacks.
- Able to provide countermeasures against various input injection attacks.

Course Outcomes: At the end of the course, student will be able to

Course Outcomes		Knowledge Level (K)#
CO1	Explain Hacking Web Apps and Profiling	K2
CO2	Illustrate to provide Authentication to the web application.	K2
CO3	Develop Penetration Testing and implement Input Injection Attacks.	K3
CO4	Name the basic fundamentals of Metasploit	K1
CO5	Apply knowledge on Capturing User Input and Abusing UI Expectations	K3

#Based on suggested Revised BTL

Syllabus:

UNIT–I: Hacking Web Apps and Profiling-Web Application Hacking: GUI web Hacking, URI Hacking, Methods Headers and Body, Resources. The Web Client and HTML, Other Protocols, How & Why Web Apps attack. Infrastructure Profiling: Footprinting and Scanning, Basic Banner Grabbing, Advanced HTTP Fingerprinting, Infrastructure Intermediaries. Application Profiling: Manual Inspection, Search Tools for Profiling, Automated Web Crawling, General Countermeasures.

UNIT–II: Bypassing and Attacking Web Authentication-Web Authentication Threats: Username/password Threats, Password Guessing and its Countermeasures, Eavesdropping attacks and its Countermeasures, Forms-based Authentication attacks and its countermeasures. Stronger web Authentication, Web Authentication Services. Bypassing Authentication: Token Replay, Cross-site Request Forgery, Identity Management.

UNIT–III: Penetration Testing and Input Injection Attacks- Where to find Attack vectors, Common Input Injection Attacks: Buffer Overflow, Canonicalization and its countermeasures, Advanced Directory Traversal, Navigating without Directory Listing, HTML Injection: XSS, Embedded scripts, Cookies and Predefined Headers, Counter countermeasures. SQL Injection: SUB Queries, UNION, Sql Injection countermeasures, XPATH Injection and its countermeasures, LDAP Injection.

UNIT–IV: Metasploit-Basics of Penetration Testing: The Phase of PTES, Types of Penetration Tests. Metasploit: Introduction, Metasploit Basics: Terminology, Metasploit Interfaces, Metasploit Utilities. Intelligence Gathering: Passive Information Gathering, Active Information Gathering, Target Scanning. Vulnerability Scanning: Basic Vulnerability Scan, Scanning with scanning tools, Using Scan Results for Autopwning.

UNIT–V: Attacking Users-Defacing Content, Capturing User Input: Using Focus Event, Using Keyboard Events, Using Mouse and Pointer Events, Using Form Events, Social Engineering: Using TabNabbing, Abusing UI Expectations: Using Fake Login Prompts, Pretty Theft, Gmail Phishing

Text Books:

1. Hacking Exposed Web Application, 3rd Edition by Joel Scambray, Vincent Liu, Caleb Sima
2. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by DafyddStuttard and Marcus Pinto Wiley Publication
3. Metasploit - The Penetration Tester's Guide by David Kennedy, Jim O'gorman, Devon Kearns andMatiAharoni, No Starch Press Publication

Reference Books:

1. The Browser Hacker’s Handbook by Wade Alcorn, Christian Frichot and Michele Orru, Wiley Publication
2. Web Penetration Testing with Kali Linux by Joseph Muniz, AamirLakhan, Packt Publication

I Semester	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolution neural networks.

Course Outcomes:

After completion of course, students would be able to:

- Explore feedforward networks and Deep Neural networks
- Mathematically understand the deep learning approaches and paradigms
- Apply the deep learning techniques for various applications

UNIT I:

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

UNIT II:

Feedforward Networks- Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders. **Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layer wise training.

UNIT III:

Better Training of Neural Networks- Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT IV:

Recurrent Neural Networks- Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

MACHINE LEARNING UNIT V:

Recent trends- Variational Auto encoders, Transformers, GPT Applications: Vision, NLP, Speech

Text Books:

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas,1996
2. Pattern RecognitionandMachineLearning,ChristopherBishop,2007
3. DeepLearningwithPython,FrançoisChollet,ManningPublications,2017

I Semester	OPERATING SYSTEMS ADMINISTRATION AND SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Students will learn and apply basic concepts and methodologies of System Administration and Security by building from the ground up a miniature corporate network.
- To know some basic security measures to take in system administration.
- To prepare for possible disasters, including an understanding of backup and restoration of file systems.

Course Outcomes: At the end of the course, student will be able to

Course Outcomes		Knowledge Level (K)#
CO1	Discuss the important computer system resources and the role of operating system in their management policies and algorithms.	K6
CO2	Explain the concepts of Access control Fundamentals, Multics.	K2
CO3	Identify and assess current and anticipated security risks and vulnerabilities.	K3
CO4	Identify the security Techniques and apply the real time applications.	K3
CO5	Know the role and responsibilities of a system administrator and Create and administer user accounts on both a Linux and Windows platform.	K3

#Based on suggested Revised BTL

UNIT–I:

Overview of Operating Systems- Introduction, Computer system Organization and Architecture, Operating System structure and operations, Principles and design of process, memory, and file systems management. Protection and security, **Secure OS:** Scope of system security, security goals, trust model, threat model.

UNIT–II:

Access Control Fundaments-Access Control Fundaments, Protection systems, Lampson's access matrix, mandatory protection systems, Reference monitor, Secure operating system definition, Assessment criteria' MULTICS, security fundamentals, protection systems, access control lists reference monitor, security, vulnerability analysis

UNIT–III:

Operating System Security-Security in Windows and UNIX: Protection system, Authorization, Security analysis and vulnerabilities, Verifiable

Security goals: Information flow – secrecy models – integrity models- convert channels, **Security kernel:** Secure Communication processor architecture hardware – SCOMP trusted OS-Gemini Secure OS, VM systems.

UNIT–IV:

Computer Security Techniques-Authentication, Access control, intrusion detection, malware defences, buffer overflow attacks, UNIX and Windows security,

OS patch management- Automates Windows patching, mitigates security risks and fixes vulnerabilities in minutes.

UNIT–V:

Linux Administration with Shell Scripts- Introduction, Linux Kernel architecture, system administration tasks in linux managing user accounts-.rc files, device management disk space allocation automation system administration with shell scripts

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts",9th Edition, Wiley Publication,2008.
2. Mukesh Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill, 2000

Reference Books:

1. William Stalling, Operating System: Internals and Design Principles, Prentice Hall, 7th Edition, 2012.
2. Promod Chandra P Bhat, An Introduction to Operating Systems: Concepts and practice, Prentice hall of India, 4th Edition, 2014
3. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, Inc., 1st

I Semester	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Objectives:

- Provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

UNIT I:

Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields. **Displays:** Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays. **Tracking:** Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT II:

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking. **Interaction:** Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction. **Software Architectures:** AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception. **The Geometry of Virtual Worlds:** Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations. **Light and Optics:** Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

UNIT IV:

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR. **Visual Perception:** Visual Perception - Perception of Depth, Perception of Motion, **Perception of ColorVisual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT V:

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection. **Interaction:** Motor Programs and Remapping, Locomotion, Social Interaction. **Audio:** The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Text Books:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

Reference Books:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. SanniSiltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005

I Semester	INTRUSION DETECTION AND PREVENTION SYSTEM	L	T	P	C
		3	0	0	3

Pre requisites: Fundamental knowledge in Operating Systems, and Networks

Course Objectives:

1. Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
2. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes:

1. Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
2. Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.

UNIT-I

History of Intrusion detection, Audit, Concept and definition , Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT-II

Intrusion Prevention Systems, Network IDs protocol based IDs ,Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis , techniques Responses requirement of responses, types of responses mapping responses to policy Vulnerability analysis, credential analysis non credential analysis

UNIT-III

Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple. Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes

UNIT-IV

Working with Snort Rules, Rule Headers, Rule Options, The Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL

UNIT-V

Using ACID and Snort Snarf with Snort, Agent development for intrusion detection, Architecture models of IDs and IPs.

TEXT BOOKS:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.

REFERENCES:

1. Christopher Kruegel,FredrikValeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander" Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
3. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
4. T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment". 6th Edition, KhannaPublihsers, 2012.

I Semester	CLOUD ARCHITECTURES AND SECURITY	L	T	P	C
		3	0	0	3

Course Objective

Cloud computing has drawn the attention of many business organization and normal users of computers in the recent past. Security aspects of cloud computing have always been subjected to many criticisms. Hence it becomes important for any security professional to possess an understanding of the cloud architecture and methods to secure the same. The aforementioned fact evident the need for the course.

Course Outcomes

1. Understand the fundamentals of cloud computing.
2. Understand the requirements for an application to be deployed in a cloud.
3. Become knowledgeable in the methods to secure cloud.

UNIT – I-

CLOUD COMPUTING FUNDAMENTALS

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture.

UNIT – II

CLOUD APPLICATIONS

Technologies and the processes required when deploying web services-Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages- Development environments for service development; Amazon, Azure, Google App.

UNIT – III

SECURING THE CLOUD

Security Concepts - Confidentiality, privacy, integrity, authentication, nonrepudiation, availability, access control, defence in depth, least privilege- how these concepts apply in the cloud and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud.

UNIT – IV

VIRTUALIZATION SECURITY

Multi-tenancy Issues: Isolation of users/VMs from each other- How the cloud provider can provide this- Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security- storage considerations, backup and recovery- Virtualization System Vulnerabilities.

UNIT - V - CLOUD SECURITY MANAGEMENT

Security management in the cloud – security management standards- SaaS, PaaS, IaaS availability management- access control- Data security and storage in cloud.

REFERENCES

1. Gautam Shroff, "*Enterprise Cloud Computing Technology Architecture Applications",* Cambridge University Press; 1 edition [ISBN: 978- 0521137355], 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "*Cloud Computing, A Practical Approach",* Tata McGraw-Hill Osborne Media; 1 edition 22, [ISBN: 0071626948], 2009.
3. 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.
4. Ronald L. Krutz, Russell Dean Vines, "*Cloud Security",* Wiley [ISBN: 0470589876], , 2010.

I Semester	CYBER LAWS AND SECURITY POLICIES	L	T	P	C
		3	0	0	3

Course outcomes:

This course provides to know the cyber laws and different security policies and to know the different ethical responsibilities In the present world and student can able know how the cyber employ will be in the organization and to know the different organization and human adoption rights

Unit-I

Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates andlegislation, Privacy considerations, International security activity.

Unit-II

Secure System Planning and administration, Introduction to the orange book, Security policyrequirements, accountability, assurance and documentation requirements, Network Security, The Redbook and Government network evaluations.

Unit-III

Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparation-developing policies-asset classification policy-developing standards.

Unit- IV

Information security: fundamentals-Employee responsibilities- information classification-Information handling- Tools of information security- Information processing-secure program administration.

Unit-V

Organizational and Human Security: Adoption of Information Security Management Standards,Human Factors in Security- Role of information security professionals.

REFERENCES

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media, 2006.
2. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2nd Edition Prentice Hall, 2004.
3. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis andResponse Solutions", IGI Global, 2009.
4. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2nd Edition, Prentice Hall, 1996
5. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springer-verlag, 1997
6. James Graham, " Cyber Security Essentials" Averbach Publication T & F Group.

I Semester	ETHICAL HACKING	L	T	P	C
		0	1	2	2

Course Objectives:

The main objective of this course is to render every database based transaction safe, secure and simple. We aim to transform the internet security industry by infusing professionalism and a never before seen efficiency.

Course Outcomes:

By the end of the course students will

1. Learn various hacking methods.
2. Perform system security vulnerability testing.
3. Perform system vulnerability exploit attacks.
4. Produce a security assessment report
5. Learn various issues related to hacking.

UNIT-I

Hacking Windows: BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies URL History, The Registry, Baby Sitter Programs.

UNIT-II

Advanced Windows Hacking: Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.

UNIT-III

Getting Past the Password: Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords, .

UNIT-IV

The Perl Manual: Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The?: Operator, Loops, The While Loop, The For Loop, Arrays, THE FOR EACH LOOP: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special VariableS.

UNIT-V

How does a Virus Work? What is a Virus?, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, How do I make my own Virus?, Macro Viruses, Using Assembly to Create your own Virus, How to Modify a Virus so Scan won‟t Catch it, How to Create New Virus Strains, Simple Encryption Methods.

TEXT BOOKS:

1. Patrick Engbreston: “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”,1st Edition, Syngress publication,2011.
2. Ankit Fadia : “Unofficial Guide to Ethical Hacking”, 3rd Edition , McMillan India Ltd,2006.

REFERENCES:

1. Simpson/backman/corley, “HandsOn Ethical Hacking & Network Defense International”, 2nd Edition,Cengageint,2011.

I Semester	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT–I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)**Philosophy of the Indian Constitution-** Preamble, Salient, Features

UNIT–II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT–III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, **Executive-** President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT–IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT–V

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

Reference Books:

1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014

MINORS

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

Course Outcomes (CO): After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network. (L1)
- Explain the functionality of each layer of a computer network. (L2)
- Identify and analyze flow control, congestion control, and routing issues. (L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements. (L3)

UNIT-I

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT-II

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha,

Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT-III

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT-IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT-V

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbook:

1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.
3. YouluZheng, ShakilAkthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA –533003 (A.P) INDIA
B. TECH R23 IV YEAR CYBER SECURITY SYLLABUS

IV Year – I Semester	QUANTUM SCIENCE AND TECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisites: Basic Physics, Linear Algebra, and Introduction to Modern Physics

Course Objectives:

1. To introduce fundamental concepts of quantum mechanics and its mathematical formalism.
2. To explore quantum computing and communication principles and technologies.
3. To understand the physical implementation and limitations of quantum systems.
4. To enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
5. To familiarize students with the emerging trends in quantum technologies.

Course Outcomes:

After completing this course, students will be able to:

CO1. Explain core principles of quantum mechanics and their technological implications.
CO2. Analyze quantum phenomena like superposition and entanglement.
CO3. Apply mathematical tools to model and solve quantum systems.
CO4. Demonstrate understanding of quantum algorithms and quantum circuits.
CO5. Evaluate potential applications and challenges in quantum communication and sensing.

Unit 1: Fundamentals of Quantum Mechanics: Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrödinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian; Commutation relations and uncertainty principle; Quantum postulates and measurement theory; Eigenvalues, eigenfunctions.

Unit 2: Quantum Information Theory: Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states and EPR paradox; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation; Measurement in computational basis; Quantum teleportation and no-cloning theorem; Quantum state tomography (introductory)

Unit 3: Quantum Computing: Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance); Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, and Shor's 9-qubit code; Introduction to quantum programming: Qiskit, Cirq, IBM Quantum Experience (overview)

Unit 4: Quantum Communication: Introduction to quantum cryptography; Quantum key distribution (QKD): BB84 protocol; Entanglement-based QKD: Ekert protocol (E91); Eavesdropping and security of QKD; Quantum teleportation (circuit and protocol); Quantum dense coding; Quantum networks and entanglement swapping; Role of quantum repeaters; Single-photon sources and detectors; Implementation challenges (loss, decoherence, noise)

Unit 5: Quantum Technologies and Applications: Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Quantum materials: topological insulators, graphene, quantum dots; NV centers in diamonds for sensing; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era; Global initiatives: IBM, Google, D-Wave, IonQ, India's NQM; Ethical concerns and future prospects

Text Books:

1. **"Quantum Computation and Quantum Information"** by Michael A. Nielsen and Isaac L. Chuang
2. **"Quantum Mechanics: Concepts and Applications"** by Nouredine Zettili

Online Learning Resources:

1. https://nptel.ac.in/courses/104104082
2. https://nptel.ac.in/courses/115104096
3. https://nptel.ac.in/courses/122106034

	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and it applications.

Course Outcomes: By the end of the course, the student should be able to:

- Differentiate among different types of security attacks.
- Define computer forensics.
- Identify the process in taking digital evidence.
- Describe how to conduct an investigation using methods of memory, operating system, network and email forensics with different forensic tools.

UNIT-I

Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks--Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

UNIT-II

Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

UNIT-III

Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, defining a web application test scope and process, Defining types of penetration testing. **UNIT-IV**

Web Application Security: Common Issues in Web Apps, what is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues. **Forensics & Network Assurance:** Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

UNIT-V

Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. Cyber Security & Digital Forensics by Anas Zakir, Clever Fox Publishing, Publication Date-2022
2. "Beginners Guide To Ethical Hacking and Cyber Security ", by Abhinav Ojha, Khanna Publishers, First Edition, Publication Date-2023

Reference Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart

	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques	K2
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	K3
CO3	Students will be able learn different types of symmetric and Asymmetric algorithms	K3
CO4	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security	K4
CO5	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	2	1	1	1	1		1		2	2	2	2
CO 2	3	1	1	2	2	2	1	2		3	3	2	3	2	1
CO 3	2	2	2	1	2	1	1	1		2		3	1		
CO 4	3	2	3	2	3	2	1	1		2	1	2	2	1	
CO 5	3	2	3	1	2	2	1	1		2	2	2	1	2	1

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT-I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stenography.

UNIT-II

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials.**Mathematics of Asymmetric cryptography:** Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT-III

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA). **Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC. **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT-V

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH. **IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol. **Electronic-Mail Security:** Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice By Wenbo Mao. Pearson

	BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- Able to know the security issues of blockchain technology.

UNIT – I

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **Cryptocurrency:** Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. **Smart Contracts:** Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. **Consortium Blockchain:** Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. **Initial Coin Offering:** Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:

Case Study 1 – Retail,

Case Study 2 – Banking and Financial Services,

Case Study 3 – Healthcare,

Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. "Block chain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.

2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

UNIT -I

Introduction to Cloud Computing Fundamentals, Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II

Cloud Enabling Technologies, Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III

Virtualization and Containers, Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV

Cloud computing challenges, Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V

Advanced concepts in cloud computing, Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

	CYBER SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objective: To get practical exposure to Cybersecurity threats and Forensics tools.

Course Outcome:

- Get the skill to identify cyber threats/attacks.
- Get the knowledge to solve security issues in day-to-day life.
- Able to use Autopsy tools
- Perform Memory capture and analysis
- Demonstrate Network analysis using Network miner tools

List of Experiments:

1. Perform an Experiment for port scanning with nmap
2. Set up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using openSSL command
5. Perform practical approach to implement Footprinting - Gathering target information using Dmitry-Dmagic, UA tester
6. Work with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real-time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

Text Books:

1. Real Digital Forensics for Handheld Devices, E.P. Dorothy, Auerback Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

Reference Books:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C.H. Malin, E. Casey and J.M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

	CRYPTOGRAPHY & NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
    a) Ceaser Cipher
    b) Substitution Cipher
    c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

OPEN ELECTIVES

	JAVA PROGRAMMING (Open Electives-I)	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- identify Java language components and how they work together in applications
- learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- understand how to design applications with threads in Java
- understand how to use Java APIs for program development

UNIT I

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. **Control Statements**: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator ?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this. **Methods:** Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array toAnother Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. **Interfaces:** Introduction, Declaration of Interface, Implementation of Interface,

Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto- boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class. **Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer. **Multithreaded Programming:** Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. **Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface. **Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1) The complete Reference Java, 11th edition, Herbert Schildt, TMH
2) Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

	OPERATING SYSTEMS (Open Electives-II)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/ http://peterindia.net/OperatingSystems.html

	DATABASE MANAGEMENT SYSTEMS (Open Electives-III)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by coveringconceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Databaseindexing techniques and storage techniques

UNIT -I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecturefor data independence; Database system structure, environment, Centralized and Client Serverarchitecture for the database. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT -II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints)and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Databaseschema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT -III

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable andnon-updatable), relational set operations.

UNIT -IV

Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF),Fifth Normal Form (5NF).

UNIT -V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification,Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke,TMH (For Chapters 2, 3, 4)
2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1) Introduction to Database Systems, 8th edition, C J Date, Pearson.
2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe,Pearson
3) Database Principles Fundamentals of Design Implementation and Management, CorlosCoronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

	COMPUTER NETWORKS (Open Electives-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network. (L1)
- Explain the functionality of each layer of a computer network. (L2)
  Identify and analyze flow control, congestion control, and routing issues. (L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements. (L3)

UNIT-I

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT-II

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT-III

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, TrafficManagement at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT-IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT-V

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbook:

1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.
3. YouluZheng, ShakilAkthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html https://nptel.ac.in/courses/106105183/

B.Tech. – IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship &Project Work	0	0	24	12